A HISTORY OF MEDICAL EDUCATION

Ihr durchstudirt die gross' und kleine Welt,
Um es am Ende gehn zu lassen,
Wie's Gott gefällt.
Vergebens, dass ihr ringsum wissenschaftlich schweift,
Ein Jeder lernt nur, was er lernen kann;

GOETHE.

Nature is made better by no mean,
But nature makes that mean: so, o'er that art,
Which you say adds to nature, is an art
That nature makes. * * * *
This is an art
Which does mend nature—change it rather: but
The art itself is nature.

SHAKESPEARE.

Oui; cela étoit autrefois ainsi: mais nous avons changé tout cela, et nous faisons maintenant la médecine d'une méthode toute nouvelle.

MOLIÈRE.

A HISTORY

OF

MEDICAL EDUCATION

FROM

THE MOST REMOTE TO THE MOST RECENT TIMES

BY

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MDCCCXCI

TRANSLATOR'S PREFACE.

VERY few words are required from me here; but to say nothing at all would savour of disrespect to the Author, whose work I have endeavoured to render more accessible to English readers, as well as to that very public, whose benevolent consideration for this English edition is now solicited.

The truth is that I am very conscious of my responsibilities to both.

In the course of the translation, it became apparent that some slight addition was required in the chapter on England. With the Author's approval I have added a few pages, which contain matter limited almost exclusively to statements of facts concerning the existing arrangements at the universities and medical schools of the United Kingdom. I have much pleasure in acknowledging the debt I owe in connection with this to the "Guide to the Medical Profession," by C. B. KEETLEY, Esq., F.R.C.S., and to the "Students' Numbers" of the "Lancet" and "British Medical Journal." To these sources I beg to refer those in need of more detailed information.

It now remains for me to express my most grateful thanks to those who have assisted me in various ways. While the responsibility for errors and shortcomings of all kinds must rest entirely upon myself, I have to thank those whose names I am about to mention, that such inaccuracies and deficiencies are not more numerous than is actually the case. From members of my own family I have received very great help. To my neighbour, H. A. B. COLE, Esq., M.I.N.A., I am especially indebted for valuable assistance throughout the year and a half during which I have been engaged with the work. To A. W. CADMAN, Esq., I am

under a great obligation for revising a portion of my MS. Herr OTTO GERNER, of Ealing, has rendered me very considerable assistance in revising MS., for which I beg to thank him very much. I have much pleasure in acknowledging the courtesy and promptitude with which Professor PUSCHMANN has replied to the questions with which I have from time to time been obliged to trouble him.

In spite, however, of the numerous lines of defence I have arranged to oppose the invasion of mistakes, I am well aware that some—perhaps many—have broken through and established themselves. I am not, however, about to point out the weak spots in my armour.

Nor will I presume to utter a word of criticism upon Professor PUSCHMANN'S work. For the task of the critic, whether of books or institutions, an independent standpoint is needful, and this, never attainable in ideal perfection, is by some unapproachable; and certainly a translator's views, in regard to a work he translates, must be peculiarly liable to distortion.

My additions are indicated by square brackets in the text and by my initials in the notes.

I have now said enough, but may be permitted to express the hope that some readers will be found to whom the chapters of the learned Austrian professor will afford as much pleasure and instruction as they have to their English Editor.

E. H. H.

CROUCH END.
October, 1891.

PREFACE.

THE following work is the first attempt at a systematic exposition of the history of medical education. In literature, up to the present time, only fragmentary contributions have been made to this end, such as have to deal with the origin and development of individual medical schools and institutions, their scientific doctrines and methods of teaching, the persons engaged and their work. These sources of information had to be collected, examined and compared with one another before becoming of use for this book. For particular parts of the subject reliable and detailed information was at times found wanting; the documents required to throw light upon them being perhaps still locked up in archives and libraries. I must limit myself to affording information up to that point only where the fountains of knowledge become small or altogether dry, and I must leave it for later inquirers to dig up this ground and to collect material for the solution of questions to which no answer can now be given.

The history of medical teaching is full of significance, not only in its relation to the history of medicine and of education, but also generally in relation to the history of civilization, of which it may truly be said to constitute a necessary and an essential part. On this ground I have considered myself bound, as well as entitled, to carefully follow up and present the connection which my theme has with the general development of civilization. Many a fact which, viewed apart from general contemporary efforts, appears enigmatical and astounding, receives in this way a flood of light upon its meaning.

If I have made use of this opportunity to rectify numerous errors which have been incorporated in textbooks of the history of medicine and at the same time to bring some truths into prominence which have hitherto not attracted notice, the value of my book as a contribution to knowledge will certainly not be thereby injured.

I fulfil an agreeable duty in giving utterance here to my most respectful thanks for kind assistance afforded me in my undertaking by the following gentlemen :—Ministerial-Rath Dr. B. von David, and Sektions-Rath Dr. von Kleemann of Vienna, Geh. Ober.-Med.-Rath Dr. Kersandt, and Geh. Ober.-Regierungs-Rath Dr. Althoff of Berlin, Medicinal-Rath Dr. Geissler of Dresden, Regierungs-Rath Dr. Bumm of Munich, Dr. von Riedel of Madrid, Physician to H.M. the Queen of Spain, Prof. Serra de Mirabeau of Lisbon, Prof. A. Corradi of Pavia, Prof. Albini of Naples, Prof. Anagnostakis of Athens, Prof. Felix of Bucharest, Prof. von Winiwarter of Liége, Dr. Daniels of Amsterdam, Prof. Petersen of Copenhagen, Prof. H. Heiberg of Christiania, Prof. Hedenius of Upsala, Prof. Rauber of Dorpat, Prof. Kollmann of Basel, Geh. Rath Prof. Hegar of Freiburg-im-Brisgau, Geh. Rath Prof. Schultze of Jena, Prof. Eckhard of Giessen, Prof. Œsterlen of Tübingen, Prof. W. Krause of Göttingen, Prof. Uffelmann of Rostock, Prof. G. Ebers of Leipzig, Profs. Bühler and Heinzel of Vienna, and also the superintendents and officials of the libraries of Paris, London, Munich and Vienna.

THE AUTHOR.

VIENNA.

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INTRODUCTION.

Quis nescit, primam esse historiæ legem, ne quid falsi dicere audeat? deinde ne quid veri non audeat? ne qua suspicio gratiæ sit in scribendo? ne qua simultatis?

CICERO, *De oratore* ii, 15.

THE historical development of medical teaching exhibits a character similar to that of medical science in general. Necessity, the inventive Instructor of Mankind, furnished the occasion, as indeed HIPPOKRATES* says, for the first attempts at healing. The combative habits of rude barbarians, whose favourite pursuits were hunting and war, entailed the infliction of wounds for which help was demanded. Sympathizing friends and fellow-soldiers tended the hurts, washing out the wounds and dressing them with cooling herbs. Soon there arose a select few, who investigating the healing properties of plants, turned their knowledge of this subject to account for the benefit of their neighbours. If they were naturally endowed with the gifts required for observing Nature they no doubt soon made the attempt, as occasion offered, to study the fundamental character of the wounds which they undertook to treat. In this way gradually a kind of medical craft was formed, the members of which, by empirical methods, arrived at remarkable dexterity in healing external injuries. In the case of internal affections, particularly however in the case of epidemics, the causes of which are not so manifest as those of external injuries, recourse was had for counsel to those who, in that early period of civilization, passed

* HIPPOKRATES. Ed. Littré. Paris 1839. T. i, p. 574.

for the representatives of all knowledge*—the priests. To them, people looked the more readily for help, inasmuch as the origin of these diseases, being dark and mysterious, was ascribed to supernatural powers. The priests took care, by prayers and offerings to appease the anger of the gods and to enlist their sympathy. By these measures they instilled hope and confidence into the minds of the sick—in fact they subjected them to "expectant treatment." Here, however, it could not fail to be noticed, that results did not always tally with expectations; often indeed expected results entirely failed to occur at the very time when the public attention was directed to the matter, as in the case of widely devastating pestilences. Unless the priests were willing to lose their reputation, which was injuriously affected by these disappointments, it became necessary for them to aim at ensuring a greater influence upon the course of the prevailing diseases, by ordering diet and drugs. For this, they felt the want of medical knowledge, which they now sought to acquire by careful observation of the phenomena of diseases and by investigation of their causes and means of cure. In course of time they collected a quantity of information which, transmitted by word of mouth or by writing, became the property of later generations and by these was rendered more and more complete. The practice of the healing art was now exercised according to strict rules and the acquisition of the required knowledge was pursued systematically.

Medicine was included among the subjects which were taught in the Temple-schools, and the priests took care that the medical knowledge acquired there should be bound up so closely with religious exercises, held in awe

* "The Sanscrit *vaidya* from *vid*, to know, and the Latin *medicus* from *medh*, to be wise, point out that the Doctor has received his name from his insight." CH. LASSEN: Indische Alterthumskunde, London und Leipzig 1874, Bd. ii, S. 517.—*Cf.* AD. PICTET: Etymologische Forschungen über die älteste Arzneikunst bei den Indogermanen in der Zeitschrift für vergleichende Sprachforschung, Bd. v, S. 24, *et seq.*, Berlin 1856.

by popular superstition, that the priests themselves should appear to be of essential importance in the treatment of diseases. They however were compelled, in accordance with the advance of knowledge, to prove themselves capable men independently of such external assistance. And in this way the emancipation from religious influence and the formation of an independent medical class was brought about. The representatives of this class combined the knowledge received at the Temple-schools with the medical experience of the Empirics. They did not limit themselves, like the Priests, exclusively to the treatment of internal diseases but attached themselves also to surgery and obstetrics. This combination of internal with external Medicine, which was brought about by the followers of HIPPOKRATES and generally by the doctors of the Greek and Roman periods of civilization acted on both branches of the healing art as a stirring and stimulating force, and led to great results. The wonderful progress which the healing art, and especially surgery, made in Alexandria and Rome affords an intimation of the great advances probable in the immediate future had not political revolutions, attending the downfall of the Roman Empire, put a stop to the further development of Medicine as of other Sciences and Arts. Races in an early stage of civilization, as were those which then peopled the world, must assimilate to themselves the knowledge acquired in former days before presuming to think of increasing it by discoveries or inventions of their own. During the next thousand years intellectual development proceeded in the direction of breadth rather than of height, for while the sum of knowledge was not substantially increased it nevertheless diffused itself over a larger tract of the inhabited earth. Even in the Orient, where traditions of distinct periods of civilization are interwoven with the crowded actions and efforts of a people pressing with the enthusiasm of youth towards ends of the loftiest character—even there practically no important treasures in the domain of

medicine have been bequeathed to us, none, at least, of any permanence or profoundly affecting its growth. Arabian medicine is but an episode—though a grand one—in the history of the Science. In the West the priests took over again the office of teachers of medicine. The Roman and German peoples were converted to the belief that the Christian Church possessed and preserved not only the truths of heavenly life but the knowledge of this world too. The Cleric united in himself, at that period, all learning; and the Cloister became the School of Man. The practice of the healing art had for priests, even then, many inconveniences in store; respect for their Order forbade them to undertake surgical operations, since through their mistakes death might ensue to their patients, and they abstained from the treatment of the diseases of women. It was thus possible, that an independent class of practitioners should maintain itself and grow alongside of, but unconnected with, any priestly profession. Amongst these might be reckoned the numerous Jewish doctors who settled down in Christian lands and on account of their practical ability combined with extensive knowledge were highly esteemed: so, too, those people who in the south of Europe had become acquainted with Arabian medical science. These latter played a prominent part in the foundation of self-supporting medical schools at Salerno and Montpelier; while the Christian cleric, on his side, exercised a controlling influence upon the origin of the oldest Universities and their regulations. The Universities, which henceforth served as centres of learning and culture, reckoned also the training of doctors amongst their tasks, but they had regard only to the acquirement of theoretical knowledge and neglected practical aims. This deficiency in the training of practitioners had to be filled up by visits to hospitals or by the personal teaching of experienced practical men, if the young doctors wished to enjoy the confidence of their patients. From this circumstance the priestly origin of

Universities brought about the result that the medical teaching there imparted, by preference brought internal diseases into the sphere of consideration. Hence arose the necessity that along with skilled physicians should be found a class of doctors devoting themselves to surgery and the treatment of external injuries. The formation of these wound-doctors was a matter connected with trade and had its beginning in the barbers' shops: however it had the effect of creating doctors who in the exigencies of practice were trusted and understood how to help the sick. A wide social gap separated at first surgeons and physicians but gradually lost its significance as the former strove to improve their general education and by independent efforts contributed to the scientific development of the healing art. Certain of them have accomplished pioneering work of such high importance as to have immortalized their names in the history of surgery. Unprejudiced, clear-headed physicians recognized the advantages which surgical training afforded and themselves sought to unite it with their own. These however, in the earlier centuries, were isolated exceptions and the division of doctors into surgeons and physicians has been preserved up to the present time even although the social distinction has become a thing of the past. On the other hand there were gradually developed a higher and a lower class of practitioners, the former comprising the graduated physicians and surgeons and the latter the so-called country practitioners of medicine and surgery. These are found in many countries up to the present day while in others, as for example in Germany and Austria, one uniform class of doctors exists holding in equal respect the various branches of practice and enjoying the highest medical training. The changes in the position of doctors have had a great effect upon the scope and forms of medical teaching. Their social position determines the amount of general education which is expected of them. The demands made upon their technical knowledge and skill depend upon the amount of the facts and doctrines

which represent the contents of medical science, and while bearing indisputable testimony to the state of medicine at different periods give direction, form, and completeness to the history of the science. The form and method of medical teaching were regulated as much by the general condition of civilization at any given time as by the particular position of medical science. The age of scholasticism demanded that medical theories brought forward in the lecture-rooms should be in accordance with the dictates of the ruling authorities; so also the following periods were satisfied with formal theses, historical and theoretical; and only in the seventeenth century did the observation of Nature and independent investigation advance into the foreground. With the awakening of the Natural Sciences, especially Chemistry and Physics, with the foundation of schools of anatomy where students had the opportunity of dissecting the human body, with the introduction of clinical teaching into appropriate hospitals and the inducement of students to undertake private independent work, a complete revolution was brought about in medical education. Practical demonstrations and experiments, which had hitherto been either altogether wanting or had only exceptionally been permitted, formed now an essential part of medical training. In this way it obtained that broad foundation which is so indispensable for a harmonious structure in the education of doctors and by these means the latter became fitted both for the practice of their art and also for scientific investigation.

I. MEDICAL TEACHING IN ANCIENT TIMES.

INDIA.

THE roots of our civilization lie in the East. On the banks of the Ganges, on the plains of Egypt, and in sea-girt Greece, thousands of years ago, Arts and Sciences flourished and attained a remarkable development. The healing art there also celebrated its earliest triumphs. It was in India at first practised by the priests, who there, as elsewhere, passed as the treasurers of all knowledge, human and divine. In the oldest writings of the Indians, the Vedas, which originated six hundred years before Christ, diseases appear to have been looked on as punishments inflicted by angry deities or spirits, or as the result of the art-magic of wicked men. To allay these visitations prayers, offerings and conjurations were employed. But already in the Rig-Veda* we find certain dietetic and medicinal remedies referred to. The larger the sum of medical knowledge and experience grew, the more did men recognize the necessity of conferring the privilege of the practice of medicine not exclusively on the priests but also on the members of other castes, if by their knowledge and ability they showed themselves fitted for it. Thus a distinct medical class by degrees was developed, organizing itself out of the three higher grades of society; only the despised Sudra, who, by their racial peculiarity, were distinguished from the Aryan immigrants, remained excluded. Later on, by the levelling influence of Buddhism, this limitation was in some degree removed. Detailed

* ROTH in the Zeitschrift der deutschen morgenländischen Gesellshaft, Bd. xxiv, S. 301 *et seq.*, and Bd. xxv, S. 645 *et seq.*

information concerning the training of doctors is found in the two commentaries on the Ayur-Veda composed by CHARAKA and SUSRUTA and constituting the oldest medical works in Sanscrit literature. CHARAKA * counsels youths, who are desirous of studying medicine, that they should seek a teacher "whose precepts are sound, and whose practical skill is generally approved, who is clever, dexterous, upright, and blameless; who knows also how to use his hands, has the requisite appliances and all his senses about him, is confident with simple cases and sure of his treatment in difficult ones; of genuine learning, unaffected, not morose or passionate, patient and kind to his pupils." Those pupils were pronounced to be quite fitted for the study of medicine "who spring from a family of doctors or associate with doctors and who have lost none of their limbs and none of their senses." On admission, the teacher admonished his pupils "to be chaste and temperate, to speak the truth, to obey him in all things and to wear a beard." As the three best means of acquiring medical knowledge, were mentioned: the study of medical writings, the personal teaching of the instructor, and association with other doctors. "When the doctor" says CHARAKA "attended by a man known to the patient and having the right of entry into his house, advances into the dwelling of the sick man he should make his appearance in good clothes, with an inclination of the head; he should be thoughtful but of firm bearing and observe all possible respect. So soon as he is within, word, thought, and attention should be directed to nothing else but the examination of the patient and what appertains to his case." "Never should even the wisest" says he "become puffed up with his wisdom. Many recoil even from a man of skill if he loves to boast. And medicine is by no means easy to learn. Therefore let each one practise himself in it carefully and incessantly. Concerning the procedures and

* Samhita iii, 8, in R. ROTH's translation in the Zeitschr. der deutschen morgenländ. Ges. 1872, Bd. xxvi, S. 445 *et seq.*

accomplishments of the practitioner much may be learnt from others; for the whole world may be called a teacher of the man of understanding and to fools only is a foe. Considering this, even from the counsel of an adversary he may venture to expect prosperity, honour and livelihood, and to act in accordance with such counsel."

He strongly recommends intercourse with other doctors. "For conversation with a colleague increases knowledge, confers pleasure, enlarges experience, imparts readiness of speech, and induces consideration. Whoever is uncertain about something learnt, will have his doubts removed by repeated instruction; whoever has no uncertainty or doubt, will be able thus to fortify his opinion. Thus often a man comes to hear what up to that time he never knew. Often a teacher can seize the opportunity of a conversation of this kind to fully and at once impart to his pupil some information partially or entirely withheld hitherto." In Susruta* (Chap. 2.) it is said that the doctor should choose as pupil the son of a Brahman, being Ksatrya or Vaisya (nobleman or freeman) and of good family: he should be sixteen years of age, should show a respectable behaviour, should possess a love of cleanliness, kindness and bodily strength, understanding, a good memory, and the desire to learn and to reach the ends he has in view. "He must have a clean tongue, small lips, regular teeth, a noble countenance, well-formed nose and eyes, a cheerful spirit and good bearing and be prepared to undergo weariness and pain. And whoever possesses the opposite characteristics should not be admitted to the doctor's calling."

The admission of the scholar ensued on a propitious day and the festivities connected therewith were celebrated in the evening when the moon and stars were shining above. They thus began. The gods were propitiated by offerings of rice, flowers, and precious stones on an altar which consisted of a mound of earth measuring four ells on each

* The Susruta Samita ed. by UDOY CHAND DUTT, Calcutta 1883. (Bibliotheca Indica, fasc. 490, 500.)

side situated towards the north or east and which was covered with cowdung* and Kuśa-Grass (Poa Cynosuroides), while the Brahmans and Doctors received presents. Then the Brahman conducting the ceremony drew a line upon the earth, sprinkled the place with water and allowed the novitiate of medicine to take a seat on his right side. Before him a fire was made in which, obediently to the directions of religion, wood of Khadira (Acacia catechu) Palasa (Butea frondosa) Devadaru (Cedrus deodara) and Vilva (Ægle marmelos), or of Vata (Ficus Bengalensis), Jaina dumbara (Ficus glomerata), Asvattha (Ficus religiosa) and Madhuka (Bassia latifolia), was burned after having previously been dipped in curdled milk, honey and clarified butter.

At the end of the ceremony the teacher conducted his pupil three times round the fire and thus addressed him, at the same time calling the god of Fire to witness: "Lay aside now all passionate desires, all anger, covetousness, foolery, conceit, pride, envy; all roughness, duplicity, deceit and indolence, and all blameworthy conduct. Thy hair and thy nails shalt thou from this time forth keep short, a red cloak shalt thou wear and lead a pure life, all dissolute intercourse shalt thou avoid and shalt obey him who is set over thee. Thou must stay, go, lie down or sit down, eat and study as I direct and always be diligent to further my success. If thou dost neglect this, thou dost commit a sin and all knowledge is useless and unavailing to thee. If however I act badly towards thee, while thou fulfillest thy duty, I then commit a sin and my knowledge bears no fruit." Further, he admonished him that later on as a doctor he should treat without reward Brahmans, teachers, poor people, his friends and neighbours, religious people, orphans and foreigners and should give them remedies. So on the other hand he ought to refuse any medical advice to those who kill animals by hunting or ensnare birds, as likewise to outlaws and criminals. "Whosoever thus practises makes himself known as a

* The cow was considered sacred.

man of wisdom and acquires friends, renown, virtue, riches and other desirable things." On certain days the pupil should not study, for example on the 8th, 14th and 15th days of the new and full moon; it was likewise forbidden him to study "in the morning or evening twilight, during thunder and lightning (when this happens at an unusual period of the year), when the king of the country is laid up on a bed of sickness; after a visit to the scene of a conflagration, after attending a burial, during war, on any high festival, during any alarming manifestation of Nature such as an earthquake or meteoric shower, or on such a day as the Brahmans themselves might select on which to abstain from study, or which he might himself consider polluted for any reason."

In these sometimes strange rules there lay obviously at bottom a reasonable notion, namely to secure to the students the relaxation and leisure necessary to their calling, as well as to remind them that when their attention is given up to other things they understand in only a superficial and incomplete way what they are taught. SUSRUTA further demands (Chap. 3) that the students of medicine should receive both theoretical and practical training: first they should read medical treatises and then learn the practice of the art. "The man who has had nothing but a theoretical training" says he "and is unskilled in the details of treatment knows not what to do when he comes to a patient and behaves himself as pitiably as a coward on a battle-field. On the other hand a doctor who is only practical does not win the esteem of the best men." "Both these classes of incompletely prepared doctors are not fitted for practice, any more than a Brahman is to perform Church ceremonial properly if he has only read half the Vedas or than a bird is to soar in the air if it has only one wing. For, if medicines are administered by an unskilful doctor they may—although like nectar in flavour—work like poisons or other instruments of destruction."

Such people, as SUSRUTA remarks, only obtain permis-

sion to practise when the Government is careless and lax. The instruction consisted in the teacher reading to the pupil extracts from the medical writings, and making him repeat them again, so often, that finally the student knew them by heart. The delivery should be "in a loud and clear voice and with distinct accentuation of the words which should not be slurred over or rendered indistinct by a nasal tone." The scholar must endeavour to lay hold of what is taught him not only by the ear but by the understanding: otherwise he "resembles an ass who bears a burden of sandalwood, knowing only the weight, not the worth of his load." (Chap. 4). The teacher is enjoined (Chap. 9) to instruct the pupil in the carrying out of surgical operations, in the application of ointments and generally in practical matters for "without practical training and merely by hearing lectures and by the repetition of discourses, no one is fitly prepared for medical practice." Particular surgical operations were taught and practised on fruits, for instance melons; puncturing was practised on bladders or leather bottles filled with water, mud or clay; scarification, on pieces of leather stretched out and with the hair on; bloodletting upon the vessels of dead animals or the stalk of a water-lily; explorations with the probe, on worm-eaten wood, bamboo, reeds or dried gourds; extraction of teeth, on dead animals; the opening of abscesses, on a lump of wax spread out on a piece of Salmali (wood of Bombax Malabaricum); the sewing up of wounds on thick garments or the edges of two pieces of thin leather; the application of bandages, on models of the human body prepared from wood or clay; the application of caustics and cauteries on thin slices of meat; the drawing-off of urine from the bladder, or the removal of matter from the pelvis by means of reeds and an earthen vessel provided with a spout and filled with water, or else a gourd. In India very high consideration was given to surgery. When DHANVANTARI (Chap. 1) asked his pupils which branch of the healing art he should expound to them, they answered: 'teach us everything, but

take surgery as the foundation of your discourse!' Indian medicine has in this sphere of work achieved remarkable results. The Indian doctors were familiar with amputation, tapping the abdomen, laparotomy, suturing the intestine; they removed stone from the bladder by operation, treated cataract by couching the lens, undertook plastic operations, practised turning and extraction in the case of abnormal presentations in childbed and undertook Cæsarean section in the case of those who died before delivery.* The great number of different instruments† shows how experienced they were in surgical technicalities: we find among them knives of various shapes, lancets, cupping-glasses, trocars, probes, reed-like catheters, scissors, bone-saws, polypus-forceps, specula and many more. The examination of the body of the patient was performed with great care.

SUSRUTA (Chap. 10) admonished young doctors to bring all five senses to bear on this subject. "By the sense of hearing we can, for instance, determine whether the contents of an abscess are frothy and gaseous, for the emptying of such is attended with noise; by the sense of feeling we may know whether the skin is hot or cold, rough or smooth, thick or thin; by the sense of sight we can determine corpulence or emaciation, vital power, energy, and change of colour; by the sense of taste we can assure ourselves concerning the state of the urine in diabetes and other diseases of the urinary tract; and by the sense of smell we can recognise the peculiar perspiration of many diseases which has an important bearing on their identification." "At the same time the patient must be interrogated concerning the character of the quarter he lives in, consideration must be taken of the time of year, the patient's position, his apprehension, the nature of his pain, his natural powers, his appetite and the duration of his illness: we then should proceed to the examination of the urine, the gaseous

* VULLERS in the Janus, Bd. i, S. 242 *et seq.* Breslau, 1846.

† Well collated in T. A. WISE's Review of the History of Medicine among the Asiatics, London, 1867, Vol. i, p. 354 *et seq.*

and solid excreta and the menstrual flow, and also make inquiries concerning the surroundings of the patient in reference to the nature of the disease."

The Indian doctors were careful observers of Nature. They were aware of crepitation as throwing light on the diagnosis of a fractured bone, and of the sweet taste* of the urine in certain cases of sickness (diabetes mellitus) long before these facts were known in Europe.

The high development of the healing art and especially of surgery in India, excites the more surprise from the fact that the study of anatomy and physiology was if not completely non-existent at least on quite a wrong track. The small anatomical knowledge of the Indian doctors was dependent on the fact that they certainly never undertook the dissection of the human body; indeed such investigations were forbidden, or at least made difficult by religious injunctions. Nevertheless they appreciated the importance of anatomy for practical medicine and declared that the doctor must acquire a competent knowledge of the human body before undertaking the treatment of its diseases. Magisterial authority was required for anyone beginning the practice of physic.

By SUSRUTA (Chap. 10) it is said that the student of medicine at the termination of his studies must petition the king to grant him authority to practise independently. In this connection SUSRUTA imparts to him certain maxims which throw remarkable light on the social position of Indian doctors. "Keep thy hair and nails short" he writes "keep thy body clean, wear white linen, put on shoes and carry a stick or umbrella in thy hand. Let thy bearing be humble and thy heart pure and free from guile. Show thyself courteous in speech and friendly to every human being and take care that thy servant has a good character." He recommends him peculiar caution when his patients "are learned Brahmans, princes, women,

* Perhaps the observation that ants sought out and enjoyed this urine, led them to make this discovery.

children or old men, timorous people, servants of the king, crafty or feeble folk, calumniators of doctors, poor, miserable or irritable people, orphan children or persons who conceal their illnesses or are not supervised in their actions." He very earnestly warns him however against "gossiping or jesting with women or taking any presents from them with the exception of some light refreshment." Further he gives the shrewd, if somewhat unkind, advice "only to treat such persons as have curable diseases but to avoid any cases of incurable disease and generally to give up every patient who is not cured at the end of a year's treatment, for curable diseases commonly become incurable in a year."

CHARAKA* shows still greater caution in recommending the doctor "not to order any remedies for persons disliked by the king or people or who are themselves hostile to the king or people; and moreover, very deformed persons, or such as are corrupt, difficult, wild or intractable are not to receive advice or help, nor are the dying, or women either, except only in the presence of their lord or guardian." CHARAKA† fills his pupils with contempt for those people "who making a great display in the train of a learned doctor eagerly seek after opportunities for practice. No sooner have these people heard of a patient than they hurry off to him, fill his ears with their own medical ability and are unceasing in their enumeration of the failures of the attending doctor. They try to win over the friends of the patient by little attentions, flatteries, and innuendoes and they extol their own modesty. If they happen to have secured a case they deem it an occasion for making perpetual visits. In order to conceal their want of skill—being unable to cure the complaint—they attribute their want of success to the absence of the necessary means and nursing, and to the patient's neglect of medical injunctions. If they notice that things are going badly with the patient they at once make off. If they find

* *Op. cit.*, S. 448. † i, 29, in ROTH *op. cit.*, S. 452.

themselves in mixed company they affect modesty and yet without appearing to do it, they magnify their own skill and, speaking as laymen, undervalue the knowledge of the truly accomplished. However, they avoid the company of the learned as travellers do the dangers of a close forest." A picture fresh as life, the realistic touches of which show much resemblance to some scenes of the present day! The doctors in India took an important position. Nowhere has the respected calling of the doctor been more beautifully or strikingly portrayed than in the Indian proverb: "To the sick man the doctor is a father: to the man in health, a friend: the sickness passed and health returned, a preserver."* The Indian doctors were, like other learned men, free from taxes and other charges and for the services they rendered patients were paid by presents. It seems that their claims in this respect were not small, judging from the information we have respecting the remarkable cures of the doctor GIVAKA KOMARABHAKKA who lived in the time of BUDDHA.† He was the son of a courtesan and was brought up at the cost of a prince who adopted him; he was then trained by a Professor whose teaching he enjoyed for seven years, till at last he became a famous practitioner. Has this account an allegorical significance? Is there a desire to show how the mean mercenary activity of the doctor may be ennobled by the high ideal aims of his work? In the schools of the Bikkhus, the Buddhist monks, which were formed after the model of the Brahman schools, the sciences were neglected and the formation of character through renunciation of the world and its delights was chiefly aimed at. The Bikkhus considered life worthless, so naturally cared nothing for remedies for the purpose of maintaining it. Their rule only to eat what others had left and to make use‡ of the urine of a cow as a remedy shows

* BÖHTLINGK: Indische Sprüche, Petersburg. 1870.

† The Sacred Books of the East translated by MAX MÜLLER, Oxford 1881, Vol. xiii, p. 191, xvii, p. 173 *et seq.*, xx, p. 102 *et seq.*

‡ KÖPPEN Religion des Buddha, S. 338.

how little importance they attached to the care and health of the body. And yet it was after all a Buddhist King, named ASOKA or PRYADARSIN who promoted the erection of hospitals not only for men but for beasts. In these establishments were held professional consultations, and medicine was dispensed just as in our clinical institutions.* To be sure it was not so much the love of knowledge, as philanthropic tendencies which inspired ASOKA here: nevertheless medical knowledge did in any case gain some advantages therefrom.

In Ceylon also there were infirmaries. King PANDUKABHAYO is said to have founded as early as the fifth century before Christ a hospital at his residence of Anaradhapura, and one of his successors, DUTTHAGAMINI who reigned in the second century before Christ could boast at his death that he had erected in eighteen places infirmaries provided with sufficient means, and carefully arranged so that sufferers should be treated with professional care, and be provided with medicines. Of King BUDHADASO living in the fourth century after Christ it is related that he practised the healing art himself and compiled a useful work on medicine. He arranged a sanitary organization embracing the whole country, appointed one medical officer for every ten villages and erected hospitals in many places, appropriating revenues from twenty villages for their support. Moreover, he founded institutions for the reception of cripples, deformed persons, and the destitute poor, and he took care that the Army should have doctors—not only the soldiers but the elephants and horses also.† Hospitals existed in Kashmir‡ as early as in the reign of King MEGHAVANA in the first century of our era.

* G. BÜHLER: Contributions to the interpretation of the Asoka inscription in the Zeitschr. d. deutschen Morgenl. Ges. 1883, Bd. 37, S. 98 *et seq.* (2 Edikt. des Königs Asoka der von 263-266 v. Chr. regierte).

† The Mahawanso edit. by G. TURNOUR, Ceylon 1837, pp. 67, 196, 243, 245.

‡ HENSINGER in the Janus (ii, 393) has given some information on this subject from the "Annales de Caschmir" by KALHANA.

The relations, which the inhabitants of India maintained with the Greeks from the time of the expedition of ALEXANDER OF MACEDON, their active intercourse with the neighbouring Persians which later on extended itself over the domains of knowledge, and their subjection by the Arabs, exercised a great influence upon the development of Indian medicine, while in recent times European medicine, and particularly the professional theories and practice of the English have there become paramount.

EGYPT.

BY far more ancient than the medical records of the Indians are those which disclose to us the condition of medical science amongst the Egyptians of old. They arise out of that early period of civilization of which the Pyramids—those mighty witnesses of a legendary past—speak to us; they stand forth in pictorial representation on the walls of temples and tombs, in implements—such as surgical instruments—which have been preserved by chance, and in papyrus-rolls of which the more important have only been discovered and deciphered during the last half-century. In Egypt, as in Babylon, the custom prevailed of laying the sick out before the houses in the streets and passages so that the passers-by might tender advice as to the treatment of their infirmities. Interest in medical subjects was taken by the whole people, and "in that land where the fruitful soil bore abundance of herbs potent for good or evil, nearly everyone was, so to speak, a doctor, a descendant of PÆON and learned among men."* But there were also persons who practised medicine professionally and to this end underwent systematic teaching. The Egyptian physicians, on account of the happy results obtained by their treatment earned great reputation and were even summoned to the courts of foreign princes. The Persian King CYRUS entrusted his sick mother to the

* HOMER: Odyssey iv, 229-232.

care of an Egyptian oculist and DARIUS too had a body-physician who came from that country.*

The position of the members of the medical profession in Egypt, like that of the representatives of other learned callings was on a level with the position of the priests; and doctors were accorded corresponding privileges. In the schools associated with the temples not only priests but judges, doctors, astronomers, mathematicians and other learned persons were trained. These teaching-institutes combined, as our Universities do, all the higher training and subserved not education only but research. The most renowned of these schools were situated at Heliopolis, Memphis, Thebes, Sais, and Chennu. Here besides a corresponding general education the pupils acquired the requisite technical training for the particular pursuit of their lives. They lived in the houses attached to the school under the inspection and discipline of their teachers. "Let not idleness overtake thee" is the warning of the teacher in one of the passages translated by CHABAS "else shalt thou be severely chastised. Hang not thine affections upon pleasures and take care that the books fall not from thy hand. Exercise thyself in conversation and speak with thy superiors in learning. When thou shalt grow older thou wilt recognize how important this is: whoso is dextrous in his craft achieves power and fame." † The Egyptian student life appears in many respects to have been like that of to-day. Thus the teacher reproves the conduct of his light-hearted pupil EMENA in these words: "It has been reported to me that thou neglectest thy studies and seekest only thy pleasure, wandering from tavern to tavern. But what profiteth the odour of beer? Avoid it; for it drives people away from thee, impoverishes thy wits, and likens thee to a broken oar upon the deck of a ship." ‡

* HERODOTUS iii, i, 129.

† CHABAS: Mélanges égyptologiques, Paris 1862, p. 117.

‡ LAUTH: Die alt-ägyptische Hochschule zu Chennu in d. Sitzungsber. d. k. bayr. Akad. d. Wiss., Histor. Kl. 1872, S. 67.

Studies were not limited to the sons of the favoured classes but were accessible to all. Industry and talent were held to be the only conditions imposed upon those who sought admission to a course of study. Instruction was founded upon "the sacred books" in which all the wisdom of the Egyptians was contained. THOTH,* the god of Wisdom, was looked upon as their author "who also conferred enlightenment upon doctors." The sacred or hermetic books formed a kind of encyclopedia and consisted of forty-two parts. They dealt with the mandates of religion, church ceremonies, the administration of justice, philosophy, the art of writing, geography, cosmogony, astronomy, the knowledge of weights and measures, medicine etc. With medicine the last six books were concerned, being called the "Ambres" and the first of these contained a description of the different parts of the body; the second, instruction concerning diseases; the third, discussions about surgical instruments and probably about operations also; the fourth, instruction in materia medica; the fifth, a description of diseases of the eye, which, it is well known, are widely spread in Egypt, and the sixth, instruction on diseases of women.† The Author begins with anatomy as the groundwork of medicine, passes on to pathology and finally mentions the specialities which presuppose a knowledge of the other parts of medicine: he arranges his matter in such a way as to correspond closely with the rational system of our modern scientific method. Unfortunately the text-book of general medicine has been lost. Only some fragments are said to have been preserved which are probably to be found in the Book of the Dead, published by LEPSIUS, and in the EBERS papyrus. G. EBERS is of opinion that the papyrus named after him contains the fourth of the medical hermetic books—the treatise on materia medica.‡ Although

* THOTH is the Hermes of the Greeks. GIUGNIAUT: de Ἑρμοῦ seu Mercurii mythologia, Paris 1835.

† *Cf.* CLEMENS ALEXANDRINUS: Stromata, lib. vi, cap. 4, Edit. Dindorf.

‡ G. EBERS: Papyros Ebers, Leipzig 1875, T. i, S. 9.

this was written in the seventeenth century B.C. it most likely represents a later treatment of the original text. GALEN extracts many passages from it, although it is known that he had no high opinion of the scientific value of the work.* It is not known whether the six medical books as well as the remaining thirty-six hermetic books were lectured upon to all students of the Egyptian temple schools alike, or only to those who had in view the practice of medicine. These latter had in any case to study and master the contents of the medical writings: moreover they were bound strictly to conform to the rules therein laid down when engaged later in the practice of their profession and they drew punishment upon themselves if they practised in any other way.†

It is not probable that medical teaching confined itself to the medical works belonging to the hermetic writings or to the works illustrating these, in which the libraries connected with the temple schools were without doubt very rich. We must take it that the students in addition to this received practical guidance in the examination and treatment of the sick. The rule existed in Egypt, that patients should be brought into the temple, to await help and the alleviation of their pains at the hands of the priests. The latter were also called to the dwellings of those sick people who were too ill to be brought into the temple. Is it not probable that the teachers of Medical Science made use of these opportunities to point out to the students the practical carrying out of the theories which they had taught them? It is also very likely, that the students assisted, as pupils of the priests, in the treatment of the sick in the temples, since this may be looked on as a part of God's service and a religious act. Moreover, the condition of the healing art in Egypt gives support to the presumption that their theoretical learning was made easier to acquire by the help of practical teaching. From the pictorial representations which have been preserved upon the temple walls it is evident that they were

* GALEN: Ed. Kühn, T. xi, p. 798.

† DIODOR. i, cap. 82.

acquainted with circumcision and castration.* In the EBERS papyrus the expression is used: "Restoration of sight in the pupils at the back of the eyes," a passage which the editor has referred to the operation for cataract. The Cæsarean section after the woman's death was perhaps first carried out in Egypt.† Can such things as these be learned from books? The requisite skill for carrying out such operations can only be acquired by the man who frequently looks on at, and himself practises, the required manipulations. Again, bones reunited after fracture have been observed in mummies; in their jaws artificial teeth have been discovered; and various surgical instruments have been found in tombs such as knives, scissors, lancets, forceps, probes, cupping apparatus of bullock's horn etc.

* In ROSENBAUM's edition of K. SPRENGEL's Gesch. d. Arzneikunde (Leipzig 1846) Bd. i, S. 73 note; as in H. HAESER's Lehrbuch der Geschichte der Medicin (Jena 1875) Bd. i, S. 57, the remark is found that the Ancient Egyptians were acquainted with amputation. This statement depends upon LARREY who in his "Rélation historique et chirurgicale de l'expédition de l'armée d'orient" (Paris 1805), p. 45 note, writes: "Le général Desaix poursuivit l'ennemi jusqu' au-delà des cataractes et donna ainsi à la commission des arts la facilité de visiter les monuments de la fameuse Thèbes aux cents portes, les temples renommés de Tentyra, de Carnak et de Luxor, dont les restes attestent encore l'antique magnificence. C'est dans les plafonds et les parois de ces temples, qu'on voit des bas-reliefs répresentants des membres coupés avec des instruments très-analogues à ceux dont la chirurgie se sert aujourd' hui pour les amputations. On retrouve ces mêmes instruments dans les hiéroglyphes et l'on reconnaît les traces d'autres operations chirurgicales, qui prouvent que la chirurgie dans ces temps reculés marchait de front avec les autres arts, dont la perfection parâit avoir été portée à un très-haut degré." But neither LEPSIUS (Denkmäler aus Agypten und Äthiopien, Berlin, 24 Bände) nor J. ROSELLINI (I monumenti dell' Egitto e della Nubia, Pisa 1832, 4 Voll.) adduce any picture which testifies to amputation. Perhaps the absence of the left arm of the god Chem or Mim points to this (CHAMPOLLION: Panthéon égyptien, Paris 1824, pl. iv): but no conclusions of this kind can be drawn from the curious forms of the images of the Egyptian gods. Thus the proof that the Egyptians were acquainted with amputation has not yet been furnished. The hasty statement of LARREY, perhaps depending on a misunderstanding, must be proved and recognized by Egyptologists before it can be considered as a historical fact.

† S. ROSENBAUM: Analecta quædam ad sectionis cæsareæ antiquitates, Halle 1836.

Anatomical teaching was not in any case associated with practical demonstrations on the human body. Since, according to the religious conceptions of the Egyptians the welfare of the soul depended upon the body being preserved with the greatest care, the dissection of the human subject was clearly not to be thought of.

Even wounding the body was regarded with so much abhorrence that the operation which had to be performed upon the corpse before the embalming process brought hatred and contempt upon the operator who carried it out. This functionary had to take himself off and fly as soon as he had made the incision in the left side of the abdomen through which the intestines were removed, while at the same time he was pelted with stones by the relations and friends of the deceased; a custom, which obviously must have been intended to typify the defence of the latter.

The operators, on whom devolved these duties took a place in the social scale similar to that of our dissecting-room attendants. They possessed neither anatomical knowledge nor scientific interest of any kind, and were by the prevailing prejudice kept from making any investigations which their calling did not force upon them.

The embalming of corpses exercised thus no beneficial influence upon the development of anatomical knowledge. This is apparent too in the strange, crude conceptions about the construction and composition of the human body which we find in the papyrus-rolls.*

So the anatomical knowledge of the Egyptian doctors was certainly very small: they knew however that the heart is the seat of origin of the blood-vessels which are distributed from thence to all parts of the body: a fact which even a thousand years later was not generally understood and recognized. In the examination of the sick the Egyptian doctors were at pains "to investigate the beat of

* See for example med. papyrus-roll, i, which has been described by CHABAS, Mélanges Egypt. pp. 55-79, and by BRUGSCH: Recueil des monuments égyptiens, Leipzig 1863, Partie ii, p. 101 *et seq.*

the heart "* and to test the nature of the urine. Thus they soon observed that the urine of the pregnant female is turbid and rich in precipitated matter† and they made use of this observation in the diagnosis of pregnancy. They attached great importance to dietetics and a reasonable regimen of life; they recommended cleanliness and temperance, baths,‡ frictions and gymnastics for the preserving of health. The hygienic properties of sea-baths are said to have been known to them at an early period and used by them in the treatment of the poet EURIPIDES. § Frequent use was made of emetics, purgatives and clysters. In the medical papyrus-roll i. are found twenty-eight prescriptions for the preparation of clysters which were generally accepted by the ancients as an Egyptian discovery.‖

Prayers were combined with medical treatment in sickness, and were specially written for each case. In conformity with the priestly character of the doctors, they offered up these prayers themselves, and ascribed at least as much importance to them as they did to their medical directions. But seldom can there in those times have been such enlightened views as the Doctor NEBSECHT shows—in the novel "Uarda" by G. EBERS, that profound authority on life in ancient Egypt—where he delegates the singing of prayers to the old blind Pastophorus TETA.

The Pastophori constituted a class of priests, who for the rest, as G. EBERS has had the kindness to point out to me, held by no means so low a rank as is attributed to them in historical works. The doctors were bound to maintain a spiritual character and allowed themselves therefore to rank with the Pastophori, although the higher priestly

* Pap. EBERS, *op. cit.* i, p. 27, T. 45.

† Med. papyr.-roll, i, in CHABAS, *op. cit.* p. 69.

‡ HEROD ii, 37, 38.

§ DIOGEN. LAERT. iii, 6. It has been thought that the verse of EURIPIDES (Iph. in Tau. v, 1193): θάλασσα κλύζει πάντα δ'ανθρώπων κακά (The sea washes away all bodily ills) referred to this.

‖ PLINY: Hist. Nat. viii, c. 41, where it is ascribed to the Egyptian Ibis.

dignities probably remained open to them.* On the other hand the Pastophori were by no means likewise doctors, as many think, but had as a body quite other functions as their name, indeed, indicates. The relation of the Pastophori to the doctors was doubtless the same, as that of the scholar to the cleric in the Christian middle ages; all scholars did not belong to the Clergy but at the same time all clergymen might be considered scholars.

Many doctors were members of the great priest-colleges and lived in the teaching-institutions belonging to the temples. They there taught medicine and carried on medical practice. It was to the interest of the priest-colleges that the ablest and most prominent representatives of the healing art should be selected for these positions, for their power was increased by the number of the students and their renown by the successful cures effected in their temples.

The doctors partook of the privileges and advantages which the priesthood in Egypt enjoyed. They were exempt from taxes and were maintained at the public cost. From the sick they received for their medical care no payment but presents: in any case they expected that at the completion of the cure offerings should be brought to the temple with which they were connected. Sometimes models of the parts of the frame which had been healed were hung up in the temple; the British Museum contains several of these. During war, or in the case of anyone falling ill upon a journey, the doctors were bound to render help gratis.†

Whether there existed, in addition to the doctors partaking of the priestly character, other practitioners who learnt and practised their calling as Empirics is not certain but is probable. The designation "Sunnu" ("one having knowledge") was applied also to doctors. For the rest, the number of priest-doctors can hardly have been sufficient

* The High priest of Sais bore the title "Chief of the Doctors."

† Diodor. i, 73, 82—Herodot. ii, 37.

for all requirements. When we are informed* that Egyptian doctors confined themselves to practice in particular departments of their profession and to the treatment of particular diseases, so that "one treated only affections of the eye, another those of the head or teeth or abdomen or internal organs," it is evident that only in populous districts can the existence of such specialities have been possible and the sick man have had it in his power to make a selection from a number of practitioners. In the great temples, the priest-colleges of which reckoned many doctors amongst their members, naturally enough one chose this, and another that, speciality: but in general such a sharp division of the healing art into departments was not carried out.

Egyptian medicine exercised a great influence upon the medical science of Greece. The fame of it outlasted the political revolutions of later times and formed a historical background for those medical schools which raised Alexandria to a prominent place among the nurseries of scientific life in ancient times.

THE JEWS.

JEWISH civilization is a daughter of that of Egypt. Moses, the great lawgiver and teacher of the Jewish people was a pupil of the Egyptian priest-schools, and there studied medicine in addition to other arts and sciences.† On the Egyptian pattern he founded a priestly class among the Jews, which included the representatives of intelligence and learning. Its members were supported by the people and served them in turn as Priests, Teachers, Judges and Doctors. The Mosaic legislature regulated the lives of the people by precepts which were directed towards improving their morals, their health, and their material welfare. The prophylaxis of disease and a rational dietary were looked upon as the essential antecedent conditions. These ends

* HERODOT. ii, 84.

† CLEMENS ALEXANDRINUS: Stromat. Lib. i, cap. 153.

were served by those laws which dealt with the care of the newly-born, the nourishing of the child, the regimen of the mother or nurse, the relation of the sexes (as for instance the laws touching on cohabitation with menstruating women and the marriage between blood-relations): by those relating to cleanliness, clothing, food, dwellings and places of burial: so too by the directions for recognizing leprosy or certain sexual afflictions, and for preventing their extension.* People sought for the relief of sickness by means of prayers and offerings, thus appealing to the theurgical character of Jewish medicine, according to which all affections were looked upon as scourges sent from God. In addition however dietetic and medical remedies were employed.† For skin-eruptions ‡ the priest-doctors recommended above everything the separation of the sick from the healthy, most scrupulous cleanliness and frequent baths.

They were acquainted also with the use of medicinal springs. And the favourable influence exercised by music in many cases of psychical disturbance was known.§ For fractures they applied bandages.‖ Castration was performed in two ways either by crushing or excision of the testes. And their performance of the operation of circumcision shows that the Jewish priest-doctors possessed a certain dexterity in surgery.

Mention was made of midwives while the Jews were still undergoing captivity in Egypt. Their practice is described

* Exod. ii, 15, 26; xix, 6; xxii, 31. Lev. vii, 23; xi. xii. xiii. xiv. xv. xvi. xviii. xix. xx, 18. Num. xii, 15; xvi, 41. Deut. xiv, 21; xxviii, 27, 58-61. Ezek. xvi, 4, etc.

† *Cf.* TRUSEN: Darstellung der biblischen Krankheiten, Posen 1843, s. 1. J. B. FRIEDREICH: Zur Bibel, Nürnberg 1848, i, s. 41 *et seq.*, 193 *et seq.* R. J. WUNDERBAR: Biblisch-talmudische Medicin, Riga und Leipzig 1850, H. 1, S. 8 *et seq.*, 73 *et seq.*

‡ By this general expression the term *Zaraat* is more properly translated than by Leprosy as it usually is.

§ 1 Sam. xvi, 23.

‖ Ezek. xxx, 21.

in several passages with realistic completeness.* King Solomon manifested great interest in the natural sciences, especially in medical science, and is said himself to have been the author of a book on the subject.† During his reign the influence of foreigners especially of the neighbouring Phœnicians made itself extensively felt. Still more did this become the case as the Israelitish people lost their national independence. Their political fortunes brought them into close relations with the Assyrians, Babylonians, Chaldees, and Persians and afforded their learned men opportunities of becoming acquainted with the acquisitions of these peoples in the domain of culture and of making them their own. They thus gained a broad view of the spiritual development of man and became freed from those narrow-minded prejudices which were a result of their somewhat cramped political surroundings. From this, medical science drew the advantage that professional practice ceased to be a monopoly of the priests.‡ From this time forth besides them not only the Laity practised the healing art but doctors were applied to who did not even belong to the Jewish faith. In this respect people went so far at a later period as to permit even the rite of circumcision to be performed by a non-Jewish doctor when an Israelitish operator was not at hand.§ In the same way it was held obligatory on Jewish doctors to extend medical aid to persons of other faiths. They might claim payment for their services,‖ and were esteemed and honoured by their fellow-citizens.¶ They were taken into council by the authorities on questions of sanitary administration and medical jurisprudence. Later on, each town was compelled to have a medical officer and sometimes

* Gen. xxv, 24-26; xxxviii, 27-30. Exod. i, 15-21.

† Suidas: Ezekias.

‡ Sybrand: Diss. hist. med. de necessitate quæ fuit apud veteres inter religionem et medicinam, Amstel. 1841, p. 28 *et seq.*

§ Talmud Tr. Menachoth, 42ª.

‖ Exod. xxi, 19.

¶ Jesus Sirach, xxxviii, 3.

also a surgeon in addition. Besides other duties they were bound to carry out circumcision. Special doctors were appointed for the priests who in consequence of their ceremonies in the Temples involving cold baths, light clothing, walking with bare feet on the cold stones and fasts, were much predisposed to abdominal diseases.*

Although the medical profession was open to all, yet those connected with the priesthood seem especially to have devoted themselves to it, as appears from the information at our disposal. Medical science on account of its intimate relation with the religious and social legislation of the Jews was surely drawn into the domain of education in the Priest-schools as in the Prophet-schools which were frequented by full-grown youths. Certain prophets, as for instance, ELISHA were famous for their successful cures. Who ever aspired to be considered a learned man was obliged to be possessed of some medical knowledge. This, indeed, was a part of general education and was sought after by those who desired to occupy a prominent position in public life.

The technical training of doctors was effected through the personal instruction of pupils by a teacher who was practised and experienced in the healing art. As to the nature of this teaching and the appliances used in it, we unfortunately possess no information in regard to the earlier times but only in regard to the later—the Talmudic period. The Talmud, the origin of which dates from the first century after Christ, contains a number of expressions borrowed from the vocabulary of the Greek tongue, especially its medical terminology, and even directly refers to a connection with the medical science of the Greeks. Talmudic medicine lacks originality and is supported chiefly by the teaching of Greek doctors.† The anatomical knowledge of the Talmudists, of whom some distinguished themselves as doctors, does not rise above that which had been pro-

* Talmud Tr. Schekalim v, 1, 2.

† J. BERGEL (Die Medicin der Talmudisten, Berlin u. Leipzig 1885) attacks this asserted connection but is able to adduce no facts in support of his views.

pounded by GALEN. Their observations on the development of the fœtus deserve notice, especially as to the formation of the bones. With this aim, they betook themselves to the dissection of the human body. Thus it is narrated in the Talmud that the pupils of Rabbi ISMAEL BEN ELISHA studied the individual bones on the corpse of an unfortunate woman, who had suffered the penalty of death, and that Rabbi ISMAEL examined the fœtuses of certain pregnant female slaves, who, with this object in view, were put to death during their pregnancy.* At the same time the Talmudic philosophers endeavoured by dissections of animals to enlarge and confirm their anatomical knowledge. They recognized the important bearing which observations and examinations made on animals have on medical knowledge and they drew definite conclusions from this method of research.

In this way they found out that wounds of the kidneys are not always fatal and that the spleen can be removed and even the uterus cut out without the death of the animal resulting.† The doctors performed amputations and were acquainted with the use of artificial feet and legs,‡ were skilled in the treatment of fractures and dislocations, healed umbilical rupture in the newborn by a compression bandage and in retention of the placenta removed it by art, operated on urinary fistula, made observations on hermaphroditism, referred to the fact that the descent of the testes is sometimes not completed, and published some valuable experiences upon injuries of the internal organs:§ especially so in observing that injury to the spinal cord in animals is followed by paralysis of the hind-legs. They possessed a great number of surgical instruments and

* J. M. RABBINOWICZ: La Médecine du Thalmud, Paris 1880, p. 75.—RABBINOWICZ: Einleitung in die Gesetzgebung und Medicin des Talmuds, deutche Ubers. 1883, S. 250.—Talmud Tr. Bechoroth, 45[a].

† RABBINOWICZ *op. cit.*—Talmud Tr. Sanhedrin 21, 33[a] u. 93[a], Bechoroth 28[b].

‡ WUNDERBAR *op. cit.* iv, S. 66-68.

§ RABBINOWICZ *op. cit.* S. 258 *et seq.*

appliances* and showed themselves dexterous and experienced in operative midwifery; they were acquainted with several causes of abortion, undertook embryotomy† and carried out the Cæsarean section on the dead and on the living.‡ The Talmudic philosphers devoted an ardent study to the medical writings of the Greeks, and made their scientific acquisitions accessible to the doctors of the Jewish people. The medical science of Greece had already by that time become the common property of the whole civilized world. The Jews possessed at that epoch celebrated high-schools at Tiberias, Sura and Pumbeditha, in which, as before in the prophet-schools, medicine was probably taught at least in its general outlines. Teaching lasted only for part of the year: during the remainder the students went about their business in order to supply themselves with the necessary means to support life.§ Among them were to be found, mechanics, merchant-folk, and perhaps doctors who were anxious to acquire from the teachers of the high schools scientific foundations for their observations. And conversely the teachers themselves, who were only at home in theoretical subjects, sought eagerly for information from experienced practitioners upon doubtful and difficult points of practice.‖ Many doctors seem to have undertaken the treatment of both internal and external affections, while in other instances they only devoted themselves to either the one or the other branch of medical science. Whosoever wished to practise as a doctor had to obtain the permission of the magistrates

* Wunderbar (*op. cit.* i, S. 50-56) enumerates 56 distinct kinds, among them knives, scissors, probes, lancets, cupping instruments of horn, perforators, portable commodes, spoons, sieves, etc.

† Talmud Tr. Bechoroth 46ª, Nidah 19.

‡ On the meaning of *Joze dophan* see also Virchow's Archiv Bd. 80, H. 3, S. 494. Bd. 84, H. 1, S. 164. Bd. 86, H. 2, S. 240. Bd. 89, H. 3, S. 377. Bd. 95, H. 3, S. 485.—A. H. Israëls in d. Ned. Tijdschr. v. Geneesk 1882, p. 121 *et seq.*

§ P. Beer: Skizze einer Geschichte der Erziehung und des Unterrichts bei den Israeliten, Prag. 1832, S. 55.

‖ Talmud Tr. Nidah 21ᵇ.

of the place in which he wished to settle. "No one may practise the healing art however fully qualified he may be without the permission of the Beth-Din (the council of the town) and whoso practises without such permission, even if fully qualified, is culpable."* Whether this permission was granted after examinations, and if so of what character these were, is unknown to me. In the following centuries Jewish medicine was merged completely into that of the other nations. Jewish doctors and philosophers exercised a beneficial influence upon the scientific development of medical science, especially in the middle ages, and have, at every period, maintained a prominent position in this domain of knowledge.

THE PARSEES.

ONLY very sparse accounts have been handed down to us concerning the medicine of the ancient Persians. With them, also, the healing art stood in intimate relation to culture, and the priests and Magi practised it. The general conception was that diseases, which were called into existence by evil spirits, could be dispersed by conjurations and prayers. With these many superstitious ceremonies were combined; here magic celebrated its marriage with medicine.† THRITA, a hero celebrated by tradition who later on was added to the celestial spirits, was considered the first doctor whose privilege it was to remove diseases and to subdue the demons who sent them. He was worshipped on this account as the patron and guardian of doctors and so to speak as the god of the art of healing. The religious law-books of the ancient Persians recommended purity of mind and body as the best medicine to ward off sickness. Sexual excesses were threatened with severe punishment. In the same way the induction of abortion was forbidden. As to the treatment of diseases we learn that in addition to prayers and medicines, of which they

* WUNDERBAR: *op. cit.* i, S. 36.

† PLINY: hist. nat. xxx, 1.

vere acquainted with a great number from the vegetable ;ingdom, the knife too came into use. Those who cured liseases by prayer alone were looked upon as the most :xcellent doctors; they were, so to speak, "doctors of loctors." Then came those who ordered medicinal herbs ınd the lowest place was assigned to those who handled he knife.* Whoever wished to be a doctor was obliged to ›ractise first of all among the lowest despised classes. So ;oon as he had accomplished three satisfactory cures upon nembers of these classes, he was at liberty to practise ımong the higher grades of society. But if the three est-patients died he was never allowed to become a loctor. As in ancient Egypt so here too the doctors ›ractised the veterinary art as well as their own. There vas a kind of medical-taxation regulated in accordance vith the position and wealth of the patients. From a priest he doctor might demand nothing further for his services han a benediction; on the other hand from the chief of a ›rovince he received four oxen, from his wife, a female :amel; from the chief of a town, a large draught-horse, rom his wife, a mare; from the head of a village, a medium-ized draught-animal, from his wife, a cow; from a house-ıolder, a small draught-animal, from his wife, a she-ass. In ike manner it was ordained how much he should demand or the treatment of the various domestic animals.†

This fragmentary information supplies us with no in-ormation regarding the medical knowledge or professional eaching among the ancient Persians, and enables us to orm no settled opinion as to the state of medical science ımongst them. In any case, their doctors were later on ;urpassed in skill by their Egyptian and Greek colleagues, or the Persian kings caused doctors from these countries o repair to their courts.

* Vendidad vii, 118-121.

† *Ibid.* vii, 105, 117.

THE GREEKS BEFORE HIPPOKRATES.

THE earliest information concerning the medical science of the Greeks is veiled in mythical surroundings. In these APOLLO appears as a god sending diseases and pestilences but also vouchsafing the remedies to cure them and control their power for evil. When, later on, the several characteristic powers and attributes of this god of Light,—who in the worship of a primitive people obviously represented the Sun—were personified and obtained separate representatives, ASKLEPIOS assumed the character of the God of the healing art. Tradition spoke of him as the son of APOLLO, in order to give expression to the intimate relations of the two. Enlightened Greeks of a later age explained this in an allegorical manner when they said: "If ASKLEPIOS is the air,—indispensable to the health of man and beast, yet APOLLO is the sun and rightly is he called the father of ASKLEPIOS, for the sun by his yearly course makes the air wholesome."* HOMER and PINDAR celebrate the cures of ASKLEPIOS; but neither they nor HESIOD call him a god. How the fame of his cures, preserved by legend and enlarged by posterity gradually led to his apotheosis, unfortunately no information has been handed down to us. Later on, temples were erected to him, and by fervent worshippers powers ascribed to him similar to those of ZEUS the creator and preserver of all things. The poets, who, as HERODOTUS† says, found serviceable material in mythology, adorn the narratives of the birth and life of ASKLEPIOS with their rich fancy. PINDAR states that he was instructed in medical science by the centaur CHEIRON: he was taken to CHEIRON "that he might teach him the ways of healing diseases which bring many woes on mankind. All who approached him suffering from ulcers arising from internal causes, those too whose members were injured by the sword or by the stone slung

* PAUSANIAS vii, 23.

† HERODOT. ii, 53.

from afar and those again whose bodies were enfeebled by excessive heat and cold; all these he delivered from their multifarious ills: on some using gentle incantations, giving others refreshing drink or applying soft healing salves to their wounds: some also he cured by operation."*

By ASKLEPIOS stood his wife EPIONE the "Pain-Soother" and his daughters HYGIEIA, JASO and PANAKEIA whose allegorical significance is seen in their names. These all assisted him. Doubtless, there is more historical truth contained in the statement that he had two sons, MACHAON and PODALIRIOS, to whom he transmitted his acquirements in the healing art. They were numbered among the suitors of HELEN and proceeded to Troy with the Grecian armies as commanders of the Thessalian warriors from Trikka, Ithome, and Oichalia. They were considered as dexterous in the art of war as in that of medicine, and were on several occasions called upon by their comrades in arms to give professional counsel and help.† MACHAON made himself chiefly prominent as a surgeon, while PODALIRIOS distinguished himself in the treatment of internal diseases. As in the Iliad, so too in the Æthiopis of the poet ARKTINOS which was composed soon after the former poem but is now only extant as a fragment, allusion is made to his separation of the two chief branches of medical science, in the words: "then ASKLEPIOS bestowed the power of healing upon his two sons, nevertheless he made one of the two more celebrated than the other: on one did he bestow the lighter hand, that he might draw missiles from the flesh and sew up and heal all wounds; but the other he endowed with great precision of mind so as to understand what cannot be seen, and to heal seemingly incurable diseases."‡

It is noteworthy that here internal medicine was given the preference. This opinion remains to the present day,

* PINDAR Pyth. Od. 3, 80-95.

† DIODOR. iv, c. 71.

‡ F. G. WELCKER: Kleine Schriften, Bonn 1850, Bd. iii, S. 47.

and must have originated in the fact that the recognition and cure of internal diseases appears more difficult and wonderful to the laity than the treatment of external injuries, the cause and seat of which are, in most cases, apparent to everyone.

The healing art of those early periods of Greek history was limited essentially to extracting arrows and lance-points, arresting bleeding, alleviating pain, and applying bandages. In the Iliad a great number of wounds of various kinds are described, and the methods of treatment which were applied to them illustrated.* MACHAON and PODALIRIOS are not the only doctors mentioned in the heroic poems of HOMER.† ACHILLES, PATROKLOS, and other military commanders and warriors were renowned for their healing powers. Many of them owed their knowledge on the subject to CHEIRON,‡ "the Man of the Hand." They made use of these acquirements for the welfare and assistance of their men, just as other heroes gladdened their men's spirits by their power of song; but they did not use the healing art as a calling or for pay.

The instruction in medical science took place under the personal supervision of a teacher who united in himself knowledge and experience. The father imparted his medical lore to his sons, and these in turn bequeathed their art to their progeny.§ This fact appears to lie at the root of those legends which suggest that medical acquirements were confined to the relations of CHEIRON and ASKLEPIOS, and were preserved by them as precious family legacies. As the professional fame of the descendants of ASKLEPIOS became more and more widely

* Ilias iv, 190. v, 73-75, 112, 694. xi, 349-60, 397, 846. xiii, 438-45. xiv, 409-439. xv, 394. *Cf.* DAREMBERG: La Médecine dans Homère, Paris 1865. H. DUNBAR: The Medicine and Surgery of Homer, Brit. Med. Jour. Lond. 1880, 10 Jan.

† Ilias xiii, 213. xvi, 28.

‡ Ilias iv, 219. xi, 831. Panofka in den Sitzungsber. d. Akad. d. Wiss. zu Berlin, Philos-hist. Kl. 1843, S. 269 *et seq.*

§ PLATO: de republ. x, c. 3.

spread, and a thankful generation began to attribute the honour of godhead to their ancestor, it may easily have arisen that other practitioners took to giving themselves out as members of the family, and in possession of the family secrets. So gradually there became developed a professional class tracing its origin from ASKLEPIOS.

The Asklepiadæ, the putative descendants of this mythical ancestor of Greek doctors, united, later on, into societies which celebrated their mutual relations by offerings made in common and by religious festivals. An inscription found in the ruins of the temple of ASKLEPIOS at Athens, and published by GIRARD,* and which KÖHLER ascribes to the first half of the third century, establishes the fact that these were ancient customs. The Asklepiadæ were moreover doctors bound together in a guild and by no means identical with the priests who were established at the temples of ASKLEPIOS as K. SPRENGEL and other medical historians have erroneously thought.

The most ancient sanctuaries of ASKLEPIOS were situated at Trikka in Thessaly, at Titane, Tithorea, Epidauros, on the Island of Kos, at Megalopolis, in Knidos, Pergamus, Athens,† and other places. Here the god of the healing art was worshipped and approached by the sick who implored at his hands a deliverance from their maladies. In connection with the temples where the religious service was held were dwelling-places for the priests and attendants of the temple, and large covered and pillared halls which served as places of retreat for the pious pilgrims and the helpless sick.‡

The Asklepieia were generally distinguished for their healthy situation and cheerful surroundings. They were

* P. GIRARD: "L'Asclépieion d'Athènes d'après de récentes découvertes" in the Bibliothèque des écoles françaises d'Athènes et de Rome, T. 23, p. 85, Paris 1881.

† JOH. HEINR. SCHULTZE mentions in his Historia Medicinæ (Lips. 1728), p. 118-125, a great number of Asklepieia and names the authors by whom they are mentioned.

‡ PAUSANIAS ii, c. 11, 27 *et seq.* x, 32, and GIRARD *op. cit.* p. 5.

ıilt in a fertile region on mountains or hills in the cinity of forests and woods which protected them from jurious winds and evil epidemic influences and by the de of streams and springs yielding a fresh, sweet-tasting ater.* Some had salubrious thermal and mineral springs great celebrity for the cure of disorders. These mples of health were surrounded by pleasant well ıred-for gardens, in which fresh water was continually)wing, and contained in their interior statues, frescoes, ıd votive offerings of all sorts. By the side of statues of SKLEPIOS and other deities were memorial tablets keeping alive the fame of celebrated doctors as favourites of the)ds.†

Stringent rules provided that these sanctuaries should be ept clean and free from anything which might endanger eir sanitary condition. On the gate of the temple at)idauros were inscribed these words: "Whoso desires to ıter here, must possess a pure spirit."‡ There, as strictly in Delos, it was forbidden that a birth a burial or a emation should take place in the precincts of the temple. ven if a patient died there the sanctuary was held to be filed. The persons who sought relief were compelled to)serve scrupulous cleanliness, to bathe in the stream, in e sea, or at the fountain, and to fast and abstain from wine certain number of days before venturing to approach the mple or to make prayers or offerings to the deity. veet-smelling vapours which arose from the fumigations ed the air, and the song of priests extolling the might d power of the god of healing entranced the soul. Conrsation with fellow-sufferers whom the patients met in e halls of the temple, and the sight of the numerous tive tablets and inscriptions telling of happy restora-ns to health which had occurred in the place, imparted nfidence and hope. Willingly did they therefore submit

* PAUSANIAS iii, 24. viii, 32. VITRUV.: de archit. i, c. 2.

† ANAGNOSTAKIS in the Bull. de corr. hellèn: i, p. 212, pl. ix.

‡ CLEMENS ALEXAND.: Stromat. v, c. i, 13.

to the injunctions of the priests and with painstaking care follow their orders.

As in the famous Amphiaraion and in other ancient oracular places so too in the temples of ASKLEPIOS means of cure were suggested by dreams. The sufferers slept during the night in the hall of the temple and awaited the dreams in which the deity should reveal himself to them. When, in them, the treatment of their malady was not clearly and plainly pronounced, they told the substance of their dreams to the priests and their assistants, who expounded the same to them, naming the remedy they were to apply. If the patient on the first night had no dream at all, he passed another and if necessary a third night in the Asklepieion. If dreams refused to come to him altogether, he begged the priest or some other man of a pious disposition to sleep there for him and to dream. This method of consultation by deputy was already customary at oracles* and led, later on, to deceit; for cunning speculators, like many spiritualistic mediums of the present day, turned the intercourse with celestial beings into a profitable business.† The deceit was of a still grosser kind when the priests appeared at night in the mask of the god to the visitors at the temple in order to make them believe they had been dreaming. ARISTOPHANES has represented this in his comedy of Plutos in an exceedingly droll manner.‡

The remedies which were enjoined were—at least in the more ancient times—rather of a dietetic and psychical than of a strictly medical character. Many of the methods of cure recommended were thoroughly rational § and highly adapted to bring about a successful issue. Which may

* HERODOT. viii, c. 134.

† *Cf.* the biography of APOLLONIOS of Tyana by PHILOSTRATOS i, 89. iv, 1.

‡ v, 620 *et seq.*

§ *Cf.* VERCOUTRE: "La Médicine sacerdotale dans l'antiquité grecque" in the Révue Archéolog., Paris 1885. Ser. iii, T. 6, p. 285 *et seq.*—v. WILLAMOWITZ-MOELLENDORFF: Die Kur des M. J. Apellas, in dessen Philol. Untersuchungen, Berlin 1886, H. 9, S. 116 *et seq.*

be explained in this way that the dream-pictures giving expression to the predominant, sometimes the single, subject of interest in the mind of the sleeper, drew forth from the depths of his soul some half or wholly forgotten reminiscences of happy cures effected.

When the dreamers failed then the priests came to their aid. The latter having by tradition and personal experience acquired some medical knowledge of their own were able to help the sick with counsel and explanation. When they got either no result at all or an unfavourable one, they withdrew themselves by sophistical artifices from the painful position.*

The priests of the temples of Asklepios were not doctors, as many assume. Certainly there were among them as among their assistants the Zakoroi, many who were skilled in medical science,† indeed they had probably learned the subject systematically. But between the healing art as practised in the Asklepian temples and that of the professional doctors the great distinction existed that in the former case it was held to be not a fruit of the human understanding, but a divine revelation. Medical interference must from this circumstance here have appeared at least superfluous. On this ground it is not probable that between the priests of Asklepios and the doctors there existed any competitive or unfriendly relations.‡ It is much more reasonable to take the contrary for granted, when one considers what humble reverence both doctors and Asklepiadæ paid to the sanctuaries of Asklepios, and what submissive trust they reposed in his imagined utterances in doubtful cases of their practice.

The Asklepiadæ settled down by preference in the neighbourhood of the Temples dedicated to Asklepios and founded medical schools there. Among these, those which were situated at Rhodos, Kroton, Kyrene, Kos and Knidos

* Artemidor: Oneirocrit. v, 94.

† Girard *op. cit.* p. 34.

‡ Malgaigne in the "Journal de Chirurgie," Paris 1846, iv, p. 340.—Ch. Daremberg in the "Revue Archéol.,' Paris 1869, T. 19, p. 261 *et seq.*

acquired the highest reputation. A noble spirit of emulation was established among them which favoured the development of medical knowledge.* So too must the fact that the Asklepiadæ were constant frequenters of the temples, where they saw maladies of all kinds, heard of successful cures and the means employed to effect them, and read the thanksgivings left on record by the cured, have operated powerfully upon them and increased their professional knowledge and experience.

The schools of the Asklepiadæ were societies of doctors who subscribed to the same theories and corresponded rather to our Academies than to the departments of Universities. The training of doctors was carried on by the same methods as in the most ancient times, the teacher imparting to one pupil or more the knowledge and skill required for the practice of medicine. In the admission of students no limitation was made, as in former times, to scions of families deriving their origin from Asklepios,† and if the Asklepiadæ sought by keeping registers of their pedigrees to preserve this belief, they only wished in this way to assert that the healing art of their ancestor Asklepios was transmitted by them pure and unadulterated.‡ On a like ground they enjoined on their students strict secrecy concerning the subjects taught them and forbade them to impart their knowledge to others, not of the Asklepiadæ-guild.§ Similar rules were made by other learned societies to prevent the profanation of their secrets especially where a religious bond held them together as, in this case, the common worship of Asklepios.

Medical teaching began in early youth. If the father was a doctor he naturally was the first teacher of the son who devoted himself to medicine: he then both sought for and

* Galen: Ed. Kühn, T. x, p. 5.

† Galen *op. cit.* T. ii, p. 281.

‡ For the rest, the still existing fragments of the genealogical tablets of the Asklepiadæ, are of a later period and consequently have no claim to authenticity. Tzetzes (12th century post Christ.): Histor. var. chil. ed. Th. Kiessling. Lips. 1826, p. 276, v. 944-989.

§ Hippokrates: Ed. Littré, T. iv, p. 642.

found opportunities for further practical training amongst other skilful doctors. The teacher imparted to the pupils his opinions concerning the structure and functions of the body, explained to them the origin of sicknesses and brought them to the bedside and there pointed out to them the symptoms of the various maladies and their treatment. The pupils were obliged to pay* an honorarium for their instruction and to teach the sons of their teacher the healing art without remuneration. When the training of the student was finished, he was received into the Society of the Asklepiadæ on taking the following oath :†—"I swear by Apollo, the Healer, by Asklepios, by Hygieia and Panakeia and by the other gods and goddesses and call them to witness, that I will hold to this my oath with all my strength and capacity. I will revere him who has taught me the healing art as I do my parents, sharing my means of living with him and caring for his wants. His children shall be treated by me like my brothers and sisters; and his sons, should they wish to learn the healing art, will I teach without payment or indebtedness on their part. The professional rules and all that I have heard and learned of the healing art, will I impart to my own sons, to the sons of my teacher and to my pupils who, in accordance with the professional law, have been consigned and bound to me for that purpose; but beyond these, to none. The way of living of the sick, as far as I am able and know, will I regulate for their good and protect them from injurious and unwholesome influences. Never will I give a deadly drug, not even if I am asked for one, nor give any advice tending in this direction. Neither will I at any time give to a woman any drug or instrument for the purpose of causing abortion. Purely and holily will I spend my life and possess my art. Castration will I not carry out‡ even

* Plato: Menon c. 27. Protagoras c. 3.

† Hippokrates *op. cit.* T. iv, p. 628-632.

‡ The words: *οὐ τεμέω δὲ οὐδε μὴν λιθιῶντας* have at all times afforded great difficulty to commentators and translators. They mostly think that the person taking the oath binds himself not to perform lithotomy. By this explanation,

on those who suffer from stone, but leave this to those people who make a business of it. When I enter a house it shall be for the purpose of healing the sick. I will do wrong to no one intentionally nor inflict any injury, and I will never incite to unchastity either women or men, bond or free. Whatever I, in my medical practice or out of it may hear or see in respect of the private life of men, if such ought not to be publicly known, thereon will I observe silence and secrecy. May it be my lot, observing and not breaking this oath, to make full use of my life and art and to earn an enduring reputation among men. If, however, I break my oath and am forsworn, may the opposite happen to me." From the tenor of this oath, which without doubt belongs to the Ante-Hippokratic period, it is clear that castration, which was undertaken in order to supply eunuchs, was left to those people who undertook the performance of

however, the *οὐδέ μὴν* of the text is superfluous and disturbing to the sense since lithotomy could only have been undertaken in the case of those suffering from vesical calculus. LITTRÉ conjectured therefore that *αἰτέοντας* should be substituted for *λιθεῶντας*, so the translation should run: "I will not perform lithotomy even if the patients request me." But perhaps the passage does not refer exclusively to lithotomy: for the doctors of that period were not at all shy of undertaking other operations and busied themselves also with the investigation and treatment of diseases of the bladder. (HIPPOKRATES *op. cit.* T. vi, p. 150.)—The view of R. MOREAU, CHARPIGNON and others has greater authority, that it is a question in this passage of the forbidding of castration; for this appears in close connection with other disgraceful things, for instance the giving of poisons, procuring abortion, etc. Moreover the word *τέμνειν* occurs in this sense in Greek literature, though it is true the compounds *ἐκτέμνειν* and *ἀποτέμνειν* were used with this meaning more frequently. The immediately following *οὐδε μὴν λιθιῶντας* means then, that castration is not permitted even in those suffering from stone although the considerations against it must have been less in such cases, since lithotomy by the methods of operating then in use generally resulted in incapacity for sexual intercourse in consequence of the destruction of the seminal ducts. Moreover *λιθιᾶν* has also the meaning "to suffer from a swelling of stony hardness," and according to TH. GOMPERZ is used, in this sense, of indurations in the eyelids, joints, uterus, etc. Perhaps reference is here made to the testes and the passage in question must be translated: "I will not perform castration even in those who have indurated testes." —*Cf.* CHARPIGNON: Étude sur le serment d'Hippocrate, Orleans and Paris 1881.—TH. PUSCHMANN in Bursian's Jahresber. f. Alterthumswissenschaft 1884, iii, p. 55, and in the Jahresber. über. d. Fortscher. d. ges. Medicin, herausgeg. v. VIRCHOW u. HIRSCH. 1883, i, S. 326.

this operation as a matter of business. Perhaps other branches of surgery, for instance cystotomy and the treatment of fractures and sprains, were practised by empirics who had acquired great skill and certainty therein.* At any rate we are permitted to assume that in addition to the Asklepiadæ there were other doctors who did not belong to their association.† It was at a later period that all doctors were called "Asklepiadæ."

The Philosophers exerted great influence upon the development of medical science and especially upon the training of practitioners. The mode of Greek thought which sought to fathom the origin and essential characters of things brought into view before all else Man and Nature surrounding him. PYTHAGORAS who saw in number, in the relations of masses, and in law, the principles lying at the bottom of every existent thing, was himself a doctor and concerned himself with the structure of the body and with the activity of thought and spirit no less than with the procreation and development of man. After a somewhat lengthy sojourn in foreign lands especially in Egypt where he must have‡ been initiated into the wisdom of the learned priests, he settled down in the Greek colonial town of Kroton in Lower Italy, where the famous Asklepian school was situated. There he founded a confederation which strove after objects of an ethical and political, rather than a philosophical, character. Its members were generally doctors and soon found here a centre for the scientific interests which they had in common. They turned their attention chiefly to dietetics and sought by simple remedies, by fomentations, by frictions and ointments to bring about cures; surgery was neglected by them.§ Amongst the disciples of PYTHAGORAS are mentioned the doctors PHILOLAOS, ELOLATHES who considered health to be due

* *Cf.* H. HAESER: Geschichte der Medicin, 3. Aufl., Jena 1875, i, S. 88.

† WELCKER *op. cit.* S. 103 *et seq.*

‡ DIODOR. i, 69, 98.

§ JAMBLICH: de vita Pythag. c. 29, § 163 *et seq.*

to the harmonious correspondence of humours in the body, likening it to a condition of harmony in music,* EPIMARCHOS, METRODOROS and others. Probably ALKMÆON and DEMOKEDES who had received their professional training in Kroton, belonged to his school. The last-mentioned by his successful cures spread the fame of the healing art of his native country in foreign lands and obtained a prominent position at the court of King DARIUS† whose sprained foot he was able completely to restore after the vain attempts of his Egyptian body-surgeons. ALKMÆON is said to have been the first to undertake anatomical dissections and by these means he discovered the origin of the optic nerves from the brain‡. He taught that the human spirit is immortal and like the stars is engaged in everlasting movement. He sought to explain the origin of the five senses and formulated the first theory of sleep. "When the blood," he said, "retires into the great blood vessels, sleep comes on; when it again disperses into the smaller vessels awakening takes place."§ His views concerning the nourishing of the child in its mother's womb and concerning the causes which lie at the bottom of the infertility of hybrids are deserving of less attention. One of the most prominent natural philosophers of that time was EMPEDOKLES, who, musing on the eternity of the universe, attacked|| the theory of the origin and extinction of matter, seeing in it himself nothing but change manifesting itself in association and division, and being evoked by love and hate. He established, as ARISTOTLE tells us,¶ that doctrine of the four elements which exerted the greatest influence upon the physiology and pathology of later times

* KÜHN: Opusc. Acad., Lips. 1827, i, p. 47-86.

† HEROD. iii, c. 129-134.

‡ CHALCIDIUS in Platon. Timæum ed. Meursius, Lugd-Bat, 1617, p. 340. M. A. UNNA: De Alcmæone Crotoniata ejusque fragmentis quæ supersunt in CH. PETERSEN: Philologisch-historische Studien, 1. H., Hamburg 1832, S. 41-87.

§ PLUTARCH: de placit. philos. v, c. 24.

|| HIPPOKRATES *op. cit.* T. vi, p. 474.

¶ ARISTOTELES: Mataph. i, 3, 4.

and he already foreshadowed that great theory of creation which asserts that the development of organisms proceeds from lower to higher forms, and that only the conformable survive. He was of opinion that not only men and brutes but plants also are endowed with souls; he busied himself with the subject of the senses and with the act of respiration which he sought to elucidate in a mechanical way; and he regarded the labyrinth of the ear as the seat of hearing. His contemporaries ANAXAGORAS of Klazomene, and DIOGENES of Apollonia directed their attention chiefly to anatomy. The former undertook the dissection of animals* and noticed the lateral ventricles of the brain: moreover he was the first to give utterance to the opinion—raised into a dogma† by later doctors—that the bile is the cause of acute sickness. DIOGENES left behind him a description of the vascular system which it must be confessed contains numerous errors.‡ HERAKLITOS saw in the constant changes of form, in the everlasting mutations of things, the individual nature of these. Like EMPEDOKLES he ascribed a weighty influence upon the activities of the organism to *fire*, the internal heat. His views hold a place in the collection of dogmas belonging to the Hippokratic school and for a long time played an important part in physiology and pathology. In a higher degree was this the case with the theories of LEUKIPPOS and DEMOKRITOS. The materialism which dominated their doctrine of atoms, led to the investigation of nature, as the only way which promised results. DEMOKRITOS§ devoted himself with great zeal to anatomical investigations and appears to have been very skilful in them for he was able to compose a special treatise upon the structure of the chameleon.‖ He

* PLUTARCH: Perikles, c. 6.

† *Vide* die Nach-Galen'sche Schrift über die kritischen Tage in HIPPOKRATES *op. cit.* T. ix, p. 300 *et seq.*

‡ ARISTOTELES: Hist. Animal. iii, 2.

§ ARISTOTELES: de generat. i, 2.—CICERO: Tusc. quæst. v, 39.

‖ PLINIUS: Hist. Nat. xxviii, c. 29.

also appears to have written on various diseases; on canine rabies, on the healing influence of music,* etc.

A tradition, having origin in remote times,† tells that the people living in the vicinity of the great philosopher, considering him to be insane, summoned HIPPOKRATES to Abdera to investigate his case. But he, knowing the abundance of wisdom and intellect possessed by DEMOKRITOS, may well have felt himself compelled to give utterance to the opinion that he was the wisest of all men. He owed to his intercourse with DEMOKRITOS many suggestions and doubtless much information.‡ The philosophers reckoned the study of man and of diseases as belonging to their weightiest problems.§ Many of their number belonged to the medical profession, and practised as doctors.

This happy relation of mutual understanding between philosophy and medicine was maintained till a later period, and was attended with advantages to both departments of learning, drawing the former away from barren speculation and towards a secure foundation of facts, and offering the latter a deeper comprehension of things and a general scientific foundation for professional endeavours and aims.

THE TIME OF HIPPOKRATES.

THE medical school at Rhodes appears to have existed for only a short time: for the later authors make no further mention of it.‖ In the fifth century before Christ the medical school of Kroton was in the highest repute owing, no doubt, partly, to its connection with the Pythagoreans. The School of Kyrene¶ commanded the second position, and there other branches of knowledge,

* GELLIUS: Noct. Attic. iv, c. 13.

† HIPPOKRATES *op. cit.* T. ix, p. 320-386.—SORANUS: Leben des HIPPOKRATES in IDELER: Physici et medici Græci minores (Berlin 1841) T. i, p. 253.—ÆLIANUS: Var. hist. iv, c. 20.

‡ CELSUS: Præf.—SORANUS *op. cit.* p. 252.—BŒTHIUS: de musica i, 1.

§ ARISTOTELES: de respir. c. 8.—CELSUS: Præf.
GALEN *op. cit.* T. x, p. 6.

¶ HERODOT. iii, c. 131.

especially mathematics and philosophy, were ardently pursued.* Not long after this the Asklepiadæ-Schools of Knidos and Kos flourished. Unfortunately the writings† of THEOPOMPOS, treating of these, have been lost: but we possess in the Hippokratic collection a source giving us valuable information concerning their performances and individual administration. According to it there existed between these two schools essential differences in respect of medical theories and methods of investigation and treatment. The doctors of Knidos were good observers and skilful surgeons, showed an interest in scientific questions and liked treatment to be as simple as possible. Since, however the work in which their maxims were collected, namely the Knidian Sentences, has not been handed down to us, if we wish to form a conception of their scientific significance we are obliged to refer to the few remarks made upon the subject by other writers of antiquity. They proceed for the most part from opponents of the Knidian school and are consequently neither favourable nor just. The reproach is made against the latter that it was contented with inquiring into the subjective complaints of the sick and in consequence neglected the accurate objective investigation of their bodies.‡ The Knidian doctors were further blamed in that they divided diseases according to the various parts and organs of the body and distinguished between too many forms of disease. They laid it down as a law, for instance, that there were seven kinds of diseases of the bile, twelve of the bladder, four of the kidneys, as many kinds of strangury, three forms of tetanus, four of jaundice, three of consumption and several forms of quinsey, assigning chiefly the exciting causes as the points of distinction between them.§ Their descrip-

* *Cf.* HOUDART: Histoire de la médecine grecque depuis Esculape jusqu' à HIPPOCRATE, Paris 1856, p. 128 *et seq.*

† Photii Bibl. p. 120[b] ed. BEKKER.

‡ HIPPOCRATES *op. cit.* T. ii, p. 224.

§ HIPPOCRATES *op. cit.* T. vii, p. 188 *et seq.*—GALEN *op. cit.* T. xv, p. 363-64.

tion of the symptoms of disease was short and striking as may be seen by the fragment of RUFUS concerning *nephritis*.* In chronic diseases they ordered chiefly milk, whey and purgatives, for consumption they recommended much exercise on foot. EURYPHON, one of the most noted doctors of this school who lived in the age of HIPPOKRATES and distinguished himself as a medical author,† advised consumptives to drink asses' milk or to take women's milk straight from the breast,‡ and as appears from a scene of the comic dramatist PLATON he also used moxæ in this disease.§ Another representative of this School, KTESIAS, lived for a long time as body-physician at the Persian Court and composed historical works on Persia and India and also some medical writings.‖ Of the remaining Knidian doctors of that period we know little more than the names.¶ Information concerning the school of Knidos is more meagre almost than the remains left of its once flourishing civilization.

More favoured by fate was the medical school of Kos.** Its merits in connection with medical science have been handed down to posterity by HIPPOKRATES—its most renowned representative. The doctors of Kos were indebted to him for their writings having by later generations been made the foundation of the structure of medical teaching and for their school being even at the present day named with admiration and reverence.

> " A ray of glory fell on her; its glow
> Did straightway immortality bestow."

* Œuvres de Rufus d'Ephèse, ed. par Daremberg et Ruelle, Paris 1879, p. 159.

† GALEN *op. cit.* T. vi, p. 473; xi, 795; xv, 136; xvii, A. 886; xix, 721.

‡ GALEN *op. cit.* T. vii, 701.

§ GALEN *op. cit.* T. xviii, A. 149.

‖ DIODOR, ii, c. 32.—Œuvres d'Oribase ed. p. BUSSEMAKER ET DAREMBERG Paris 1851-76, T. ii, p. 182.—GALEN *op. cit.* T. xxiii, A. 731.

¶ HOUDART *op. cit.* p. 255 *et seq.*

** M. DUBOIS (De Co insula, Paris 1884) tells us about the excavations carried on in the Island of Kos by order of the French Government.

HIPPOKRATES, whose life extended approximately over the period between 460-377 B.C. was a scion of an ancient family of the Asklepiadæ residing on the island Kos and tracing its descent from ASKLEPIOS and HERAKLES. His grandfather and father distinguished themselves by their medical skill. From the latter HIPPOKRATES received his first instruction in medical science. For his more extended medical training he betook himself to Athens where he received manifold suggestions and instruction. There, at that period, flowed in a mighty stream all that Greece possessed of the Great, the Beautiful, and the Noble. It was the age of PERIKLES—that period of outward splendour, of civic prosperity, and of artistic activity, when the spirit of Hellenism was celebrating its imperishable triumphs. By the side of the philosophers SOKRATES and PLATO were to be seen the great tragic poets EURIPIDES and SOPHOKLES, the historian THUKYDIDES, the sculptor PHEIDIAS and the Architect INNESIKLES, who were filling the world with their fame, while the comic dramatist ARISTOPHANES and the lyric poets ION of Chios and DIONYSIOS attuned men's minds to happiness and serenity. Athens was adorned with splendid buildings; there arose the Propylæa, the Temple of Athené with its rich ornamentation of statues and sculpture, the imposing broad steps leading to the Akropolis, and the Odeion, while PHEIDEAS was creating the Olympian Zeus and the two statues of Pallas Athené. Impressions such as these must have exercised an influence upon the spiritual development of HIPPOKRATES; must have stimulated his ambition and fortified his energies. He sought the opportunity, in his intercourse with prominent doctors and philosophers, to perfect himself in his own province, and soon it was his lot to occupy a distinguished position in this sphere. His successful cures caused him to be much sought after as a doctor and his fame began to overstep the limits of his native land. He was summoned first to this and then to that town in order to give professional advice in difficult cases. His renown brought him a

multitude of pupils who hoped under his guidance to train themselves into becoming skilful doctors.* Among these were his sons THESSALOS and DRAKON and his son-in-law POLYBOS. THESSALOS, if his speech to the Athenians† contained in the pseudo-Hippokratic writings and dating from early times, is founded on fact, took part in his youth, as military surgeon, in the expedition of ALKIBIADES against Sicily: he lived later as body-physician at the court of King ARCHELAOS of Macedonia‡ and was esteemed as the author of numerous writings of the Hippokratic collection.§ That certain portions of these proceed from POLYBOS is a fact historically authenticated: for ARISTOTLE cites a fragment upon the distribution of the blood vessels from a book of POLYBOS which is found word for word in the Hippokratic writing upon the nature of man.‖ POLYBOS practised in Kos and at a later period gave instruction in medicine in the place of his father-in-law.¶ Around the life of HIPPOKRATES a multitude of traditions and legends are crowded, only a few of which can have truth in them. Thus the tale that he burned the library of Knidos** or the Temple of ASKLEPIOS in his native town†† so that he might appear as the discoverer of medical learning contained in the inscriptions there and which he appropriated to himself,—this tale which contradicts all that we know of the character of HIPPOKRATES is certainly false. Had he perpetrated an incendiary act of this kind, worthy of HEROSTRATOS, instead of the universal reverence which was paid to him in ancient times, he would only have met with scorn, however important a man he

* HIPPOKRATES *op. cit.* T. ix, p. 420.—SORANUS *op. cit.* p. 254.

† HIPPOKRATES *op. cit.* T. ix, 404.

‡ GALEN *op. cit.* T. xv, p. 12.

§ GALEN *op. cit.* T. vii, 855, 89c. ix, 859. xvii, A. 796, 882.

‖ *Cf.* ARISTOTELES: Hist. Animal. iii, c. 3.—HIPPOKRATES *op. cit.* T. vi, p. 58, and GALEN *op. cit.* T. iv, 653. xv, 108, 175. xviii. A. 8.

¶ GALEN *op. cit.* T. xv, 11.

** SORANUS *op. cit.* p. 253.

†† PLINIUS: Hist. Nat. xxix, c. 1.

might have been in his profession. The writings ascribed to him bespeak genuine philanthropy, sincere religious feeling, and glowing patriotism. From the prevailing petty agitations of political or social parties he held himself aloof and lived only for his science and his calling. The words which EURIPIDES addresses to the Natural Philosopher may be applied to him:

"Oh! happy the man
Who exploring the realms of knowledge has thoroughly surveyed them.
Thought does not lead him towards strife pernicious to the citizens
Or to a deed of wrong:
He thoroughly investigates the never-aging Universe
Of the Everlasting Mother—Nature;—how it came into being:
Never harbours in the heart of the upright man
A thought of shameful actions."

HIPPOKRATES passed the last years of his life in Thessaly: and there he is said to have died. Even up to the time of SORANUS* his tomb was pointed out in the district between Gyrton and Larissa: on it a swarm of bees had settled, and the honey thence derived was considered to have the power of healing sores in the mouths of children.

The high importance of HIPPOKRATES was already recognized by his contemporaries. PLATO † compared him with POLYKLEITOS and PHEIDIAS, and ARISTOTLE ‡ called him the 'Great' HIPPOKRATES. His writings were preserved by his successors with the works of the other members of his family and served them for medical teaching and for instruction when they had need of counsel in their professional practice. When the Ptolemies began to found a library and with this object caused the works of the most celebrated authors to be bought, transcripts of the Hippokratic collection reached Alexandria. Through the unprincipled acts of interested speculators, who turned the love for books manifested by Egyptian kings to their own account, the opportunity was seized upon for ascribing to renowned authors many works not belonging to them in

* *Op. cit.* p. 254. † Protagoras c. 3. ‡ Polit. vii, 4.

order to increase their selling value.* The librarians who were charged with the inspection and examination of the acquired books did not always possess the knowledge and means necessary to distinguish the true from the false or to make certain of the authenticity of documents. Thus it came about that certain works were declared to be by authors who really had had no hand in them. The Hippokratic writings among others met with this fate: even at that time people had been at work upon them with the result that essential differences had been introduced into the text.† Can we wonder then if to the collection which originally contained only the works of HIPPOKRATES and of his nearest relatives, other writings have been added which did not emanate from them at all.‡ The transcribers, who used the manuscripts at hand in the libraries to copy from, contributed to this, by giving confirmation and more general acceptance to certain writings as of real Hippokratic origin, and bold editors increased the error by arbitrary additions to, and enlargements and alterations of, the text.§ When GALEN wrote his commentary to the works of HIPPOKRATES he had before him a copy of the text with many different readings: he followed the plan, as he says himself,|| of always considering the most ancient reading as the correct one. Under these circumstances it is conceivable that even in very ancient times differences of opinion prevailed as to which writings were really composed by HIPPOKRATES and which were not. This question has exercised the ingenuity of the learned and of critics up to the most recent times, and even in the last few years LITTRÉ, ERMERINS, KÜHLEWEIN and others have made attempts to bring it nearer solution. In its present form

* GALEN *op. cit.* T. xvi, 5.

† GALEN *op. cit.* T. xvii, A. 606.

‡ *Cf.* the letter of ST. AUGUSTINE to FAUSTUS, the Manichæan, L. 33, 6 (T. vi, p. 493. Edit. FROBEN 1556).

§ GALEN *op. cit.* T. xv, 21. xvii, A. 795.

|| GALEN *op. cit.* xvii, A. 1005.

the collection of medical writings known by the name of the Hippokratic collection contains, by the side of a great number of treatises which without any doubt were composed by him and his nearest relatives, a mass of writings not less in quantity which came from other authors. Almost all belonged to the age of HIPPOKRATES, only a few additions coming from an earlier or later period. They furnish a complete survey of the medical acquirements possessed by people in the age of HIPPOKRATES and give us important information regarding the regulation of medical teaching and the position of the medical profession which with the help of other notices of the subject in literature we will try to illustrate in an accurate way.

It was generally recognized that the art of healing is not to be transferred from one person to another in any mysterious manner but has to be learned like any other art and that for this purpose recourse must be had to teachers who understand it, and are skilled in the practice of it.* The doctors' calling stood open to all. Medical studies began in early youth.† The teaching was probably organized in the same way as in the Platonic academies and other schools of philosophy; a teacher undertook the whole medical training of a student and made him acquainted with everything worth knowing in the various branches of medicine. He only was allowed to act as a teacher who was in actual practice, and who appeared to unite knowledge and experience in medicine. He demanded an honorarium from the students whose medical training he undertook, for the teaching given by him; this was secured by an agreement and was sometimes pretty considerable. On the entry of a pupil on his course of study care was taken to see that he was in good health; for the doctor must appear healthy in which case the people think "that he is at liberty to look

* PLATO: Ion. c. 8. Gorgias c. 14, on the civic qualification (beginning).

† PLATO: Rep. L. iii, c. 16. HIPPOKRATES *op. cit.* T. iv. p. 638.

after the health of others."* The author of the Hippokratic writing "on the Physician" takes this opportunity of making the amusing remark that it is also advantageous for a doctor to be "fairly plump in body"; unfortunately he omits to inform us whether the confidence of the patients in this case depended upon their belief that fat men are kinder than thin, or whether their plumpness suggested a larger income and consequently a more extensive practice. Furthermore it was enjoined upon doctors "to keep themselves clean, to be respectably dressed, and to make use of sweet ointments spreading an agreeable, but not suspicious, aroma."† Many seem to have given too great weight to this piece of advice, so that there was opportunity given for making merry over practitioners "Adorned with curls on the forehead and oiled, and overburthened with rings."‡

"The doctor, like a prudent man, will be careful to observe silence on many matters and in intercourse with his patients to maintain a becoming demeanour. Good manners have a most favourable influence on public opinion." "When he acts inconsiderately or rashly, he will be blamed." "Let there be deep thought without ill-humour in his lineaments: he must not appear arrogant or misanthropic. Whoso bursts out laughing and is unrestrained in his behaviour will be considered—an uncultivated man. This must be avoided. It is highly important that the doctor should know how to conduct himself properly: for his relations to his patients then become very close. Not only these are committed to the hands of the doctor but in treating them he has also to do with their wives and daughters and property. It is worth a man's while to be master of himself."§ In another Hippokratic writing it is said that "the doctor should assume a certain courtliness of manner, for a rough disposition is displeasing to the

* Hippokrates *op. cit.* T. ix, 204.
† Hippokrates *op. cit.* T. ix, p. 266.
‡ Aristophanes: Clouds: v, 330.
§ Hippokrates *op. cit.* T. ix, 206.

healthy and the sick alike." And again "he should not chatter too much with the people but only say what is necessary and what appertains to the treatment." Like a true philosopher he must strive "to be free from covetousness, to be reserved, modest, dignified, to form opinions and judgments for himself, to be of a peaceful disposition, sociable and of pure morals; he must speak intelligently, and should acquire prudent habits in life, must be on his guard against vice and superstition, and be distinguished for piety."* The author of the book "on the Sacred Disease" gives expression in one place to belief in the power and goodness of God; he is speaking of the idea that diseases are sent by God and he makes use of these beautiful words: "I cannot believe that there is any defilement of the body of man caused by God—injury to the lowest by an act of the Highest. Should a blemish be caused to it or a hurt inflicted upon it by anyone, the Deity is much more ready to cleanse and restore it than to cause it further abasement; for God it is who purifies us from the heaviest afflictions and takes away their stains."†

Beside this ethical training of the doctor his scientific education was not neglected. This matter was entered on with the correct view that the normal relations of the body must be first studied,‡ since the knowledge of these forms the groundwork of all medical acquirements.§ Anatomy was for the most part pursued upon the bodies of the lower animals. The dissection of the human body was made difficult by religious and social prejudices. Only in the case of enemies and traitors to the state or of heinous criminals was examination of the human body possible. Opportunities of this kind were certainly made use of by doctors seeking for information to confirm and augment their anatomical knowledge. The corpses of children left out

* Hippokrates *op. cit.* T. ix, 232-234.

† Hippokrates *op. cit.* T. vi, 362.

‡ *Cf.* Plato: Laws, l. xii, c. 10.

§ Hippokrates *op. cit.* T. vi, 278.—Aristotle: Eth. Nicom. i, 13.

to die must also have attracted their attention. So too may the glimpses into the structure of the body afforded by external wounds have been not without result. Various accounts point to the fact that there was no shrinking with horror from opening and examining the human body.* Even if no scientific aims were pursued in these investigations, evidence is nevertheless afforded that anatomical investigations were possible. That these were actually undertaken is an assumption of great probability in consequence of certain remarks of ARISTOTLE and the Hippokratic writers and above all in view of the extent of the anatomical knowledge of that period. The author of the Hippokratic treatise "on the joints" says incidentally of dislocation of the spine that it is permitted in the dead, but not in the living, to open the body by incision in order to reduce the dislocation by the hand, and in the lecture "on the Heart" the statement is made that this organ is to be withdrawn from the body of a dead person for the purpose of examination in the manner customary for a long time previously.† A passage in the 5th book of the Epidemics speaks indeed of a dissection which was undertaken for the purpose of determining the origin and extent of a disease.‡ Speaking generally they appear to have confined themselves to opening the thoracic and abdominal cavities; and the position and form of the contained organs are fairly correctly described. ARISTOTLE who on various occasions drew comparisons between the structure of the human body and that of the lower animals declared that the internal organs of man were as yet but little known.§ Certainly, the knowledge possessed by the doctors of the Hippokratic period, of the brain, nerves, vessels and even muscles was scanty and deficient. On the other hand, the bones were

* PLINIUS: Hist. Nat, xi, 70.—VALER. MAXIM, i, 8, 15.—PAUSANIAS iv, 9. —HERODOT. ix, 83.

† HIPPOKRATES *op. cit.* T. iv, 198. vi, 16. ix, 88.—GALEN ii, 280.

‡ HIPPOKRATES *op. cit.* T. v, 224.—ARISTOTLE: de part. anim: iv, 2.

§ ARISTOTLE: Hist. anim. i, 16.

very exactly described and even minute particulars noticed about them which only strike one on very careful examination. That human bones served chiefly as objects for study appears certain from the descriptions. If the examination of the human body or of parts of the same was the privilege only of certain prominent investigators, nevertheless the dissection of animals, which, as ARISTOTLE more than once observes, formed the principal source of anatomical knowledge, was accessible to everyone. This no doubt formed an essential assistance in anatomical teaching. Perhaps artificial imitations of skeletons were used for this purpose like that one which was preserved as a votive offering at Delphi and originally, according to UPORT, came from HIPPOKRATES.* Broadly, anatomical teaching consisted in this, that the teacher imparted to his pupils what he himself knew or thought about the structure and composition of the human body. It was the same with instruction in physiology, which consisted of a loose fabric of unfounded hypotheses and unsupported speculations. Training in the examination and treatment of the sick promised much greater results. The doctors of ancient Greece were masters in the art of observing the symptoms of diseases and in controlling them in ways conformable to nature. To the complaints of the sick and even to their dreams they paid great attention; but they attached the greatest weight to a close examination of the ailing body. In performing this the colour and condition of the skin and mucous membrane were observed, as also the state of the abdomen and the form of the thorax; the temperature was tested by application of the hand; and the excretions were subjected to a careful examination. By the touch they were able to recognize the size of the liver and spleen: nay, even the change in form of the latter which occurs in certain diseases.† Succussion served them at the same time for diagnosis and for therapeusis as pus might thus be caused to break through

* PAUSANIAS x, 2, 4.

† HIPPOKRATES *op. cit.* T. vii, 244.—PLATO: Timæos, c. 33.

into the bronchial tubes. They were acquainted with the pleuritic friction-sound and with vesicular crepitation which were compared with the creaking of leather and the boiling of vinegar respectively.* In this connection it is expressly stated that the ear was placed for a considerable time against the chest-wall to enable the sounds to be heard (*πολλὸν χρόνον προσέχων τὸ οὖς ἀκουάζῃ πρὸς τὰ πλευρά*).

The descriptions of individual diseases and of their course, as they mostly lend themselves to observation in private practice are admirable. Certain particular descriptions, as those of pneumonia, pleuritis, and phthisis, (which they considered contagious,) are so complete that even now little can be added to them. Among the causes of disease, in addition to the influence of heredity and defects of diet much also was ascribed to climate, nature of soil, the quality of the drinking-water, the time of year, the winds and the temperature. Prognosis stands on a high grade of development. In the Hippokratic writings a number of symptoms are mentioned which foretell a favourable or unfavourable termination to diseases. The doctors valued very highly the art of "predicting the future from the past and present." "Truly" writes the author of the Prognostics, "it is better to cure diseases than to foretell their course, but this is unfortunately not always possible."† In other passages the doctors are exhorted to observe caution in prognosis and are warned against asserting more than they can be answerable for.‡ The Hippokratic doctors have earned for themselves imperishable fame by their therapeutic principles which have endured from their time to ours. The high importance of dietetics was recognized by them in such a way as is seldom the case among their representatives of a later age. In a life spent in accordance with natural laws, in the use of baths, in exercise of the body and in wholesome nourishment they saw the best

* Hippokrates *op. cit.* T. vi, 24. vii, 92, 94.

† Hippokrates *op. cit.* T. ii, 110.

‡ Hippokrates *op. cit.* T. ix, 6 *et seq.*

means of avoiding illness. The doctor was looked upon as the hodman of Nature, whose efforts to heal it was his duty to second and imitate. Above all things he had to endeavour to remove the causes of the complaint if possible, in his general treatment to have regard to the special circumstances of the case, and especially to keep his attention fixed rather upon the patient than the disease: he had to be careful always to render aid or at least never to do any harm.*

The therapeutic agents used were chiefly of a dietetic nature: but mention is made of the more important drugs of the materia medica, which are still ordered at the present day. They were used as lotions, fomentations, injections, clysters or draughts. For blood-letting they employed venesection, scarification, and cupping. All these things were not only taught to the students in theoretical discourses but were also pointed out and explained at the bed-side. With this object they either accompanied the teacher in his professional visits † or received the necessary instruction in the Iatreion attached to his residence.‡ The latter was an institution like our private sanatorium, in which patients obtained medical advice, received medicines, were operated upon, and sometimes stayed and were taken care of for a considerable time.§ They were, as is mentioned in the Hippokratic treatise "on the Doctor," so situated as to be sheltered from the wind and the dazzling sunshine for "if for the doctor engaged in his work the sunshine is not unpleasant, to the patient it is troublesome, and injurious to his eyes." "The chairs must, as far as possible, be all of a similar height. Only the instruments should be made of bronze: for it seems a superfluous luxury to have the utensils of this metal. The drinking-water supplied to the patients must be agreeable and pure."

* HIPPOKRATES *op. cit.* T. i, 624. ii, 634. v, 314. vi, 92, 490.

† PLATO: Gorgias, c. ii.

‡ HIPPOKRATES *op. cit.* T. ix, 206 *et seq.*—ÆSCHINES in Timarch. 124.

§ PLATO: "Laws," i, 14. Repub. iii, 13, 14.—HIPPOKRATES *op. cit.* T. ii, 604. iii, 272 *et seq.* ix, 206 *et seq.*—ARISTOPHANES: Acharn, v, 1030.

"The napkins must be kept clean and be of soft texture as also the linen used for the eyes and the sponges for the wounds for these things are of great importance for the healing. The instruments must be adapted in size, hardness, and delicacy to the purpose for which they are used." In the Iatreia besides surgical instruments there were always at hand sponges, clean soft linen, slings, bandages, cupping glasses, porringers, enema syringes, basins, bathing-tubs, etc. The metal of which these objects were made, imparted to the whole a very bright aspect.*

The number of Iatreia possessed by a place depended upon its wants in this respect. "Where many diseases prevail" writes PLATO † "there are also many Iatreia." The doctors prepared the medicines themselves, and bought the substances used for this purpose from simplers or else collected them themselves. There were no apothecaries in our sense of the word: for the pharmacopôlæ not only traded in drugs and special preparations but also sold other things such as amulets, burning glasses and curiosities of all kinds.‡ His students and assistants stood by the doctor while compounding the drugs, performing operations, and generally during the treatment of the sick. The assistants were, as PLATO says, also called doctors. Students too were employed in this service, especially such as already possessed some knowledge of the healing art "so that they, upon occasion, could give directions and apply remedies without hesitation." The duty also devolved upon them of watching over the state of health of the patient during the absence of the doctor, their teacher, "so that nothing which had occurred in the interval should remain unknown to him." The Hippokratic author gives strict warnings upon this point not "to entrust such duties to the inexperienced: for if a mistake is made the blame falls upon the doctor." The students were also instructed in the

* ANTIPHANES in POLLUX: Onom. x, 46.

† PLATO: Rep. iii, 13.

‡ *Cf.* W. A. BECKER: Charikles iii. S. 52, Leipzig 1854. 2 Aufl.

use of surgical instruments and apparatus.* "In surgical operations the assistants," as is described in 'the Doctor's laboratory,' "in part hold forth that part of the body on which the operation is performed and in part hold the rest of the body secure: and while thus employed must observe silence, only listening to what the master says." "The instruments must be so placed that they are not in the way but are ready to hand when required. If one of the students hands them to the operator he should lay them out in order for himself beforehand and be prepared to execute the orders of the operator." Complete directions were given to the operator concerning his clothing, his attitude, the manner in which he should hold his arms and how he should place his feet during the operation. "The nails ought not to project beyond the finger tips and yet not to be too short, since use is made of the tips of the fingers. A man should test this on himself by moving the fore-finger against the thumb, bending the hand so as to present a level surface with the finger tips, and then pressing one hand against the other. It is a very favourable circumstance for a doctor if the spaces between the fingers of his hand are large and if the thumb is in good opposition to the forefinger." "He must accustom himself to the use of both hands and be able to accomplish the same tasks with one hand as well, as nicely, with equal celerity and order, as with the other, without its being tedious or difficult for him."† The doctors of the Hippokratic period practised surgery as well as internal medicine. It appears that as yet there were no specialists‡ though some doctors no doubt by preference gave special attention to particular departments of medical science, for instance the treatment of the eyes or teeth.§ Surgery was in a very imperfect state, which is explained by the neglect of anatomy.

* Hippokrates *op. cit.* T. ix, 216.

† Plato: Laws iv, 10.—Hippokrates *op. cit.* iii, 278 *et seq.*, 288. ix, 242.

‡ Cicero: de oratore iii, 333.

§ *Cf.* Becker *op cit.* S. 59.

The tying of vessels for the purpose of arresting the flow of blood was not yet known and therefore it was impossible to risk such operations as amputations and the removal of large tumours which entail a free loss of blood. On the other hand trepanning, the operation for empyema, paracentesis abdominis, and similar operations where the loss of blood is insignificant, were carried out.

The descriptions and treatment of wounds and fistulæ but especially that of dislocations and fractures deserve recognition. Here the experience gained in the gymnasia must have materially contributed to pave the way for a simple and natural method of cure. Fractures and dislocations, which occurred in the practice of gymnastics demanded prompt assistance and the teachers installed at the gymnasia must have acquired a certain amount of knowledge in these matters to enable them to make the necessary preparations for such accidents. If they were endowed with good powers of observation and practical dexterity they could not have failed to take notice of other ailments which came in their way. Through the study of medical treatises and intercourse with doctors they then sought to obtain enlightenment and confirmation on the subjects of their private experiences. Certain gymnasts, as IKKOS and HERODIKOS the latter of whom, as PLATO says, associated medicine with gymnastics, gained great reputation for themselves by their medical ability. They made use principally of dietetic means of cure, vapour baths, ointments, frictions and exercise of the body, as in long runs.* At the same time we must not look upon the gymnasts as doctors. PHILOSTRATOS defines in his book "on Gymnastics" the position of gymnasts and their relations to the healing art, in a short and striking manner, when he says "that their appropriate work consists in such matters as these—dispersing collections of fluid, removing superfluous material, making hard places soft, making other

* PLATO: Rep. iii, 14. Protagoras c. 8. Phædros c. 1.—HIPPOKRATES *op. cit.* T. v, 302.—PLINIUS: His. Nat. xxix, 2.

parts fat, modifying the shape or raising the temperature of parts," whereas in serious organic diseases, in wounds, and affections of the eyes and matters of that kind, application was made to the doctor.*

The Hippokratic doctors possessed fairly advanced knowledge in gynæcology. They were acquainted with various alterations in the position of the uterus, with the prolapse of this organ, and with a great number of diseases of the female sexual organs. Midwifery was in the hands of midwives and only in difficult cases was the help of the doctor sought. They trusted to the workings of Nature and interfered only when danger menaced the life of mother or child. In abnormal presentations they employed turning; prolapsed extremities were replaced or when this was impossible, separated from the body.† SOKRATES the son of "the stout and dignified midwife PHÆNARETE," as he calls himself with pride, has left us some information about the vocation of the midwife. Women who devoted themselves to the business must have borne children but must also have reached the age at which they could no more become pregnant. They gave information whether or not the birth was near at hand, endeavoured by medicines and psychical means to hasten it, tried to alleviate the pain, and divided the umbilical cord after the birth. When they considered it necessary they produced abortion. Along with this they carried on the no doubt very lucrative business of match-making attaching themselves to it of course on more grounds than one.‡ Many midwives, it appears, took pregnant women into their homes.§

No information has unfortunately reached us concerning the professional training of midwives. Probably they were instructed in their duties by an old colleague who was already rich in experiences of this field of activity. Does not a tradition worked into poetry, that the practice

* PHILOSTRATOS: to *περὶ γυμναστῆς*, Edit. Daremberg, Paris 1858.

† HIPPOKRATES *op. cit.* T. viii, 146 *et seq.*, 480, 512.

‡ PLATO Theætetos, c. 6.

§ ARISTOPHANES: Lysistratos v, 746 *et seq.*

of midwifery was at first confined to men and was given over to women only after they had received instruction from men, point to the fact that the midwives owed their medical knowledge to the doctors?*

Medical practice was permitted to everyone who considered that he possessed the requisite knowledge. The doctors treated patients, as has been already said, either in the Iatreia or else visited them professionally in their own homes. In the Hippokratic writings and especially in the "Epidemics" a number of cases of illness are mentioned and in every instance the residences of the patients are given. In their visits the doctors took with them certain of their assistants and pupils and charged them with many of the functions appertaining to the treatment. Thus they had firmly fixed in their mind "the medicines and their properties and all that has been written upon the subject" as also the methods of treatment, before they trusted themselves with the sick. "On entering a sick room a man should sit down, show a modest dignified demeanour, should not speak too much or let himself become embarrassed. He then should approach the patient, pay attention to him, reply to his complaints, remove any hindrances to his repose, criticize any want of order, and be prepared to render any service." These visits must be frequently repeated, in which way any mistakes can be corrected. The doctor must take care to see how the sleeping apartment of his patients is situated, and whether they are disturbed by noise or annoyed by strong smells and in such a case he must urge with tact but with firmness that such conditions be improved.† In serious cases of illness consultations between several doctors took place "for it is no subject for shame" as is stated in the Hippokratic treatises "if a doctor, who in a given case of disease is in doubt and from want of experience does not see to the bottom of the circumstances

* Hyginus: fabul. 274.—Welcker *op. cit.* S. 195 *et seq.*

† Hippokrates *op. cit.* T. ix, 238 *et seq.*

attending it, calls in other doctors so that he may confer with them and place on a firmer basis the treatment for the relief of the patient."*

Many doctors practised not only at their own place of residence but even undertook journeys for this purpose. On these occasions they took instruments with them which were of simple manufacture and easy to carry.† The doctors were entitled to demand a fee for services rendered to patients.‡ But the Hippokratic author exhorts them "to allow themselves to be influenced only by the motive of gaining in this way a greater opportunity for improving their knowledge. They were also to conduct themselves in this respect in not too sordid a spirit, but to consider the means and position of the patient, sometimes indeed to afford gratuitous aid and to consider that the recollection of a good deed is of more value than a temporary profit. The opportunity should not be neglected of helping a stranger or a poor man, for a love for humanity goes hand in hand with a love for knowledge."§

Quite at an early period the practice of paying doctors out of public funds was instituted, the obligation being laid on them of treating patients without further charge. This regulation must have existed before CHARONDAS (7th century B.C.).‖ In any case it was an ancient institution, and DEMOKEDES who was mentioned in the preceding chapter affords a well-known instance of it from the sixth century B.C. for he, before coming to Darius, had been district medical officer in Ægina with the yearly pay of a talent, was then appointed to a similar post in Athens with a salary of one hundred minæ, and was called thence to Samos by POLYKRATES, who settled upon him the salary of two talents.¶

* HIPPOKRATES *op. cit.* T. ix, 260, 262.

† HIPPOKRATES *op. cit.* T. ix, 236.

‡ PLATO: Politikos, c. 37.—ARISTOTLE: Rep. iii, 16.—XENOPHON: Memorabil. i, 2, 54.—PLINIUS: Hist. Nat. xxix, 2.

§ HIPPOKRATES *op. cit.* T. ix, 258.

‖ Diodor. xii, 13.

¶ Herodot. iii, 131.

The δημοσιεύοντες, the "people's doctors" were elected by the community. In Athens, the candidates desirous of filling such posts had to present themselves at a public meeting of the citizens, to give information concerning their education and to name the master from whom they had learned the healing art. In the election, which probably was conducted in the same way as those of other public officers, the most able candidate came off victorious.* Similar to that of Athens must have been the procedure for the appointment of public medical officers in the other towns of Greece. Their salaries were levied upon the town and its environs, as were the sums required for providing music and other things for the public advantage. In an inscription discovered at Delphi which however dates from a somewhat later period (214-163 B.C.) it is mentioned that some had immunity from this tax.† Besides the State subsidy the amount of which depended upon the work the doctors had to do and the wealth of the town, the public medical officers probably had an Iatreion erected and maintained at the cost of the public.‡ There they received patients who sought professional assistance at their hands, and imparted medical teaching. The public medical officers were summoned in the case of epidemics to give directions calculated to remove the same, and attended the authorities as experts. Their particular duty, however, consisted in the treatment of sick people without charge. The public in establishing a doctor in this way wished especially to assure themselves that in case of necessity their citizens should at all times find medical aid at hand. Although from the information that has reached us it is not certain that free treatment was exclusively for the poor, it may be assumed that this was practically the case and people of

* Xenophon: Memorab. iv, 25.—Plato: Gorgias, c. 10, 70.—Politikos, c. 2, 37.—*Cf.* also Böckh: Staatshaushalt der Athener 1, c. 21.

† C. Wescher and P. Foucart: Inscriptions à Delphes, Paris 1863, p. 20, No. 16.

‡ *Cf.* Vercoutre: "La Médecine publique dans l'antiquité grecque" in the Revue Archéologique, Paris 1880, Ser. ii, T. 39, p. 332.

means showed their recognition of the doctor's services by presents.

Just as the Greeks originated the institution of public medical officers, so too did they take care that their troops were provided with doctors. LYKURGOS considered this an important matter and appointed medical officers to the Spartan army.* Among the "ten thousand" commanded by XENOPHON there were eight military medical officers.† THESSALOS the elder son of HIPPOKRATES must have been practically a military medical officer for a certain time, and the author of the HIPPOKRATIC treatise "on the Doctor" writes "that the doctor gives himself the best training in surgery by entering on service with an army:" and he also takes occasion to remark that already a distinct literature of military medical science existed, in which the wounds met with in war were described.‡ The Army of ALEXANDER of Macedon was accompanied by PHILIPPOS of Akarnania, KALLISTHENES of Olynthia, GLAUKIAS and ALEXIPPOS—all celebrated doctors of that period.

The medical profession enjoyed high consideration. The expression of HOMER§ "that a single doctor is as valuable as many other men put together" was held to be true at a later period also. Doctors who distinguished themselves by unselfish devotion and remarkable performances in their calling and deserved well of their country were rewarded with eulogies and honours. On the bronze tablet of Idalion which dates from the 5th century B.C. the services of the doctor ONASILOS are commemorated: he served in war with his pupils gratuitously and received in consequence a grant and exemption from taxes.|| The Athenians are reported to have overwhelmed HIPPOKRATES with honours, initiated

* XENOPHON: on the Government of Sparta, c. 13.

† XENOPHON: Cyropæd. i, 6, 15.—Anabasis iii, 4, 30.

‡ HIPPOKRATES *op. cit.* T. ix, 220.

§ Ilias xi, 514.

|| M. SCHMIDT: Der Inschrift von Idalion, Jena 1875, and Sammlung Kyprischer Inschriften, 1876, Taf. 1.

him into the Eleusinian mysteries at the public expense, crowned him with a golden crown, and distinguished him in other ways.* The doctor EUENOR who, as is stated in an inscription of the year 388 B.C.,† "being entrusted by the people with the superintendence of the preparation of medicines for the public Iatreion, for this purpose has devoted a large sum out of his private means and has treated many sick people gratuitously," was publicly praised for this act and was honoured with a wreath and by having conferred on him rights of citizenship. In the inscription of Karpathos which WESCHER‡ ascribes to the end of the 4th or beginning of the 3rd century B.C. it is stated "that in consideration that MENOKRITOS, the son of METRODOROS of Samos in his position of public medical officer has devoted himself for more than twenty years with zeal and devotion to the care of the sick and has comported himself with spotless integrity in his professional capacity and in his private life; in consideration further that during a pestilence which broke out in the town and exposed to great danger both natives and strangers, by his self-sacrifice and frugality he contributed chiefly to restore health; in consideration finally that instead of demanding payment he willingly lived in indigence, saved many citizens in dangerous diseases without receiving any reward, as would have been only right and just, and that he never refused to visit sick people living in the environs of the town—the people of Brykontion have decided to honour him and to adorn him with a golden wreath and to cause this decree to be proclaimed publicly at the gaines of Asklepios and further to confer on him the privilege of participation in all festivals of the people of Brykontion and to erect to him a marble statue in the temple of Neptune on which this decree of the people extolling him, shall be inscribed."

* HIPPOKRATES *op. cit.* T. ix, 402.

† RHANGABE: Antiquités hellén. 1855, T. ii, No. 378.—E. CURTIUS in d. Gött. gelehrt. Anz. 1856, No. 196 *et seq.*

‡ Revue Archéologique, Paris 1863, T. viii, p. 469.

Certain authors,* relying upon the isolated judgments of doctrinaire philosophers, have considered that the medical profession since it was practised for money and was classed among the "handicrafts of citizens"—for so the word *δημιουργία* may be translated—did not meet with its due share of respect among the Greeks. But PLATO says expressly that "the true doctor follows a nobler object than the making of money" and that the healing art even if it is practised for rewards yet is not mercenary.† Although he writes in the "Laws" that the health of the body does not belong to those goods which are of primary importance to the State, yet he declares it to be a duty of the State to take care that able doctors are trained up.‡ The amount of esteem given to the doctor depended, as it always has, upon the individuality of the doctor himself, his acquirements, his endowments in the qualities of intelligence and of sympathy, and upon the outward conduct of his life. A slave, who as the assistant of a doctor acquired an important amount of information and manifested great devotion and industry, remained however still in a subordinate dependent position. It seems moreover that the doctors derived from the slave class did not have such a technical education as other doctors but learned their art in a purely empirical manner. "If any one" says PLATO "should care to exchange some philosophic conversation with such a man upon the structure and functions of the body he would assuredly enjoy a hearty laugh and exclaim: 'Thou fool! thou art no doctor but the dry-nurse of thy patients.'" §

In judging of a doctor his scientific education served very certainly as an important point for consideration. Ignorant and unskilful doctors were laughed at and mocked and given

* *Cf.* K. F. HERMANN: Lehrbuch der griech. Privat-Alterthümer, Heidelberg 1852, iii, S. 192.

† PLATO: Rep. i, c. 15, 18.

‡ PLATO: Laws i, 6.—Rep. iii, 16.

§ PLATO: Laws iv, 10. ix, 4.

over to public scorn. In the Hippokratic "Law" they are likened to the supernumeraries in a theatre "who appear to be actors, are clothed and wear masks like them and yet are only so in name, not in reality." * In another place it is said that it is with unskilful doctors as with bad pilots. "If they alter the rudder and commit a mistake in a calm sea no one notices it; but if an adverse wind and violent storms arise and the ship is cast on shore every one is convinced that their ignorance and mistakes are to blame. Even so is it with bad doctors, who form a majority among their professional colleagues. When they are treating lighter cases of illness, in which the greatest mistakes may be committed, without serious results ensuing, their want of skill will not strike the laity; when on the other hand they are called to a serious, violent, dangerous case it becomes clear to every one that they know nothing about it and give wrong directions." † "Ignorance is a bad possession, a poor ornament, a constant illusion, a picture of the fancy, affords no pleasure or happiness, and is the nurse of timidity and of rashness." ‡ The Hippokratic doctors exhorted their pupils to diligence and assiduous study. "Art is long, life short" they told them,§ and "the healing art cannot be learned in a hurry." ‖ They strongly recommended perusal of the medical treatises and with affecting piety recalled the honest, if not always successful attempts, which the doctors of an earlier period made to advance medical knowledge and to raise it to the rank of a science.¶

The intimate relations between medicine and philosophy which existed before HIPPOKRATES were made still more binding by him and his school and endured to a later period. "Philosophy and medicine have mutual need of one another and each is illustrated by the other. The doctor, who is also a philosopher stands in the highest position" writes a

* HIPPOKRATES *op. cit.* T. iv, 638.
† HIPPOKRATES *op. cit.* T. i, 590.
‡ HIPPOKRATES *op. cit.* T. iv, 640.
§ HIPPOKRATES *op. cit.* T. iv, 458.
‖ HIPPOKRATES *op. cit.* T. vi, 330.
¶ HIPPOKRATES *op. cit.* T. i, 596.

Hippokratic author.* SOKRATES and PLATO had amongst their pupils several doctors and students of medicine as may be gathered from the frequent use of similes drawn from medical science; and ARISTOTLE the founder of comparative anatomy and the advanced explorer in all departments of the investigations of Nature wrote† "most naturalists seek in medicine the end and object of their studies and of the doctors those who practise their art in a scientific spirit begin the study of medicine by working at natural science."

IN ALEXANDRIA.

THE youthful ALEXANDER of Macedon had subdued in a rapid series of conquests a great part of Europe, Africa, and Asia. The Thracian and Illyrian races as far as the Danube, Greece, Phœnicia, Palestine, Egypt, Persia and the whole of Asia Minor were subject to the sway of his sceptre; even many Indian states recognized his sovereignty; and from Italy and the Celtic tribes came embassies to seek his protection and alliance. Already must his heart, swollen with ambition, have conceived the daring project of a world-monarchy embracing all the regions of the earth as far as they were then known. But his sudden death put an abrupt termination to all these hopes. He died at the age of thirty-three in the vigour of youth and in possession of a power such as no mortal had exercised before him. The tragedy of his death is of even greater significance than his unexampled victories and successes. His empire fell to pieces as quickly as it had been built up. Aspiring generals shared in the heritage and made themselves masters of single provinces. But only his political creations were demolished. Whatever in the way of civilization and knowledge had been advanced by means of him or under his sway remained firm and bore rich fruit.

* HIPPOKRATES *op. cit.* T. ix, 232. † ARISTOTLE: De Sensu, C. 1.

The contact of the spirit of Greece with the peoples of the Orient exercised an abiding influence upon both sides. The Orientals learned to understand Science and Art which with them were but little developed if at all, and obtained the opportunity of acquiring Grecian education and refinement of manner; while the Greeks were freed from that narrow-mindedness which, evidently as a consequence of their small political commonwealth, had resulted in an overestimation of themselves and a contempt for foreigners. Hellenism drew from this source that cosmopolitan colouring which distinguished the efforts of the later Greeks. Art and Science derived from this acquaintance with foreigners many suggestions and improvements; especially so the natural sciences,—Zoology, Botany, Comparative Anatomy, and Materia Medica. These received a rich influx of material from lands thrown open to discovery, which, arranged and sifted by able hands, facilitated and promoted the carrying on of systematic work in these branches of knowledge. ALEXANDER'S dreams of future political power were soon forgotten. Only the plan of making Egypt the central state, and Alexandria—named after him—the capital of the world-empire he strove to create, was carried out, though in a manner quite different from his intentions. Egypt was indeed not the political, but the intellectual, centre of nations and undertook the part of dispenser of civilization, being especially called to this, as much by its situation as by its possessing a history of thousands of years. The princely family of the PTOLEMIES, on whom after ALEXANDER'S death the dominion of the Nile valley devolved, were of Greek descent and remained true to their Greek character in their new home.

While the trade and industry of Egypt flourished and her ships sailed as far as Madeira westwards, and eastwards to India and Persia, Arts and Sciences were nurtured at home and Greek culture was diffused. The PTOLEMIES brought artists and learned men from Greece to their court; caused magnificent buildings to be

erected, adorned their residences with the choicest objects the world could produce, and supported the sciences with royal liberality. They laid out botanical and zoological gardens, founded libraries, and created the Museum and the Serapeum,* two institutions in which learned men received accommodation and maintenance so that they might devote themselves to scientific studies without having to give their attention to providing the daily necessaries of life. These edifices contained, besides day and night apartments, great halls for meals and covered colonnades adorned with pictures, opening on to spacious courts and shady pleasure grounds.† The great libraries, in founding and extending which no expense was spared, stood adjoining, and no doubt in organic connection with them. Ecclesiastics of high rank exercised supreme control over these institutions and in conjunction with the heads of the several departments—into which the whole was divided according to the sciences pursued—exercised administrative power.

The Museum lay in immediate vicinity to the royal palace and was even treated as a part of it. The Serapeum was situated in a more remote part of the town and ranked after the Museum in importance. The library of the Serapeum was not so rich as that of the Museum. The lofty well-lighted halls of the libraries, in which the statues of celebrated men of learning were erected, contained many thousand papyrus-rolls of the most important works, especially of Greek literature. As to their number, accounts differ: while AMMIANUS and GELLIUS, for instance, estimated the whole of the papyrus-rolls of the Museum-library at 700,000, EPIPHANIUS reports that the number only reached 54,800.‡ The learned men who lived in the Museum and Serapeum formed societies like our

* G. PARTHEY: Das Alexandrinische Museum, Berlin 1838.—Fr. RITSCHL: Die Alexandrinischen Bibliotheken, Breslau 1838.

† STRABO xvii, 1.

‡ AMMIAN. xxii, 16.—A. GELLIUS: Noct. Attic. vi, 17.—*Cf.* also PARTHEY *op. cit.* S. 77.

Academies. In friendly intercourse and in free conversation they discussed the scientific questions which had been suggested to them by reading or observation. Their princely patrons took a stirring interest in their investigations and encouraged them by large stipends and rich presents. They busied themselves with grammar, with criticizing the texts of the manuscripts contained in the libraries, with the art of poetry, with music, history, philosophy, mathematics, mechanics, astronomy, geography, the natural sciences, and medicine. But these "priests of the Muses," as THEOKRITOS calls them,* did not live only for research: they devoted their time also to teaching. Students from all countries inhabited by Greeks came to Alexandria in order to obtain there the best instruction for their future professions. The Museum and Serapeum were thus not only academies but also high schools. Information is unfortunately wanting concerning the relation of these to the institutions which served the purpose of teaching medicine.

Two medical schools arose in Alexandria founded by different persons but alike, or nearly so, in the scientific principles guiding them. Both took their stand on the doctrines of the schools of Kos and Knidos and made the scientific acquisitions of these the foundations for their own investigations. At the head of one was HEROPHILOS† and of the other ERASISTRATOS.

The former was born about the year 300 B.C. at Chalcedon. His teachers were CHRYSIPPOS of Knidos who made himself remarkable for rejecting the too frequent employment of blood-letting and drastic medicines, who tried to set limbs by bandaging and who recommended‡ vapour baths in dropsy, and PRAXAGOROS of Kos one of the most copious medical writers of that period.§ HEROPHILOS attained to such importance that no less than four doctors of ancient times

* Idyll. xvii, v. 112.

† K. T. H. MARX: Herophilus, Karlsruhe und Baden 1838.

‡ GALEN *op. cit.* T. iv., 495. xi, 148, 230, 252.

§ C. G. KÜHN: De Praxagora Coo. progr., Lips. 1823.

undertook the task of writing his life. His most eminent services lay in the sphere of anatomy. He was at pains to fill up an essential gap in the Hippokratic teaching by submitting the nervous system to a careful examination, and he succeeded in throwing some light upon this hitherto but little investigated department of Anatomy. He described the membranes of the brain, the choroid plexuses, the venous sinuses, the *torcular Herophili* (named after him), the cerebral ventricles and the *calamus scriptorius* which was so called by him; he traced the origin of the nerves to the brain and spinal cord and recognized that the nerves transmit sensation and motion.* He also gave attention to the structure of the eye, described the vitreous body, the choroid, and the retina, drew attention to the singular form of the duodenum and noticed that the coats of the arteries are thicker than those of the veins.† How exact he was in his anatomical investigations is shown by his observation that the left spermatic vein in certain cases joins the renal vein.‡ He recognized various forms of the pulse according to its volume, strength, frequency, and regularity and laid the foundation for a scientific treatment of the indications afforded by it.§ HEROPHILOS had also remarkable experience as a surgeon, as is seen by his remark that dislocations of the femur relapse after reduction on account of the destruction of the *ligamentum teres* at the time of injury.‖ He recognized the cessation of menstruation when pregnancy exists and composed a text-book of midwifery, in which subject he is said to have imparted instruction.¶ Throughout, he held himself bound to the principle that in practical medicine a man should not be contented with theoretical

* GALEN *op. cit.* T. ii, 712, 731. iii, 708. xix, 330.—RUFUS *op. cit.* p. 153. PLUTARCH: de placit. philos. iv, 22.

† RUFUS *op. cit.* p. 154, 171.—GALEN *op. cit.* T. ii, 572, 780. iii, 445.

‡ GALEN *op. cit.* ii, 895.

§ GALEN *op. cit.* T. viii, 592, 956, 959.—PLINIUS: Hist. Nat. xi, 88. xxix, 5.

‖ ORIBASIUS *op. cit.* iv, 233.

¶ GALEN *op. cit.* T. ii, 150.

information, but should look upon experience alone as really important.* STOBÆUS relates that HEROPHILOS answered the question, who is the best doctor, thus: "He who knows how to distinguish the possible from the impossible."†

His contemporary ERASISTRATOS who participated with him in the fame won by the school of Alexandria derived his origin from Iulis in the island of Keos. He too had been taught by CHRYSIPPOS of Knidos: in addition to him METRODOROS, the son-in-law of ARISTOTLE, is mentioned among his teachers. ERASISTRATOS lived for a long time at the court of the King SELEUKOS NIKATOR where he achieved distinction by a remarkable diagnosis. ANTIOCHOS, the son of the King, was ill and ERASISTRATOS recognized by the agitation which he manifested at the sight of his stepmother that his disease had been occasioned by the hopeless love he bore her.‡ GALEN makes the humorous remark, touching this story, that he is unable to understand the foundation for this diagnosis, for "there is no such thing as a lover's pulse."§ Like HEROPHILOS, ERASISTRATOS was very diligent in anatomical investigations. He described the convolutions of the brain and considered the greater intricacy of these in man as compared with brutes to be the cause of the intellectual preponderance of the former over the latter.‖ He distinguished the motor from the sensory nerves, but thought that the former arose from the membranes, and the latter from the substance, of the brain.¶ He recognized the bronchial arteries, assumed an anatomical connection by anastomosis between the arteries and the veins and described the valves of the heart so accurately that GALEN was unable to add anything to his description.**

* PLINIUS: Hist. Nat. xxvi, 6.

† STABÆUS: Florileg: Ed. A. Meinecke iv, 2.

‡ PLUTARCH: Vita Demetrii, c. 38.—PLINIUS: Hist. Nat. xxix, 3.

§ GALEN *op. cit.* T. xiv, 631.

‖ GALEN *op. cit.* T. iii, 673.

¶ RUFUS *op. cit.* p. 185.

** GALEN *op. cit.* iii, 465, 492. v, 166.

Most remarkable of all is his recognition of the lacteal vessels,* the functions of which he evidently could not know or at most could only surmise: science had to wait for this for nearly two thousand years. His attempts to explain digestion and other physiological processes in a mechanical way deserve also due recognition: and those too made for the purpose of discovering the origin of diseases by pathological dissections.†

HEROPHILOS and ERASISTRATOS were undoubtedly assisted in their anatomical investigations by much important work previously done, as by that of DIOKLES of Karystus whom GALEN mentions with praise:‡ but above all they owe their extraordinary results to the circumstance that the Egyptian Kings placed at their disposal, in any quantity they wished, human subjects for dissection. They even had the opportunity of opening living men! Criminals from the prisons were handed over to them for this purpose "so that they could study the particular organs during life in regard to position, colour, form, size, disposition, hardness, softness, smoothness and superficial extent, their projections and their curvatures." They justified these vivisections in this way, saying "it must be permitted to sacrifice the lives of a few criminals if by doing so a permanent advantage accrues to the lives and health of many worthy men." Their opponents replied to this "that it is not only a cruel practice and degrades the healing art, which should serve as a blessing to mankind, not as a torture, but is also superfluous, since the people whose abdomens have been ripped up, diaphragms cut away, and thoracic cavities opened, *die* before it is possible to make scientific experiments on them."§ The pupils and followers of these two

* GALEN *op. cit.* T. ii, 649. iv, 718.

† GALEN *op. cit.* T. xix, 373.—CELSUS: Proem. and. iii, 21.—DIOSKORIDES, Ed. C. Sprengel, Lips. 1830, T. ii, p. 72. CÆLIUS AURELIANUS: de chron. iii, 8. v, 10.

‡ GALEN *op. cit.* T. ii, 282, 716.

§ CELSUS: Proem.—TURTULLIAN: de animâ, C. 10.

leaders of the Alexandrian school neglected, unfortunately, the exact methods of inquiry which HEROPHILOS had carried to remarkable results, and trod the convenient, easy paths of speculation. Only a few like the anatomist EUDEMOS, the doctors BACCHIOS of Tanagra and MANTIAS who did good service in materia medica, the obstetricians DEMETRIOS of Apamea and ANDREAS of Karystus, who gave a comprehensive and fairly complete exposition of the various causes of difficult labour, the surgeon PHILOXENOS and others were notable exceptions. Certain of them transported their classes to other localities and founded and fostered medical schools like ZEUXIS at Laodicea and HIKESIOS at Smyrna.

The slight differences between the followers of HEROPHILOS and ERASISTRATOS respectively became gradually less and less: the former distinguishing themselves from the latter chiefly in being more conservative and in ascribing a greater authority to the writings of the Hippokratic authors which they furnished with commentaries. But both schools were doomed to destruction inasmuch as they ceased to strive, by independent investigations, after an increase of knowledge and confined themselves to holding fast to theories which had been handed down to them and which gradually congealed into dead formulæ. "Truly it were easier" writes PLINY "to sit and listen quietly in the schools, than to be up and wandering over deserts and to seek out new plants every day." *

Under such circumstances it was not surprising, that thinking doctors forsook these dogmatists and swore allegiance to an empiricism which, though certainly not promising a solution of physiological and pathological problems, satisfied the requirements of medical practice. Under the influence of the scepticism which, started by PYRRHON and extended by KARNEADES the founder of the so-called third Platonic Academy, had reached a commanding position in the world, they arrived at the opinion that on this earth there is no certainty, no

* PLINIUS: Hist. nat. xxvi, 6.

real knowledge concerning phenomena and that probability is the highest limit that human understanding can reach. They thus resigned the most beautiful hopes which have animated scientific effort, and pronounced such effort to be without prospect. The Empirics neglected anatomy and physiology, declaring the study of them to be superfluous and unfruitful; they did not concern themselves at all about the essential nature of diseases but were satisfied with observing their symptoms, discovering their immediate causes, seeking remedies and trying which appeared adapted to effect a cure. In this they allowed themselves to be guided chiefly by experience and moreover did not confine themselves to consulting their own previous observations but also had regard to those which had been made by others and which in course of time had become historical. When they met with previously unknown symptoms a course of treatment was adopted which had been found to be useful in cases of a somewhat similar character. In thus adding the decision *per analogiam* to that by experience and that by history they completed the so-called empiric tripod.

The Empirics gave their attention chiefly to practical medical science. Materia medica, midwifery and surgery were by them essentially improved. The method of performing lithotomy, as described by CELSUS, we owe to them. Even the first attempts at lithotrity, which were undertaken by AMMONIOS, date from this period.* Materia medica was enriched by the works of NIKANDER and of KRATEVAS who dedicated his book upon the medicinal properties of drugs, which was furnished with coloured drawings, to King MITHRIDATES of Pontos. Besides these, PHILINOS a pupil of HEROPHILOS, SERAPION, GLAUKIAS and HERAKLIDES of Tarantum were among the well-known representatives of the Empiric sect.† While the sciences in

* CELSUS vii, 26.

† CH. DAREMBERG (Histoire des sciences médicales, Paris 1870, T. i, p. 159) has arranged in chronological order, beside one another, the adherents of this and of the two dogmatic schools in Alexandria.

Alexandria flourished and prospered, protection was offered them in other places in which they were soon to make themselves homes. The princely families of the SELEUCIDÆ in Syria and of the ATTALI in Pergamos vied with the PTOLEMIES in their guardianship of intellectual treasures. The ATTALI founded both elementary schools* and institutions for the learned like those in Alexandria and their library was, after that of the Museum and that of the Serapeum, the most celebrated of ancient times. The opposition which they offered to the PTOLEMIES in the purchase of manuscripts, led to an order forbidding the exportation of papyrus leaves from Egypt which was the indirect cause of the discovery of a durable material for writing upon, namely parchment, the name of which comes from Pergamos. The schools, thus founded, attained a high position and attracted men of learning who distinguished themselves in textual criticism, mathematics, and especially in medicine. Pergamos for a long time enjoyed a prominent position as a centre of medical training; and GALEN one of the greatest doctors and investigators of any period, received his first medical instruction there.

The last King of Pergamos, the weak-minded ATTALUS III, has acquired a bad reputation in the history of medical science. In continual fear of being poisoned by his enemies, he desired that effectual antidotes against poisons should be discovered and caused for this purpose experiments to be made upon criminals and other persons of whom he wished to be quit. "With his own hand he cultivated poisonous plants, henbane, hellebore, hemlock, aconite and doryknion in the royal gardens and collected their juices and fruits in order to study their properties." † The murderous MITHRIDATES of Pontos, another of these royal poison-mixers devoted himself to a similar pastime: he daily took some poison in order to accustom himself gradually to the use of the same. These experiments

* TH. MOMMSEN: Röm. Geschichte, Bd. v, S. 334.

† PLUTARCH: Vita Demetrii, C. 20.

although undertaken at the instance of madness and cruelty, had this advantage for medical science, that they led to a careful examination of the properties and powers of many substances; and the statements of medical authors of a later period testify that they were not unproductive of results.

The benevolent protection which was extended to the sciences by the first PTOLEMIES was changed later into indifference and mistrust, and gave place at last to a feeling of hatred and contempt. The seventh PTOLEMY drove men of learning from Alexandria and shut up their institutions. When these were reopened at a later period, they bore the signs of decay on their face. The appointments for learned men at the museum were now held at the caprice of the Prince and served as rewards for flattery and base services. The biting words of TIMON of Phlius might have been said of this period, "that the museum is a great food-trough in which scribblers fatten and quarrel about things they do not understand."* Under the Roman dominion it came to such a pass that athletes were nominated as members of the museum. The celebrated libraries were partly destroyed by fire, partly plundered by the foreign conquerors who came to Egypt. Some of their literary treasures reached Italy and Constantinople, and served to found or enlarge the libraries formed there. What remained must, at the capture of Alexandria, have suffered mutilation at the hands of the Arabs or have been destroyed by the Christians.

In the year 389 the temple of SERAPIS was changed into a Christian Church, and in the Serapeum "monks, so-called, took up their abode; who" as EUNAPIOS writes "in their figures resembled men but in their manner of living—swine."† He must surely have had in his mind unclean Oriental monks and not highly cultivated people like the Benedictines of our day. The medical schools in Alexandria maintained their prominent position under the Roman

* ATHENÆOS: Deipnosophistæ, i, p. 11, Basil. 1535, Ed. Bedrotus.

† EUNAPIOS in ædes i, p. 43, in Parthey *op. cit.* S. 102.

dominion and even improved it, probably contributing materially to that remarkable expansion which the art of healing experienced under the Arabs.

MEDICINE IN ROME.

THE Italian peninsula formed for centuries the scene of embittered quarrels and feuds, the final result of which was the subjection of isolated communities to the Roman dominion. The small rural states, which by degrees were swallowed up in the general Roman commonwealth, had devoted but little attention to the arts and sciences, and the Etruscans only could show any pretence to acquisitions of civilization containing germs rich in promise of future development. The science of medicine exhibited a character partly theurgical, partly empirical. Prayers, offerings, mystical and magical sentences, and invocations of deities, along with certain potent simples, the action of which chance had taught and experience confirmed, formed the principal materia medica of which the people availed themselves in sickness. Some knowledge of the treatment of wounds they also possessed, as well as of such subjects as the arrest of bleeding and the cure of fractures and dislocations. SENECA * characterizes the position of the healing art of that period appropriately in the words: *medicina quondam paucarum fuit scientia herbarum quibus sisteretur fluens sanguis, vulnera coirent.*

A real medical profession did not exist, and good friends, charitable women, and true devoted servants afforded, as in Homer's time, in case of necessity the required help. The Romans considered that the foundation and extension of their political power were the only employments which claimed the enlistment of the energies of the nation. Having concern with things of inferior importance such as the healing art appeared to them opposed to such aims. The sum of medical knowledge was from this circumstance

* Epist. 95.

not added to by them and the practice of the art remained in the same hands as before. To be sure the inspection of entrails, which the Haruspices undertook might have been able to serve for imparting information of an anatomical nature, but these priests lacked the necessary training and in their investigations they kept in view not scientific aims but mystical religious exercises which predisposed them to find peculiarities even where none existed. Notwithstanding this, the numerous expressions in anatomical terminology* which are borrowed from the Latin tongue point to the fact that the Romans knew and were able to distinguish from one another the most important organs of the body. But only very loose relations existed between anatomy and the practice of the healing art.

The Roman father of a family as he appears before us in M. PORCIUS CATO, had his book of recipes which he consulted in cases of sickness affecting his family, slaves, or domestic animals.† In this, besides many superstitious magical formulæ, all manner of expedients were detailed for use against internal affections and the treatment was sketched which was to be employed in injuries, fractures, dislocations, wounds, abscesses, fistulæ, nasal polypi and many other complaints. Great importance was ascribed to dietetics, and certain domestic remedies, such as colewort, stood in high esteem.‡ Even wine was frequently used for these purposes and CATO "whose virtue" as HORACE writes "often grew warmer under the influence of good wine,"§ recommended it as an addition to various remedies. The patriarchal custom of the father of the family being also the family doctor, naturally disappeared with the development of the healing art and formed certainly an exception even in CATO'S time.

* RENÉ BRIAU: "Introduction de la médecine dans le Latium et à Rome" in the Révue archéol., Paris, 1885, Sér. iii, T. 6, p. 197.—Jos. HYRTL: Onomatologia anatomica, Wien 1880.

† PLINIUS: Hist. nat. xxix, c. 8.—PLUTARCH: Cato major, c. 23.

‡ PLINIUS: Hist. nat. xx, c. 33.

§ Od. iii, 21, Ad amphoram.

The increased demands which were made upon the knowledge and skill of those who professed the art of healing and the great advances made in political and social conditions justified the education of a distinct medical class. Unfortunately historical information fails us as to how this process was brought about. May we not suppose that the want of assured medical assistance which was experienced in the frequent military expeditions of the Romans, exerted an influence in this direction? In the most ancient times the soldiers used to dress each other's wounds and carried with them bandages for this purpose. Each took his share in caring for the wounded * but the medical help which they received appears to have been inadequate, so much so that after the battle of Sutrium (309 B.C.) more warriors were lost by dying subsequently of wounds than were killed in action by the enemy.†

Yet it is certain that at that time the healing art was practised as a profession in Rome. This is demonstrated not only by the testimony of the authors of antiquity,‡ who on various occasions make mention of doctors, but also in a convincing manner by numerous other facts. The *Lex Aquilia* made the doctor who had neglected a slave after an operation responsible if he met his death in consequence.§ PLUTARCH || relates, that among the persons attached to the Embassy which the Romans sent to Bithynia there was a man on whom the operation of trephining had been successfully performed, and even in the twelve law-tables of Numa mention is made of teeth artificially bound together with gold thread.¶ On the other hand PLINY** plainly affirms that Rome for many centuries did without doctors though not without medicine (*sine*

* TACITUS: Annal. iv, 63.
† LIVIUS viii, 36. ix, 32. x, 35. xxx, 34.
‡ DION. HALICARN. i, 79. x, 53.—LIVIUS xxv, 26.
§ Institut. iv, tit. 3. § 6 and 7.
|| Cato major, c. 9.
¶ CICERO: de leg. ii, 24.
** PLINIUS: Hist. nat. xxix, 5.

medicis, nec tamen sine medicina). But he meant by this only to say that in Rome until the immigration of Greek doctors of whom he soon afterwards speaks there were really no persons who deserved the name of doctors and he remarks that Greek medicine was expected with joyful eagerness but that when a man came to make its acquaintance, he was undeceived about it (*Medicinæ vero etiam avidus, donec expertam damnavit*); he corrects himself in a later passage by saying that the calling itself was not alluded to so much as the particular kind of practice then carried on.*

The Greek influence had made itself felt in Rome long before Romans were acquainted with the scientific acquirements of Greek doctors; and it is indicative of the mode of thought of that period that this influence showed itself first in the sphere of religious mysticism. Already, at an earlier period, the Romans, during severe epidemics, had had recourse to the oracles, and to the health-deities of the Greeks, who were propitiated in conjunction with their native Gods. A temple was dedicated to APOLLO as Healer during a pestilence which raged in Rome in the fifth century B.C.† In the year 291 B.C. the service of ASKLEPIOS was transplanted from Epidauros to Rome; a proceeding which has been enlarged upon by various authors with poetic ornamentation and even glorified by the painter's art.‡ In the year 154 B.C. a *Collegium Æsculapii et Hygeiæ* was erected in Rome, the document of foundation of which has been preserved in an inscription found in the Garden of the Palestrine Palace.§ As Rome after the Punic wars grew up to that

* PLINIUS *op. cit.* xxix, 8.

† LIVIUS iv, 25, 29. vii, 20. xl, 51.

‡ VALER. MAXIM. i, 6, 8, LIVIUS x, 47. xxix, 22.—OVID: Metam. xv, v. 626-744.—PANOFKA: Asklepios und die Asklepiaden, Berlin 1840, S. 52 u. Tafel ii, 3.—BÖTTIGER in K. SPRENGEL's Beiträgen z. Gesch. d. Med., Halle 1795, i, 2, S. 163 *et seq.*

§ SPON: Recherches curieuses d'antiquité, Lyon 1683, p. 326-343 and reprinted by J. ROSENBAUM: K. Sprengel's Versuch einer Geschichte d. Arznei-

world wide power which was able to contest successfully the supremacy over the Mediterranean and the lands on its shores, the immigration from abroad increased to a remarkable extent. Whoever by birth, ability, talent, or knowledge overtopped his fellows, betook himself to the City on the Tiber, since there he might hope soonest to bring his superiority to a profitable recognition. Thither flocked a herd of adventurers seeking their fortunes, and leaving no stone unturned to accomplish their object, as well as that vast multitude of slaves who were drawn by rich Romans from abroad in order to minister to their increased luxury. The inordinate enjoyment of sensual pleasures resulted in new vices and new diseases against which help was sought at the hands of foreign doctors.

The Greeks, as heretofore, formed the largest contingent of the foreign immigration: their tongue and culture were widely diffused in Rome. Nothing illustrates the importance possessed by Hellenism at that period more, than that CATO himself, that despiser of all appertaining to Greece, felt himself impelled to study its language and literature, and that the same General LUCIUS ÆMILIUS PAULUS, who conquered the Greeks on the field of battle caused his children to be educated by Greek teachers. Only on the arena of politics and in war did the Greeks yield to the Romans: in a competition of intellects the Greeks were victors.

> Græcia capta ferum victorem cepit et artes
> Intulit agresti Latio.*

Education and medical science experienced in Rome the most important modifications from this cause. The wonderful advancement which medical science owed to the Greeks make it intelligible that every effort was made to profit by their knowledge and skill in this sphere. The Greek

kunde, Leipzig 1846, S. 208 Anm., and G. PINTO: Storia della Medicina in Roma, Roma 1879, p. 191.

* HORATIUS: Epist. i. 1, v. 156.

doctors were sought out in Rome and their Roman colleagues were compelled to pick up special information in Greek medical literature if, in the struggle for existence, they did not wish to be worsted. The medical art of the Romans, so far as it took its rise on a national foundation, yielded before the influx of Grecian science and, like all civilization of a lower character when absorbed by that of a higher, left its traces behind only in popular tradition. Professional medicine in Rome was henceforward Greek. Its practice was founded on Greek writings and its prominent representatives belonged to the Greek nation. This preponderance was maintained even until the later periods of antiquity. The Romans have never acquired for themselves an independent position in this sphere of intellectual activity and their best medical works possess the value merely of collated treatises for which the creations of Greek genius served as a copy.

The Greek doctors who were the first to migrate to Rome were not, it appears, the most respectable members of their profession. Offensive in consequence of their foreign manners and of their bias towards quackery, which however natural in their oriental home was opposed to the severe customs of the Romans, they soon made themselves despised and hated for their covetousness and boastfulness. Certainly but few of them were inspired by enthusiasm for their art or by love of their fellow-creatures : pursuit of riches and pleasure attracted the majority of them from their home to foreign lands. The grave accusations which CATO made against them, even if exaggerated, were not wholly undeserved.*

The doctor ARCHAGATHOS (a good beginning!) who came from the Peloponnesus to Rome about 219 B.C. at once attracted public attention. His surgical operations excited such a sensation that the Senate conferred Roman citizenship upon him and at the public cost bought a consulting room for him in a populous quarter of the city. But his love "of cutting and burning" and perhaps some unsuc-

* PLINIUS *op. cit.* xxix, 5, 7, 8.

cessful results of operative treatment, soon deprived him of the confidence of the people who now called him not a surgeon but an executioner (*Carnifex*).*

The Bithynian doctor ASKLEPIADES later on attained a prominent position, having settled in Rome in the time of POMPEY. Possessed of a thorough general education, endowed with unusual intellectual gifts, an acute, penetrating understanding, and rich experience of life, he soon raised himself above the crowd of ordinary doctors. His polished manners in society, his trustworthy courteous aspect in conjunction with his gifts of speech, which enabled him to give appropriate expression to his unbounded self-confidence, provided him with an introduction to the highest circles of Rome and procured him the distinguished friendship of such men as CICERO, L. CRASSUS, MARCUS ANTONIUS and others. King MITHRIDATES sought by promises to attract him to his Court, but, as ASKLEPIADES declined his invitations, had to be satisfied with the transmission of his writings. ASKLEPIADES preferred to remain in Rome where he acquired great riches and was honoured "as one sent from Heaven." He knew well how to maintain, and if possible, to enhance, the high opinion entertained of him by the people and disdained no means to this end. Thus he 'restored a man to life' whose obsequies were actually about to be carried out. With quackish boastfulness he declared, that people might cease to consider him a doctor if he were ever taken ill himself; and Death was so good as not to give him the lie, for he died from the fall of a ladder.† Like other people of his disposition ASKLEPIADES disclaimed any authority and believed only in himself. He rejected the dogmatic teaching of his predecessors and contrived a medical system of his own founded upon the atomic doctrine of the

* PLINIUS *op. cit.* xxix, 6.

† PLINIUS *op. cit.* vii, 37. xxvi, 7, 8, 9. CICERO: de oratore. i, 14.—APULEIUS: florid., c. 19.—SEXT. Empir. ad logic. dogm. i, c. 91, ad. mathem. iv, c. 113 etc.

Epicureans as the latter had received it from DEMOKRITOS and in a somewhat modified form from HERAKLIDES of Pontus. He taught that the human body is compounded of atoms having no constant shape and subjected to continual motion and change, and of spaces lying between them which allow the movements of the juices and also transmit sensation. He attributed health and sickness to the activity and disposition of the atoms and their relation to the spaces between them.* The human soul appeared to him as the result of the activity of thought. He said that it is, as it were, a breath which penetrates every part of the body, and, in no manner, has its seat in any particular organ; an assertion which has given an opportunity to the ecclesiastical author TERTULLIAN of indulging in some insipid witticisms.† The materialistic ideas, which at the same time found an eloquent advocate in the poet LUCRETIUS, had many friends and adherents among men of intellectual advancement. ASKLEPIADES sought to combine them with the moral philosophy of the Stoa in order that they might give no offence to natures spiritually endowed. In this way he insured for his teaching the applause and admiration of the educated laity while the doctors were won over by the preference he showed for the humoral pathology. The defective views of physiology and pathology afforded by the theory of juices of the Hippokratic writers could not satisfy thinking doctors. When ASKLEPIADES suggested the part played by the solid structures of the body, the matter appeared obvious to them. In this, as also in introducing materialism into medicine he rendered great services to the development of that science. His therapeutic principles culminated in the doctrine that the doctor must so act as to make his patient well quickly, safely, and in an agreeable manner. He was opposed to the misuse made by the doctors of his time, of drastic purga-

* CAEL. AURELIANUS: de acut. i, 14, 15.

† TERTULLIAN: de anima, c. 15.

tives, emetics, and sudorifics and recommended in their stead chiefly active and passive exercise of the body, frictions, baths, the drinking of cold water, clysters and other similar remedies combined with a strict regulation of the diet. To induce sleep he caused his patients to lie in hammocks which were put into gentle swinging motion. In croup he recommended the performance of tracheotomy,* as others before him had done.

The teachings of ASKLEPIADES were more extensively elaborated by his pupils and adherents and formed the fundamental tenets of the medical sect called the Methodists. The actual founder of this, THEMISON of Laodicea a pupil of ASKLEPIADES, undertook the task of adapting the philosophical system of his master to the comprehension and requirements of practical doctors. He said that diseases indicate either a state of increased or diminished tension, or else a state involving a mixture of these two conditions, manifested by the organs, at various times, in the way of exalted, impaired, or otherwise modified secreting activity.† The characters common to all diseases were called "Communities" and to attack them by remedies which possessed an opposite action was decided to be the proper aim of medical treatment. The Methodists confined themselves to treating the general symptoms of diseases: to investigate their seat and origin they considered superfluous and almost hopeless. They busied themselves chiefly with Semeiology and Therapeutics and directed their attention by preference to questions connected with practice. Their doctrines were so simple and easy to learn and so conveniently carried out that they found a ready acceptance with the majority of doctors. But such as cherished the interests of science could not fail to observe their deficiencies. The Community-doctrine which sought to explain everything according to a pattern

* CELSUS ii, 14. iii, 4. iv, 19.—CAEL. AUREL.: de acut. i, 15. iii, 4, 8.—PLINIUS: Hist. Nat. xxvi, 7, 8, 9.

† CELSUS: Præf.

model, and which not only left unanswered questions of scientific theory but seemed unprofitable in practice, was bound to prove itself as superficial and untenable in time as was the immature materialism which pretended to have found a solution of the problem of organic life in a fortuitous concourse of atoms.

For this reason intelligent men embraced an eclecticism which sought to combine the Greek philosophy of nature with the humoral theories of the Hippokratic writers and the tissue pathology of the Methodist school, and, by the adoption of the Pneuma—a spiritual element pervading the body and denominating it,—to fill up a broad gap in the various medical systems. The doctrine of the Pneuma was by no means new: it was already pointed at in the Hippokratic writings, discussed at length by the Peripatetics, applied by ERASISTRATOS to explain many processes in the human organism and at a later period dragged again to the front at the Stoa. Certain doctors, as for instance ATHENÆUS of Attalia, ascribed such a prominent part to the Pneuma, that they have been characterized as "Pneumatists." In medical practice the Eclectics took their stand upon a foundation of facts and saw in experience the only true and certain guide for conduct in their craft. Yet they did not assume an indifferent or hostile attitude towards scientific investigation but favoured the same, and made progress themselves in paths, such as those of anatomy and physiology, the use of which in practice was not immediately apparent.

Eclecticism was prepared for and led up to in an efficient manner by the writings of the Encyclopædists which set forth in a connected form all that had been achieved in the preceding periods of civilization in the different paths of intellectual effort. Besides philosophy, history, politics, military science, geography, the natural sciences, agriculture, painting and sculpture, etc. they introduced medicine also into the field of observation. Their writings on this subject bring into review all the medical knowledge of that period and are so much the more valuable in that they

contain a multitude of extracts from medical works which have been lost. The best known Encyclopædists were M. TERENTIUS VARRO, A. CORNELIUS CELSUS and the elder PLINY. The last mentioned in writing his natural history made use of not less than 2,000 books as he himself relates * and CELSUS in his work on Medicine which by its elegant expositions and classic language ranks with the best examples of Roman literature, gives us some, if insufficient, recompense for the great number of medical works of the Alexandrian period of which an envious fate has robbed us. Eclecticism developed into an organic whole, instinct with life, uniting the advantages of the other medical systems in itself without their deficiencies and faults. Holding fast to the traditions of past ages but free from that pedantry of the schoolmaster which regards every departure from the beaten track as wanton risk, it was admirably adapted to encourage activity in research among individuals and to render possible the advance of science. Eclecticism was a want,—a necessity,—for medical science if it was not to be reduced to the dead level of rude empiricism or one-sided methodism. It is thus easily comprehensible that it obtained dominion in medicine. The doctors attached themselves to it with enthusiasm and medical literature received an eclectic colouring. Even the teaching of GALEN which during fifteen centuries of the history of the world passed in medical matters as the highest and as an almost infallible authority was in its origin nothing but a purified eclecticism. It certainly soon obtained the power of standing alone and erected itself into a compact system through the creative power of its founder, who disclosed a crowd of facts to medical science and opened for it new paths.

GALEN was born in the year 131 of our era at Pergamos the future seat of government of the Attali. His father the architect NIKON was an able and educated man who possessed sound acquirements in mathematics, physics, and the natural

* PLINIUS *op. cit.* i, præf.

sciences. With loving care he superintended the education of his son and paid particular attention that he should be instructed by distinguished teachers. Furnished with an admirable preliminary training, GALEN began in his 17th year his medical studies. He first of all attended the medical school of his native town at which the anatomist SATYRUS, a pupil of QUINTUS, STRATONICUS the Hippokratic, the Empiric ÆSCHRION and others were working. On the death of his father which occurred four years later he left Pergamos and betook himself to Smyrna in order to continue his studies there under the guidance of PELOPS a famous anatomist and of ALBINUS the Platonist; he then went to Corinth where he received instruction from another distinguished anatomist, NUMESIANUS.* He now travelled through Asia Minor and Egypt mainly with the object of increasing and confirming his acquirements in the natural sciences. In Alexandria where the medical schools and other institutions of a similar kind were of the first order, he remained until his 28th year. He devoted himself with great zeal to anatomy, greater opportunity being afforded him for this study there than anywhere else.† At the same time he endeavoured to enlarge and refine his knowledge in the other branches of medical science. Alexandria was filled to overflowing‡ with medical practitioners and there was probably no medical system, no method of treatment which had not its adherents and advocates amongst the doctors residing there. Nowhere could the student of medicine see and learn so much as in Alexandria. On this account the young doctors came there when they wished to perfect themselves in their specialities. Even in later times the best recommendation a doctor could have was to have studied in Alexandria.§ Rich in intellectual acquire-

* J. CH. ACKERMANN: Vita Galeni in Galeni opera. Ed. Kühn, T. 1 (Introduction) gives the references for this.

† GALEN ii, 220.

‡ FULGENTIUS: Mythol. i, p. 16.

§ AMMIAN. Marcell. xxii, 16.

ments, GALEN turned his steps back to his home and undertook the professional treatment of gladiators and prize-fighters. But the mean and petty circumstances of his native town, and an insurrection which broke out there, induced him after some years to settle in Rome. In order to become known there he gave public lectures on the structure and functions of the human body. The interest of the subject and the practical knowledge of the lecturer soon attracted a numerous audience composed of representatives of the most distinguished circles of the capital. Amongst his hearers were men in influential positions such as the philosophers EUDEMUS and ALEXANDER of Damascus, the prefect SERGIUS, the consuls BOËTHUS and SEVERUS, who afterwards mounted the throne, and BARBARUS the uncle of the Emperor LUCIUS. In this way GALEN succeeded, within a short time, in obtaining a profitable medical practice. But the envy and jealousy of his colleagues and other adverse circumstances disgusted him with residence in Rome. He on that account took to travelling and visited various parts of Italy and Greece, the island of Cyprus, Palestine, and Pergamos, his home. A year later he was called by the Emperors LUCIUS VERUS and A. MARCUS AURELIUS to Aquileia to accompany them in their campaign against the Germans. The death of the former changed his destination: he remained in Rome and was appointed body-physician to the young heir to the throne, COMMODUS.* How long he held this office, whether he returned to his home and if he did at what period, is unknown. As little do we know when and where he died. As SUIDAS points out he must have reached his 70th year, for his death did not take place before 201 A.D.

If the life of GALEN has been fully described here, the justification lies not only in the extraordinary importance which he acquired in reference to the healing art but that at the same time a prominent example is given of the method employed in the training of able doctors at that

* GALEN xiv, 648 *et seq.*

period. GALEN was an experienced and skilful doctor, a learned investigator, a teacher of medicine much in request, and an uncommonly industrious author. His literary activity is evident from the number of his writings which in KÜHN'S edition fill 21 volumes each containing about 1,000 pages. It is certain that among these are many works which have been falsely ascribed to him: but on the other hand a multitude of works really written by him are absent from the edition—works which partly have been lost, partly only existed as translations and have never been printed. GALEN'S works treat of philosophy, anatomy, physiology, materia medica, practical medicine, surgery, gynæcology, the history of medicine, etc. They place before the reader all that had been attained in this sphere of work and, like the Hippokratic collection, exhibit a picture of the condition of contemporary medical science; while particular parts throw much light upon the professional acquirements of the doctors as well as upon their social condition.

Medical teaching also is mentioned in them in numerous passages. The development of this was strictly dependent upon the destinies of medical science in general. The subject matter and aims of teaching were regulated by the progress of science and by the system prevailing at the time, while the manner of imparting instruction was defined by the relations of the medical profession to society at large.

MEDICAL TEACHING IN ROME.

IN the most ancient periods of Roman history medical knowledge was transmitted from the father to the son or to a relative and friend. The personal superintendence of the pupil by the medical practitioner remained also at a later period the commonest, if not the only, form of medical teaching. When the medical art of the Greeks was transplanted to Rome, medical teaching became possessed of material borrowed from the rich medical literature of the

Greeks and also assumed the external form which it had in Greece. The Greek doctors who had migrated to Rome there acted as teachers of their art and introduced the regulations of their home. As in Greece so also in Rome the practice of medicine was a free profession which every one who thought he possessed the necessary ability was at liberty to carry on. There were no legal ordinances regulating the character of the training of doctors. They obtained their special knowledge how and where they liked. Their education was consequently not at all uniform. The medical profession contained in itself individual members differing widely in respect of their knowledge. Alongside of men who at that period were an honour to their calling there were persons who had no knowledge of medical, or of any other, science. PLINY* was right in complaining "that people believed in anyone who gave himself out for a doctor even if the falsehood directly entailed the greatest danger." "Unfortunately there is no law" he writes further on "which punishes doctors for ignorance and no one takes revenge on a doctor, if, through his fault, someone dies. It is permitted him by our danger to learn for the future, at our death to make experiments, and without having to fear punishment to set at nought the life of a human being."

The junior members of the profession, who wished to do honour to their calling were naturally anxious to acquire some fundamental knowledge of their subject. They addressed themselves to this by a preliminary course of philosophical study which at the same time completed their general education. GALEN† wrote a treatise upon the necessity that a doctor should possess training both in mind and morals—in a word should be a philosopher. In CATO'S time general education embraced, besides a knowledge of law, military science, and agriculture, an acquaintance with medicine as well; it consisted in fact of an encyclopædic

* PLINIUS: Hist. Nat. xxix, 8.

† GALEN *op. cit.* i, 53-63.

review of all things of most importance and use in practical life.

When, with the transplantation of Greek civilization to Roman soil the sphere of these sciences was so much enlarged that the knowledge of them had to be reserved for specialists, the conception of a "general education" became of a less extensive kind. The necessities of the particular case and custom regulated the subjects of instruction taught in the schools. Reading, writing, and reckoning constituted the elementary stage. To these, after the Punic wars, was added, for advanced pupils who desired a higher training, the study of the Greek language and literature along with the perusal of Latin works, with which was associated instruction in history, geography, astronomy, the natural sciences, philosophy, music, and other branches of knowledge. The schools of rhetoric had an academic character and in them industrious youths learned dialectics and the art of speaking in public.*

Ancient times knew nothing of medical schools in our sense of the word. Medical teaching was everywhere imparted by a single teacher in all its branches. Even when numerous teachers of medical science were working at one place there was not, as it appears, any organic connection uniting them for a division of labour. Students eager for knowledge were not satisfied with listening to one teacher but sought out other doctors in order to become acquainted with their opinions and experiences.

At first, medical teaching was entirely a private concern. ALEXANDER SEVERUS (225-235 A.D.) was the first to grant stipends to teachers of medicine and to assign them public lecture-rooms, for which concession indeed they were compelled to bind themselves to teach poor students who were supported by the state, without remuneration.† CONSTANTINE called upon the doctors to initiate a large

* J. MARQUARDT: Das Privatleben der Römer im Handbuch der römischen Alterthümer, Leipzig 1879, Bd. vii, S. 90 *et seq.*

† LAMPRIDIUS: Alexander Severus, c. 44.

number of students into their science and in return granted them many immunities.* But at a later period the Archiatri, or such doctors as had filled the office of Archiater, appear, more than others, to have devoted themselves to the business of teaching. Medical teaching was imparted either for an honorarium or without remuneration.† The duration of the period of studentship was different in different cases and was regulated by the ability, the scientific requirements, and the pecuniary means of the student. Whereas GALEN, as has been already mentioned, devoted 11 years to medical studies, THESSALUS an adherent of the Methodist sect who made himself notorious by his charlatan-like behaviour, used to promise to train his pupils into doctors in six months though but a short time before they had been working as cooks, dyers, spinners, repairing-cobblers, weavers or fullers.‡ He obtained in consequence, as GALEN tells us, a great number of pupils anxious to learn the healing art in a short time and without special trouble in order to make plenty of money. For "it is not the doctor who is most skilful in his profession but the one who knows best how to flatter who enjoys the regard of the multitude; everything is made easy for him, all doors stand open to him, he gains riches and power, and students crowd to him from all quarters."§ Medical apprentices of this kind often did not know how to read or to speak correctly.‖ They looked down with contempt upon those who busied themselves with the theoretical sides of medical science and pronounced them to be fools who were wasting their time on useless things.¶ They naturally held the study of anatomy and physiology to be

* Cod. Theodos., lib. xiii, tit. 3, *quo facilius liberalibus studiis et memoratis artibus multos instituant.*

† LUCIAN: The disowned son, c. 24.

‡ GALEN i, 83. x, 5, 19.

§ GALEN x, 4.

‖ GALEN xix, 9.

¶ GALEN i, 54. xiv, 600.—Scribon. Largi ad Callist., Edit. G. HELMREICH, Lips. 1887, p. 4.

superfluous, for they were only concerned to acquire that mechanical routine in the treatment of diseases which appeared to them necessary to their calling.

Anatomy had attained a high grade of development through the efforts of the Alexandrians and of RUFUS of Ephesus, MARINUS, QUINTUS, and their pupils LYKUS, SATYRUS, PELOPS and ÆSCHRION who were GALEN'S teachers. The position and form of the various bones was known, as too their respective connections, the sutures, the periosteum, the medullary membrane, the articular cartilages, various joints with the ligaments and tendons associated with them and the most important groups of muscles, while a fairly accurate conception was made of the form and position of the organs in the thoracic and abdominal cavities. GALEN* already referred to the analogous formation of the sexual organs in the two sexes and declared that they chiefly differed from one another in this, namely, that in the female the parts were disposed with a direction inwards, in the male with a direction outwards. The vascular system was as yet but little investigated: but a distinction was recognized between arteries and veins and the different kind of blood in these two kinds of vessels was noticed.† The knowledge of the nervous system possessed by the doctors of this period excites our astonishment. GALEN gave an accurate description of the brain and spinal cord,‡ and represented the course of many nerves. Thus he alludes to the optic nerve, the third cranial nerve or oculomotor, the fourth or trochlear, the different branches of the fifth or trigeminus, the auditory and facial, the vagus and glossopharyngeal, the nerves of the larynx and pharynx, the sympathetic, and even points out the ganglia upon the last; so too he refers to the radial, ulnar, median, crural and sciatic

* GALEN iv, 635.

† GALEN iii, 491.

‡ CH. DAREMBERG: Exposition des connaissances de GALIEN sur l'anatomie et la physiologie du système nerveux, Paris 1841.—F. FALK: GALEN's Lehre vom gesunden und kranken Nervensystem, Leipzig 1871.

nerves. The optic chiasma had already been mentioned by RUFUS, the Ephesian, who was also the first to bring to light the distinction of nerves into motor and sensory.*

The results obtained in anatomical investigation were chiefly supported by dissection of the lower animals. Only exceptionally, opportunities presented themselves for studying human anatomy; and even in Alexandria, where since the Ptolemies, freer views prevailed on this subject, such opportunities in GALEN'S time occurred but seldom. Only the corpses of hostile soldiers, fallen on the battle-field, of criminals who had been executed or were found unburied, of stillborn children or children exposed to die, were employed for this purpose.† Again, injuries which were associated with laying bare of the soft parts occasionally gave some information about the position of organs. There was naturally no thought to be entertained of vivisection in Rome, and CELSUS expressed accurately the common sentiment when he wrote :—"The opening of the living body I consider horrible and superfluous, that of corpses on the contrary I hold to be necessary for learners: for they must know the position and arrangement of the different parts of the body. For the purpose of learning these things corpses are more suitable than living and wounded men."‡ GALEN narrates, that the doctors who marched with the Roman army in the war with Germany, received permission to dissect the corpses of their fallen foes. Unfortunately, he adds, they were unable to derive thence any addition to their knowledge as they lacked the requisite preliminary acquaintance with anatomy.§ On another occasion he informs us how by chance he became possessed of two skeletons of which one was obtained from a corpse which had been floated out of its grave by a flooded stream, and the other was from the body of a robber who had been slain in the moun-

* Œuvres de RUFUS, publiées par CH. DAREMBERG et CH. EM. RUELLE, Paris 1879, p. 153, 170.

† GALEN ii, 385. ‡ CELSUS: Præfat. § GALEN xiii, 604.

tains.* GALEN'S anatomical statements rest chiefly on dissections of the bodies of the lower animals. He says so himself; it is also evident from his descriptions of particular organs. He represents for instance the hand and foot not of a man but of a monkey. For his anatomical studies he made use chiefly of the kinds of monkeys which resemble man.† He thought that their bodies were structurally identical with those of men and thus allowed himself to be led into some mistakes the correction of which was made only at a much later age. In addition, he dissected bears, pigs, horses and donkeys, ruminants, once even an elephant, also various smaller four-footed beasts, besides birds, fishes and snakes, all with the view of enlarging his anatomical knowledge.

Anatomical teaching began by the several parts being pointed out and explained to the students on the naked body of a living man, and the organs lying under the skin, named. To this were added, later, dissections of animals having forms approaching the human. In this way the several bones and groups of muscles and the inner parts of the body were noted and the position and arrangement of the organs in the body-cavity, studied. "If they do not resemble the corresponding structures of the human body in every particular point," writes RUFUS, who employed this method of teaching, "yet this is the case for the most part: but no doubt people got a more correct picture in former times, when they were allowed to make use of human bodies for such investigations."‡ GALEN speaks in a similar way of anatomical teaching. "A man cannot learn anatomy from books alone," he says, "neither can he from a superficial observation of the parts of the body."§ He recommends, therefore, an assiduous, searching study of it, beginning with the bones, and passing on to the muscles, arteries, veins, nerves, and internal organs.

Not only did dissections of animals subserve the purpose

* GALEN, ii, 221. † GALEN ii, 223.

‡ RUFUS d'Ephese *op. cit.* p. 134. § GALEN ii, 220.

of teaching, but human skeletons or prepared bones were used also. May we not assume that in many cases models formed of marble were employed for this purpose? The Vatican museums possess three of such carvings. Two of these represent the bony thorax: one appears as when opened, and affords a view of the heart, the lungs, and the diaphragm, with indications of the liver and intestines. The third copy also exhibits the heart and both lungs."*

WELCKER doubts whether these were applied to medical teaching and thinks merely that "the rare spectacle of a chest laid open, of a thorax stripped of all flesh, which the butcheries of the gladiators and the execution of criminals gave the doctors, at times, opportunities of witnessing; coupled with the peculiar tendency of many Roman sculptors to copy realistically anything they met with, often without any artistic feeling or taste, were the associated conditions which led to the preparation of these carvings."† The imitations of mummified human bodies, brought forward at feasts for the purpose of inciting ‡ the guests to enjoy life can be as little noticed here as can the numerous representations of the inhabitants of the kingdom of Death which have been handed down to us on tombs, on gems, and in bronze: for they stood in no kind of relation to anatomical teaching.§ So too the figure used by BLUMENBACH as the title-page vignette of his "Geschichte und Beschreibung der Knochen (Göttingen 1786)" which was taken from an ancient cornelian and represents a bearded elderly man, grasping with his left hand a human skeleton erect before him, points rather

* EM. BRAUM in the Bullet. dell'instituto archeol., Roma 1844, p. 16, 19.—J. M. CHARCOT and A. DECHAMBRE: De quelques marbres antiques concern. des études anatomiques in the Gaz. hebd. de méd. et de chir., Paris 1857, T. iv, No. 25, 27, 30 (where too the so-called Æsop of the Villa Albani in Rome is mentioned).

† F. G. WELCKER: Kleine Schriften, Bd. iii, S. 223.

‡ PETRONIUS: Satyr., c. 34.

§ G. E. LESSING: Wie die Alten den Tod abgebildet haben.—J. M. F. v. OLFERS: Über ein Grab bei Kumæ in den Abhandlungen der Akad. d. Wiss., Berlin 1830.

to the creation of man by PROMETHEUS, than to anatomical teaching.

It is uncertain whether drawings were made use of in the teaching of anatomy, but it is not at all improbable, since use was made of this method of conveying information in teaching other things.* Whether the representations of the uterus and ovaries contained in certain manuscripts of MUSCIO have their origin in ancient times naturally cannot be determined. The same is the case with the anatomical drawings in the "Introductio Anatomica Anonymi" said to have been taken from a Leyden manuscript, which were published by J. ST. BERNARD (Leyden, 1744).

The description of the functions of the human body and of its different parts was associated with anatomical teaching. Men proceeded in this matter from the *à priori* assumption of a systematic teleological formation of the organs, and supposed that the latter were only created in order that the functions demanded by Nature should be carried out. The opinion advanced by EPICURUS and later by ASKLEPIADES and contrary to the above mentioned view, namely that Nature makes many unsuccessful attempts before she attains a permanent result, and that the use of organs, that is to say, their functions are first acquired after, and in consequence of, their construction thus arrived at,† found in GALEN a bitter opponent. With all the intellectual acuteness, and with all the learning at his command, he made the attempt to verify a teleological view, which he considered to be the best means of reconciling the realism of ARISTOTLE with the idealism of PLATO. Yet the foreboding seems from time to time to have arisen in his mind that speculation alone could give no satisfactory answer. Hence he was led to the path of observation and experiment,—the only path leading to results in this matter. In this way he

* MARQUARDT *op. cit.*, Bd. vii, S. 107, 802.

† GALEN iii, 74, 364.

endeavoured to investigate the act of breathing and the action of the heart. In animals he divided the spinal cord, the intercostal muscles or their nerves, and removed certain ribs* in order to see what changes were caused by this proceeding, in the respiration. In this way he found that in quiet breathing the diaphragm plays the principal part and that the intercostal muscles only take part in forcible respiration.† He observed the movements of the heart in animals after the thoracic cavity had been opened; he also once had the same opportunity in the case of a boy whose heart had been laid bare by a penetrating wound of the thorax.‡ By means of numerous total or partial divisions of the spinal cord and of different nerves and by slicing the brain in layers, which operations he carried out on pigs, he hoped to discover the physiological significance of these organs.§ The results which he obtained and which he minutely describes may not have answered his expectations, but these attempts deserve full recognition, for they were the first of the kind and pointed out the right method by which these problems are to be solved.

GALEN was supported in his researches by an extremely happy imaginative faculty which put the proper word in his mouth even in cases where he could not possibly arrive at a full understanding of the matter—where he could only conjecture the truth. When for instance he declares that sound is carried "like a wave"‖ or expresses the conjecture that that constituent of the atmosphere which is important for breathing also acts by burning,¶ he expresses thoughts which startle us, for it was

* GALEN ii, 475, 681, 696. iv, 685. v, 289.—ORIBASIUS *op. cit.* iii, 236.

† GALEN iv, 465 *et seq.*

‡ GALEN ii, 631.

§ GALEN ii, 677, 682, 692, 697. v, 645.—CH. DAREMBERG: Histoire des sciences médicales, T. i, p. 224.

‖ GALEN iii, 644.

¶ GALEN iv, 487.—*Cf.* also HÆSER: Geschichte der Medicin, Bd. i, S. 360, 3 Aufl.

only possible nearly two thousand years later to understand their full significance.

In the time of GALEN the doctors felt but small interest in the problems of physiology. Practical medicine claimed their chief attention. The art of healing was thought more highly of by them than the science of man—and was also more profitable. Their aims in this direction led to a diligent study of materia medica. Numerous collections of recipes in verse and prose, and lists of drugs give expression to these efforts in their literature. The pharmacological writings of PHILO of Tarsus, of SCRIBONIUS LARGUS, of SEXTIUS NIGER, of MENEKRATES, of ANDROMACHUS, of DAMOKRATES, are among the most prominent examples, but above all is the work of PEDANIUS DIOSKORIDES of Anazarba in Cicilia who had become acquainted with a great part of the Roman Empire as a military doctor and from youth had looked upon the study of therapeutic agents as his life's work.* He subjected to a systematic review, distinguished by its completeness, all the medicinal agents known at that time in the three kingdoms of Nature. In his work the various names are given by which they were known in different countries, their native countries mentioned, the way to find them or to prepare them artificially described, and their therapeutic action explained. This book is therefore a very important one not only for medical science but also for comparative philology and especially for botany. DIOSKORIDES has described therein about 500 plants and so accurately as to render the determination of the majority of them possible. E. MEYER has characterized his services in this department by the words: "What THEOPHRASTUS is to us in the general botany of the ancients, that is DIOSKORIDES to us in their special botany—the fountain-head, worth more alone than all the rest put together."†

* PEDANII DIOSCORIDIS materia medica, ed. CURT. SPRENGEL, Lips. 1829, T. i, p. 4.

† E. MEYER: Geschichte der Botanik, Königsberg 1885, Bd. ii, S. 117.

The work of DIOSKORIDES was highly valued by GALEN, who appeals to it on various occasions, and formed throughout the middle ages even to late times the most valuable handbook of materia medica. It certainly served in no small degree to arouse and maintain consideration for botanical and pharmacological studies. "The doctor should be acquainted with all plants or at least with the majority and those most used" writes GALEN. "The species, or if it is preferred the different sorts are: trees, bushes, herbs, thorns and shrubs. Whoever is able to distinguish them from their very young state until their full growth will find them in many parts of the world. Thus I myself have found plants in various districts of Italy which those who had only seen them in the dry state were unable to recognize either during their growth or afterwards. Every vendor of salves knows the plants and fruits which are brought here from Crete; but not one knows that many of them grow in the neighbourhood of Rome. Therefore no one thinks of looking for them when the time of their ripening has arrived."* He declares thereupon that he is informed upon this point and does not neglect to gather the plants at the right time before they have been dried up by the heat of the sun and the fruit is over-ripe. In another place he remarks † that it is impossible to learn botany from books—of which many were provided with drawings ‡—but only by hunting for and observing the plants under the direction of a teacher. "This method of teaching" he adds "applies not only to the case of plants but to all specimens of materia medica in general."

The doctors were compelled to pay great attention to this subject, as they were obliged to prepare the medicines themselves. To be sure, some preferred for convenience to buy not the raw material but the medicines already made up at the druggists who kept at their stores

* GALEN xiv, 30.—MEYER *op. cit.* S. 191. † GALEN xi, 797.

‡ PLINIUS: Hist. nat. xxv, 8.

in addition to these things dyes for the hair, applications to improve the complexion and other articles for the toilet.* But in general the doctors only cared to buy the simple drugs required for making up their prescriptions.

The fear of being cheated by having damaged or adulterated goods sold them induced many to acquire drugs at first hand or themselves to collect and prepare them. GALEN undertook even long journeys for this purpose: he also caused drugs to be sent to him from the countries which produced them, through the hands of trustworthy friends so as to be sure that they were genuine.† This care was necessary, for the adulteration of drugs was systematically carried out, and it was not even possible to get pure in Rome the balsam-juice produced in the royal domain of Engaddi in Palestine and which was a state monopoly.

The drugs for the Court were on this account collected under the supervision of officials, packed in paper, furnished with a label giving the name of the plant and sometimes the place where it was found: they were then sent to Rome and kept there in special storehouses.‡ These contained such a stock of drugs that after satisfying the needs of the Court, some could be sold thence to private persons. This however was by no means sufficient to materially injure the trade in adulterated articles. The adulterations, for the rest, were not effected so much by the druggists as by the purveyors and simplers who brought the plants from the mountains to the city.§ The adulterations were effected so skilfully that the most experienced connoisseurs, as GALEN says,|| were deceived and considered the goods pure. He himself in his youth, as he narrates,¶ had received instruction from a man who occupied himself with rectifying such adulterations, and paid him a large fee for being initiated into these secrets. Being well acquainted himself with the whole matter he

* PLINIUS *op. cit.* xxxiv, 25. † GALEN xii, 216. xiv, 7 *et seq.*
‡ GALEN xiv, 9, 25, 79. § GALEN xiii, 571. || GALEN xiv, 7.
¶ GALEN xii, 216.

gave students the valuable advice to devote great attention to the study of the materia medica: "Young students must see the specimens not once or twice but often. For it is only by applying oneself with intelligence to these things" he writes* "and by examining them frequently that one gets a thorough knowledge of them."

Each drug was provided with a ticket on which its name and that of its discoverer, the disease it was prescribed for, the method of using it, and often the name of the patient were inscribed. Ointments for the eyes which formed saleable articles of trade, were packed in vessels on which the seal of the doctor who had prepared them was impressed. Seals of this kind have been found in France, England, Germany, and Transylvania, especially in places where Roman legions had been encamped. More than 160 different stamps of ophthalmic surgeons have been described.† The prescriptions were long and complicated: theriaca for instance consisted of more than 70 different vegetable and animal products.‡ Many of them were disgusting and nauseous, and GALEN was surprised at the prescriptions of the doctor XENOKRATES who had even recommended human flesh "for, of course, it is forbidden in the Roman empire to devour men."§ On another occasion where mention is made of a doctor who ordered the country-folk goats-dung, GALEN made the witty remark that a thing of this kind is not suitable for refined townsmen; dung being only useful to farmers.|| The unthinking public cherished the mistaken opinion that the most expensive remedies were also the most potent for good¶ and a rich purse-proud man was

* GALEN xiii, 570.

† C. L. GROTEFEND: Die Stempel der römischen Augenärzte, Hannover 1867.—J. KLEIN: Stempel römischer Augenärzte, Bonn 1874 (Nachtrag zu Grotefend's Buch).—MARQUARDT *op. cit.* S. 758.—HERON DE VILLEFOSSE et H. THÉDENAT: Cachets d'oculistes romains, Tours et Paris, 1882.

‡ GALEN xiv, 83 *et seq.*

§ GALEN xii, 248.

|| GALEN xii, 299.

¶ PLINIUS: Hist. Nat. xxix, 8.

highly indignant when GALEN recommended him the same kind of medicine which he had used with good effect upon his slave. When he heard that it was made of nothing but cheap ingredients he called out to him "You may keep that for beggars; I desire a remedy which is more expensive."*

GALEN, in his practice, followed the rational principle of letting Nature in the first place work out her attempts at cure and only interfering when these proved fruitless. The examination and treatment of the sick was essentially the same as in the time of the Hippokratic doctors. Thus the same diagnostic means of recognizing diseases were employed; but the indications afforded by the pulse received more attentive study under the influence of the school of Alexandria. In a treatise on the pulse which is ascribed to RUFUS† the changes which it manifests at different periods of life and in various diseases are described and a precise number of its different forms is recognized. On the other hand there is scarcely any mention of auscultation unless we account certain remarks of ARETÆUS and CÆLIUS AURELIANUS to be such in which the sounds of the heart are alluded to.‡ Special Pathology had made remarkable progress. The Roman doctors were acquainted with several diseases which, as leprosy§ and hydrophobia,‖ had escaped observation in earlier times. ARETÆUS gave the first description of diphtheritic ulcer of the throat and mouth which he designated as Syrian or Egyptian ulcer.¶ Other diseases as diarrhœa,** jaundice,††

* GALEN xiii, 636.

† RUFUS *op. cit.* p. 219-232.

‡ ARETÆUS: de acut. ii, 3.—CÆLIUS AURELIANUS: de acut. ii, 14.—GALEN xviii, B. 649.

§ LUCRETIUS: vi, v. 112-14.—CELSUS iii, 25.—PLINIUS: Hist. Nat. xxvi, 5.—CÆLIUS AUREL.: de chron. iv, 1.—ARETÆUS: de chron. ii, 13.

‖ PLINIUS *op. cit.* viii, 63. xxix, 32.—CELSUS v, 27.—CÆLIUS AUREL.: de acut. iii, 9-16.—ARETÆUS: de acut. i, 7.

¶ ARETÆUS: de acut. i, 9.

** GALEN xvii A, 351.

†† GALEN xvii B, 742.

stone,—to which GALEN assigned an origin similar to that of gouty tophi,—* and consumption† were more closely investigated. For the last mentioned disease among other things sea voyages were recommended and residence in sanatoria of suitable climate especially in Egypt. The pathology of the nervous system was pursued also with zeal and success. GALEN states that he was able to trace in one case paralysis of the fingers to an injury of the spinal cord‡ and ARETÆUS was aware that the nerve fibres cross soon after their origin and thence explains the fact that after wounds of one hemisphere of the brain the opposite side of the body is paralyzed.§

Instruction in practical medicine was given partly during the private practice of the teacher who took students with him to his patients, partly in Iatreia. The latter were arranged after the Greek pattern and were called *Tabernæ medicæ* or *Tabernæ medicinæ*.‖ They were the shops or public places of business of the doctors who received and treated patients at them, performed surgical operations, prepared and sold medicines, and dwelt with their assistants and pupils. Into some of these institutions patients—for instance people of unsound mind—were admitted.¶ Many towns erected Iatreia at their own cost and gave them over to doctors to induce them to take up their permanent abode there.** As GALEN,†† who has left complete information on this point, says, they were for the most part situated in large buildings with high doors letting in plenty of light and air and were furnished with surgical instruments and medical appliances.

* GALEN xiii, 993. xvii A, 835.

† CELSUS iii, 22.—ARETÆUS: de chron. i, 8.—CÆL. AUREL.: de chron. ii, 14.

‡ GALEN viii, 213.

§ ARETÆUS: de chron. i, 7.

‖ PLAUTUS: Amphytryo iv, 4. Epidic. ii, 1.

¶ PLAUTUS: Menæchmi v, 947-956.—SPARTIANUS: Vita Hadriani, c. 12.

** GALEN xviii B, 678.

†† GALEN xviii B, 629-925.

The convalescent homes* and sick rooms which the great landlords caused to be built for their family domestics and numerous slaves, may also have afforded opportunity for practical teaching in the examination and treatment of the sick. In any case it was here that the slaves, who were trained for doctors at the wish of their lords, were instructed in the healing art. The military hospitals, with stalls for sick horses, which were established wherever masses of troops were collected, must have sometimes subserved a similar purpose.†

The buildings, which ANTONINUS PIUS caused to be erected in the vicinity of the temples of ASKLEPIOS at Epidauros and on the island in the Tiber cannot be looked upon as institutions for the sick. They were to give admission to dying persons and pregnant women overtaken by the pains of labour, so that the sanctuaries should be kept pure and undefiled.‡

Care and treatment of patients in Iatreia and other institutions of that kind was comparatively rare in ancient times. Patients were for the most part visited in their dwellings by the doctors. For this reason instruction in the practice of medicine was more common there than in Iatreia and hospitals. The doctors used to be accompanied by the students of medicine while visiting the sick and in a suitable case explained to them the symptoms and treatment of the disease. By this the pupils were guided in forming their own judgment of pathological changes by observation and manipulation of the ailing body. When the sick man PHILISKUS was treated by the doctors SELEUCUS and STRATOKLES they brought with them, as PHILOSTRATUS§ narrates, more than 30 pupils. The witty epigram of

* COLUMELLA: de re rustica xi, 1. xii, 3.—SENECA: de ira i, 16. nat. quæst. i, præf.—TACITUS: de orat. dial., c. 21.

† HYGINUS: de munit. castrorum, c. 34.

‡ PAUSANIAS ii, 27.

§ PHILOSTRATUS: Vita Apollonii Tyan. viii, 7.

MARTIAL on his doctor SYMMACHUS is well known: "I was ill. Thou camest forthwith to me—accompanied by 100 pupils: 100 ice-cold hands were laid on my body. Till then I had no fever: now I have."*

GALEN exhorts his pupils to take care that on entering a sick room they do not wake their patient or arouse his anger by making a noise with their feet or by speaking loudly. He then gives them kindly-meant advice in regard to their clothing, their behaviour, and the language they should use with patients: he recommends them cleanliness and a proper attention to their hair and forbids them to eat onions or garlic before visiting a patient, or to drink too much wine, lest they annoy the sufferer by the offensive odour from their mouths and "stink like goats."† The high significance and importance of training in practical medicine was acknowledged on all sides. GALEN ridiculed the learned theorists and sophists who "from their high chairs shower down upon their pupils detailed explanations but if called to a patient have no idea of the complaint he is suffering from."‡

The public naturally betook themselves rather to doctors who possessed some practical training than to those who were only able to make fine speeches about the healing art.§

Surgery had, as CELSUS‖ remarks, soon after the time of HIPPOKRATES separated itself from the rest of medicine. From this time forth it formed a separate and independent subject of knowledge and education. In Rome it was not usual for the doctors who treated internal diseases to practise surgery as well: for this reason GALEN abstained from practising the latter when he settled down there.¶ CELSUS mentions the surgeons PHILOXENUS, GORGIAS, SOSTRATUS, HERON, the two APOLLONII, and the lithotomist AMMONIUS of Alexandria, and again the elder TRYPHON, EUELPISTUS and MEGES of Rome, who

* MARTIALIS: Epigram. v, 9.

† GALEN xviii B, 144-152.—CELSUS iii, 6. ‡ GALEN xviii B, 258.

§ LUCIAN: Hippias, c. 1. ‖ CELSUS vii, Præfat. ¶ GALEN x, 455.

distinguished themselves both as teachers and writers in the field of surgery. Unfortunately their works have been lost and we have to consult references to them in later authors if we wish to form an opinion as to what they accomplished. CELSUS writes "that these men have made many improvements and discoveries in surgery."

If we compare the position of this branch of the healing art under the Roman Emperors with that of Hippokratic surgery we are surprised by the wonderful progress made.

The Roman surgeons not only possessed correct information about the nature and treatment of many diseases and wounds which demand surgical interference, but they ventured upon the performance of major operations where sound knowledge of anatomy and of the use of surgical instruments was required.

Their supply of instruments was fairly large. The excavations at Herculaneum and Pompeii, during the carrying out of which a great number of such implements were discovered, have afforded valuable information upon this point. We learn thus that the following were in use — straight and curved needles, probes of various kinds, hollow sounds, curved and toothed forceps, catheters with a gentle S-shaped curve, several forms of clips, among them some with clasps and slides, conical and spheroidal cupping instruments, sharp and blunt hooks, pronged and disk-shaped cauteries, knives, spatulæ, lint, lancets, bistouries, rectal and vaginal specula etc.* Of the specula some were in one piece, some in two or three. In the year 1882 one of four parts was found: it was composed of two straight and two S-shaped branches.†

They were acquainted with various kinds of bandages and with apparatus for extension and for securing immobility

* B. VULPES: Illustrazione di tutti gli strumenti chirurgici scavati in Ercolano e Pompei, Napoli 1847.—QUARANTA and VULPES in the Museo Borbonico, Vol. xiv, 36. xv, 23.

† A. JACOBELLI: Speculi chirurgici scavati dalle rovine delle città dissepolte Pompei ed Ercolano in the Morgagni, Napoli 1883, T. xxv, p. 185 *et seq.*

which came into use in the treatment of fractures and luxations.

The performance of surgical operations was rendered easier by the fact that better methods of arresting hæmorrhage had been learnt: they were no longer limited to application of cold, compression, styptics and cautery, but the vessels were subjected to ligature * and torsion † if the other methods failed to effect the purpose. For this reason vascular new growths could be removed and amputations and resections undertaken. ANTYLLUS went so far as to operate for aneurism.‡ In amputation the circular method and the flap method were both employed.§

The skill of the Roman surgeons achieved its greatest triumphs in resection. ANTYLLUS and HELIODORUS || removed diseased portions of a bone while carefully preserving its continuity: they took away the humerus in its entirety, a part of the acromion-process, so also parts of the femur, tibia, radius, and ulna, even the inferior maxilla, while sparing the joints, and parts of the superior maxilla.

Plastic surgery also was not unknown to them. By traction of the neighbouring parts of the skin and the subjacent connective tissue they sought to restore lost tissue on the ears, the cheeks, the nose and the lips.¶

The question has been discussed by many learned men whether among the ancients artificial appliances were used to supply the place of lost limbs. On a vase belonging to the Durand Collection in the Louvre the figure of a man is represented with what appears to be at first sight, a wooden leg.** But on a closer inspection one sees that the leg is

* CELSUS v, 26.—GALEN x, 314.

† ORIBASIUS iv, 485.—RUFUS in Aëtius xiv, c. 51.

‡ ORIBASIUS iv, 52. *Cf.* ED. ALBERT in the Wiener Med. Blättern 1882, No. 1, 3, 4, 5.

§ CELSUS vii, 33.—ARCHIGENES and HELIODORUS in ORIBASIUS iv, 244, 247.

|| ORIBASIUS iii, 582. 615 *et seq.*

¶ CELSUS vii, 9.—ANTYLLUS in ORIBASIUS iv, 56 *et seq.*

** E. RIVIÈRE: Prothèse chirurgicale chez les anciens in the Gazette des Hôp., Paris 1883, No. 132, 136.

not absent but is bent round a long staff. On the other hand it is certain from a remark of LUCIAN * that artificial feet were prepared from fig-tree wood and that those who had undergone amputation made use of them.

Tracheotomy was certainly performed but did not yield good results, it appears, and consequently was distrusted.†

CELSUS ‡ has thoroughly described the operation for stone in the bladder. He mentions at the same time that the surgeon AMMONIUS made the attempt to crush in the bladder the larger stones which were difficult to remove. Unfortunately the description of the procedure is not sufficiently clear to enable one to point to it as equivalent to lithotrity. But a passage in the biography of the saintly THEOPHANES composed by an anonymous author, affords conclusive proof that lithotrity was known and practised in ancient times: for it is stated therein that THEOPHANES suffered from stone in the bladder which, by instruments which had been introduced, was crushed to pieces and then passed externally.§ OLYMPIOS believes, that instruments resembling forceps and having small, sharp, tooth-like points on them, like those found at Miletus, were used for this purpose.‖

A lengthening and laceration of the abdominal wall was looked upon as the primary cause of hernia; but GALEN brought into view in addition to this the part played by the muscles.¶ For the relief of hernia trusses or the radical operation were recommended.** Of the latter HELIODORUS has left a description which by its minuteness and clearness

* LUCIAN: Ad. indoct. c. 6.

† ARETÆUS; de acut. i, 7.—CÆLIUS AURELIAN: de acut. iii, 4.—GALEN xiv, 734.

‡ CELSUS vii, 26.

§ Corp. script. hist. Byzant., Bonn 1839, Vol. xxvi, Th. i, p. xxxiv.—Patrolog. ed. Migne. Ser. græc., T. 108, p. 37, Paris 1863.

‖ R. BRIAU in the Gaz. hebd. de méd et de chir., Paris 1858, No. 9.

¶ GALEN vii, 730.

** CELSUS vii, 20.

arouses just admiration.* Even the symptoms of incarcerated hernia were described by some observers.†

HELIODORUS divided strictures of the urethra with a cutting instrument and then placed bougies made of dried paper, and metal sounds in the urethra.‡ It was also known how to operate in a skilful way in cases of phimosis and paraphimosis, condylomata and hæmorrhoids. §

Ophthalmology was also able to show remarkable results. Not only trichiasis, hypopyon, leucoma, lachrymal fistula and other affections of the external parts of the eye were subjected to operative treatment, but even cataract itself. To be sure surgeons were ignorant of the essential nature of this disease, but they cured it. Here, as so often in medicine, Art preceded Science. Operation in cataract was effected by couching the diseased lens. If the lens rose up again or showed a soft consistence they then in addition proceeded to subject it to discission.‖ Perhaps extraction was also known. Certainly the remark of PLINY that the doctors from greediness preferred pushing away, to extracting, the scale in the eye, is too deficient in clearness, for us to refer it to that operation. The statement of GALEN that some surgeons instead of displacing the lens have made the attempt to clear it away externally,¶ rather justifies the assumption that the extraction operation was practised.** A description of it is no

* ORIBASIUS iv, 484.—ED. ALBERT: Die Herniologie der Alten, Wien 1878, S. 144.

† CELSUS vii, 18, 20.—ARETÆUS: de acut. ii, 6.—PAULUS ÆGIN. iii, 43.—AËTIUS. xiv, 24.

‡ ORIBASIUS iv, 472.

§ ORIBASIUS iv, 466, 470.—PAULUS ÆG. vi, 79.

‖ CELSUS vii, 7.—GALEN x, 1019.—VEGETIUS RENATUS: Mulomedicina ii, 17.—PAULUS ÆGIN: vi, 21.—A. ANAGNOSTAKIS: Contributions à l'histoire de la chirurgie oculaire chez les anciens, Athènes 1872.

¶ PLINIUS: Hist. Nat. xxix, 8.—GALEN x, 987.—*Cf.* hereon v. HASNER: Phakolog. Studien, Prague 1868.

** H. MAGNUS (Geschichte des grauen Staares, Leipzig 1877, S. 226 *et seq.*) defends, on grounds not to be gainsaid, the view that it is here not a question of cataract extraction but of puncture for hypopyon. In any case as ALFR. v.

where to be found. The Arabian author RHAZES ascribes a knowledge of it to ANTYLLUS and states at the same time that the latter was acquainted with the method of removal of cataract by suction.* It is much to be deplored that the ophthalmological literature of ancient times has for the most part been lost.

The work of the celebrated ophthalmic surgeon DEMOSTHENES which at the end of the thirteenth century was made use of by SIMON of Genoa and a copy of which perhaps lies hidden in some library at the present day would throw light upon many things about which now only conjectures are possible.

The course of surgical teaching embraced according to CELSUS† first of all the general principles of the art of operating and then the treatment of wounds and abscesses and all diseases of the bones. He required of the surgeon treating wounds "that he should be of such an age as to enjoy the use of all his faculties, should possess a steady and firm hand which never shakes, and should be able to use the left as dexterously as the right hand: his eyesight should be quick and clear, his spirit fearless and not so prone to sympathy as to allow himself, by the cries of the patient, whose treatment he has undertaken, to operate more quickly than the case requires or to remove less than is necessary. He should not allow himself to be influenced in any way in his work by the noise made by the patient." The surgeons were assisted in the operations by their assistants and pupils. The services which these had to render are fully discussed in many of the passages specified above.

GRAEFE (Klin. Monatsbl. f. Augenheilkunde 1868 Januar) says "The infancy of extraction is one of the most difficult chapters in investigating the history of medicine" and a positive answer to the question whether the ancients were acquainted with it, is not possible.

* RHAZES: Continens ii, c. 3, Abs. 7. ed. Venet. 1506, fol. 41.—SICHEL in the Archiv. f. Ophthalm. 1868, xiv, 3, S. 1.

† CELSUS vii, Præf.

Midwifery was practised by midwives: only in difficult cases did these call in the help of doctors and surgeons.* Women desirous of being trained for midwives should, as SORANUS says in his work on gynæcology "know how to read, possess understanding and a good memory, be active and respectable, quick witted, healthy and strong, and should have long thin fingers and short nails." It was not demanded of them, as it was in Greece, that they should have already themselves given birth. But SORANUS considers it right that they should not be too young. He further recommends midwives to be habitually temperate, quiet and trustworthy, not greedy of money, or superstitious, not to be induced for the sake of gain to give medicines to procure abortion or to allow themselves to be hindered in the fulfilment of their duties by dreams, forebodings, mysteries or religious rites. He also advises them to pay especial attention to the care of their hands, to rub them frequently with fine ointment, and to avoid working with wool, which makes the skin hard and dry.† In the training of the midwives, regard was had both to theory and practice, but care was especially taken that they should be instructed in dietetics, materia medica, and the necessary surgical manipulations. Their acquaintance with the structure of the female genital organs was very meagre: SORANUS was of the opinion that there was no need for them to know much about the subject. They had fairly correct information about the course of a normal birth, and about the help which should be rendered at that time; they supported the perineum of the mother with a napkin, tied the umbilical cord after the birth, were careful as to the delivery of the placenta, etc. They were also made acquainted with the various presentations of the fœtus and received fitting directions about the choice of a wet nurse,

* SORANUS EPHESIUS, Ed. Dietz, p. 107.—*Cf.* J. PINOFF in the Janus i, S. 705-752. ii, 16-52, 217-245, 730-744.

† SORANUS p. 3-5.

and about the care of the newly born child.* They even undertook important operations such as turning by the head or feet in faulty presentations.† Embryotomy was only performed when all attempts to deliver a living child were fruitless.‡

A law said to have been made by NUMA POMPILIUS, ordained that the Cæsarean section should be performed on women dying in labour, in order if possible to save the life of the child.§ PLINY‖ narrates that it was also carried out on living parturient women, and SCIPIO AFRICANUS owed his life to this operation.

Many midwives did not confine their sphere of action to midwifery and the treatment of women's diseases, but advanced into the domain of general medical science, and consequently were really female doctors.¶

Midwives enjoyed great respect. By the Courts they were considered** to be experts and later on possessed the right of bringing an action in support of claims for services rendered.†† Numerous inscriptions give expression to the honours paid to them. On a tombstone, as described by MOMMSEN, there is found a laudatory epitaph to "the incomparable spouse—noblest woman and accomplished midwife." One of the most celebrated of medical authors and doctors, THEODORUS PRISCIANUS, even dedicated a book to a midwife "the charming helper of his art" as he calls her.‡‡

* SORANUS p. 79 *et seq.*

† SORANUS p. 110 *et seq.*

‡ SORANUS p. 113 *et seq.*—TERTULLIAN: de anima, c. 25.

§ Pandect. lib. x., tit. 8, de mortuo inferendo.

‖ PLINIUS: hist. nat. vii, 7.

¶ MARTIAL: Epigr. xi, 71.—APULEIUS: Metamorph. v, 24.—PLINIUS: hist. nat. xxviii, 7, 18, 23, 80—JUVENAL. ii, 141.

** SENECA: Epist. 66.

†† Pandect. lib. 50, tit. 13.

‡‡ TH. PRISCIAN. lib. iii, Præf.

THE MEDICAL PROFESSION IN ROME.

The practice of the medical profession was, as has already been said, free to anyone without his being obliged to show by any examination his fitness for the same; but as early as 88 B.C., the Lex Cornelia made him liable to arrest if death was brought about by his fault. Moreover the candidature for employment in the public sanitary service, and for reception among the number of doctors favoured by definite privileges, so too the conditions of suing for medical fees, and especially the *extraordinaria cognitio*, must have afforded occasion for a distinction being made in practical life if not in law, between the scientifically trained doctors and the dabblers in medicine.*

Since many doctors had received a training that was incomplete and limited to certain departments, not having been taught in all branches of medical science, they, under these circumstances, attached themselves to certain parts of it. They could in a shorter time acquire knowledge necessary for practice in a narrowly circumscribed department of the healing art. Specialities, the beginnings of which reach back to an earlier period, gradually acquired a bad reputation, becoming not so much the indication of extraordinary efforts in a special sphere as of half-educated charlatanry. The representatives of this class exposed their weakness in an awkward manner in their intercourse with educated doctors, and served for favourite objects of scorn to the comic dramatists.

The sub-division of medical work was exaggerated in a senseless manner. There were not only surgeons, accoucheurs, gynæcologists, ophthalmic surgeons, dentists, and aurists, but also specialists for nearly every part of the body. Some confined themselves to the

* TH. LÖWENFELD: Inaestimabilität und Honorirung der *artes liberales* nach römischem Recht, München 1887, S. 428.

treatment of fistulæ and ruptures, or of definite parts of the body, for instance the buttocks, others had to do exclusively with lithotomy, operations for hernia or for cataract.* In an epigram of MARTIAL † it is said: "CASCELLIUS draws teeth out or restores them, HYGINUS burns away eyelashes growing against the eye, FANNIUS cures a swollen uvula without cutting it, EROS removes marks burnt into the skin of slaves, and HERMES is the best doctor for hernia." There were special doctors for diseases of children and also for those of old age.

Many specialists made use of particular methods of cure and employed particular agents such as water, wine, milk, certain medicines and plants, as for instance hellebore.‡ Able doctors, like GALEN, despised these proceedings and devoted their attention to all branches of medical science although they might in practice prefer this or that branch of it. "I believe" writes CELSUS§ "that it is quite possible to master all the departments of the healing art. If they are sub-divided, however, I prefer the doctor who is skilled in the greatest number of them."

Friendly relations existed between physicians and surgeons. "They support and recommend one another reciprocally," || says PLUTARCH. It does not appear that the surgeons occupied a lower social position than the doctors for internal diseases as was the case in later times: and nothing leads us to conclude that the former possessed a poorer general education than the latter.

In many cases several doctors were brought into consultation by the patients or their friends: they then settled in a general interchange of opinion the diagnosis and treatment. These consultations may easily have led¶ not infrequently to stormy differences of opinion in which the

* Pseudo-GALEN: de part. artis medic. Ed. CHARTIER ii, 282.—GALEN v, 846.

† MARTIAL: Epigr. x, 56.

‡ PLINIUS: Hist. nat. xxix, 5.

§ CELSUS vii, Præf.

|| PLUTARCH: de fraterno amore, c. 15.—GALEN xviii A, 346.

¶ PLINIUS *op. cit.* xxix, 5.

limits of good behaviour were passed. The dissimilar scientific training is illustrated by the fact that educated and experienced doctors like GALEN, in disgust at the ignorance and want of ability of their colleagues, passed a sharp judgment upon their views and medical directions.* THEODORUS PRISCIANUS has left us a realistic description of such consultations.† "While the patient" he writes "racked by his pains, tosses himself to and fro on his bed, doctors in crowds rush in, each one of whom is only concerned to fix the attention of the rest upon himself, and cares but little for the condition of the patient. In a spirit of emulation like that displayed in a circus or at a pugilistic contest, one endeavours to gain extraordinary fame by his oratory or his dialectics, another by the artistic building up of theses—a structure which his adversary soon levels with the ground." The popular humour made merry over these things and invented the anecdote mentioned by PLINY that in an epitaph it was set forth how the deceased expired in the midst of the doctors who were treating him.

The medical profession did not at first enjoy that respect which the strenuous, self-sacrificing activity of its members deserved. Romans of rank had even at the best only a patronizing regard for medicine and looked upon the practice of it as a business which was fitted for persons of low birth, for servants or slaves.‡ When at a later period the immigration of foreign doctors came about and practitioners of medicine from Greece, Egypt, Asia Minor and Palestine settled in Rome, the narrow-minded bias and civic prejudice with which all foreigners were regarded were obstacles in the way of any improvement in the social position of doctors.

It is true that the doctors themselves were largely responsible for this. The boastfulness, covetousness and vice by which some among them made themselves scorned, afforded

* GALEN viii, 357. x, 910. xiv, 623 *et seq.*

† THEOD. PRESCIANUS i, Præf.

‡ PLINIUS *op. cit.* xxix, 8.

to their enemies effective weapons to turn against the whole profession. PLINY states that doctors so far misused their position of trust as to practise legacy-hunting and adultery and to compass the death of a human being by the administration of poison.*

GALEN goes so far as to compare the doctors in Rome to robbers and says that between them there exists but one point of difference, namely that the latter carry on their infamous practices in the hills and the former in the town.† To this were added the obtrusive and braggart manners of many foreign practitioners, displeasing to the dignified seriousness of the Romans. THESSALUS, who called himself the "Conqueror of Doctors" made his way along the streets with such a crowd of attendants "as was scarcely possessed by a street performer or a celebrated circus-rider." ‡ Some doctors carried on the hunt for patients quite openly and did not blush to ask the passers-by to enter their dispensaries which in this case not unfrequently degenerated into places of resort for idlers and swindlers. The desire to become known and to get practice induced many "to recommend themselves to the favour of powerful and influential persons, to strut along the streets with them, to give banquets and to make buffoons of themselves, while others by the splendour of their dress, by costly rings and other ornaments sought to dazzle the unreasoning multitude." § As in all times, so then also, ignoramuses and quacks loved to conceal by the splendour of external semblance the essential hollowness within.‖

Doctors who possessed more knowledge and intelligence resorted to frequent appearance in public in order to make themselves known. They held popular lectures, arranged discussions with their colleagues which led to embittered

* PLINIUS *op. cit.* xxix, 8.—MARTIALIS: Epigr. vi, 31.—TACITUS: Annal. iv, 3. xii, 67.

† GALEN xiv, 622.

‡ PLINIUS: Hist. Nat. xxix, 5.

§ GALEN iv, 600.

‖ LUCIAN: Ad indoctum, c. 29.

wars of words and as a general rule contributed more to the amusement than to the instruction of the public, and they performed surgical operations before the eyes of the people in the theatre, the circus, or other public places.* This custom, which is still kept up in Italy by itinerant practitioners and especially by dentists, seems to be of Greco-oriental origin and to have first reached Rome at the time of the immigration thither of foreign doctors.

The fees received by doctors for their services were naturally of various amounts and depended upon the means of the patients and the position and ability of the doctors. GALEN received from the Consul BOETHUS whose wife he had treated for a long period 400 gold pieces.† MANLIUS CORNUTUS, formerly Prætor and Legate to the Aquitani paid the doctor who cured him of a skin disease 200,000 sestertii.‡ CHARMIS who distinguished himself by his cold-water treatment received a similar sum for a cure which he effected abroad.§ When L. STERTINIUS was offered the post of body-physician to the Emperor CLAUDIUS he declared that the pay of 250,000 sestertii was too low, since, as he showed by enumerating the families where he was medical attendant, his practice secured to him the annual income of 600,000 sestertii.‖ The doctor KRINAS, who made astrology the foundation of his prescriptions, left behind him as PLINY tells us a fortune of ten million sestertii although he had expended large sums upon public buildings. It is told of the surgeon ALCON¶ that, after he had been condemned to a fine of ten million sestertii and to banishment, within a few years of his return he again amassed a similar fortune. But such splendid receipts were certainly

* PLUTARCH: de adulatore et amico, c. 32.

† GALEN xiv, 647. This sum has according to MARQUARDT (*op. cit.* Bd. v. S. 70) a value of about 8,000 marks.

‡ PLINIUS: Hist. Nat. xxvi, 3. Over 40,000 marks. MARQUARDT *op. cit.* S. 72.

§ PLINIUS *op. cit.* xxix, 5, 8.

‖ PLINIUS *op. cit.* xxix, 5.

¶ PLINIUS *op. cit.* xxix, 8.

only the lot of a few fortunate ones. The great majority of doctors earned hardly as much as the maintenance of life required. The unequal distribution of wealth which was accumulated in the hands of certain families and gave the great masses of the people over to poverty, offered to but few doctors the opportunity of acquiring riches by the exercise of their art. The inconsiderate competition, for which they themselves were responsible, contributed also to this state of affairs by reducing the rate of pay for their services to the smallest possible. Whoever has a poor practice remains necessarily himself a poor man.*

It came to such a pass that doctors gave up their calling if it did not support them and devoted themselves to the—as it appears—more profitable business of gladiator or undertaker. The spiteful epigram of MARTIAL refers to this: he says "DIAULUS was a doctor, is now an undertaker: he makes the best use in his power of his professional art." "For the rest, while he was still a doctor he was little more than an undertaker."†

Only slowly and by degrees did the social positions of doctors improve. They owed this partly to the successful efforts of those members of their profession who by the depth of their knowledge and the purity of their character won the respect and admiration of their fellow-citizens, partly to the continually increasing recognition of the necessity and importance of the medical art. Educated people began to feel a lively interest in anatomical and physiological investigations and in medical science generally. "I am of opinion" writes GELLIUS "that it is a disgrace not merely for a doctor, but for every independent man who has been well brought up, to be ignorant of those things which concern the human body and of the means for preserving health which Nature lays open before our eyes. I have on this account given all the time I could spare to the study of medical works, since it was in them

* GALEN xii, 916.

† MARTIALIS: Epigr. i, 30. 47. viii, 74.

that I hoped to find the best instruction."* In the same way PLUTARCH thought that everyone should be able to feel his own pulse intelligently and to recognize what affected him beneficially or injuriously.† Moreover the ethical side of the medical calling was prominently brought into notice by some authors. "The doctor should not be constrained to visit the sick" writes LUCIAN‡ "he should not be intimidated or brought to them by force but should go freely and willingly." It is impossible to characterize the high dignity, the ideal worth of the healing art better than in the words of SENECA: "People pay the doctor for his trouble; for his kindness they still remain in his debt." "Thinkest thou" he says elsewhere "that thou owest the doctor and the teacher nothing more than his fee? We think that great reverence and love are due to both. We have received from them priceless benefits—from the doctor health and life, from the teacher the noble culture of the soul. Both are our friends and deserve our most sincere thanks not so much by their merchantable art as by their frank good-will."§

Even at an earlier period the necessity of medical aid led to such appointments as family doctors, doctors for communities, the army, and societies. Rich people who possessed large establishments and many slaves took care to have a doctor at command at any time in case of sickness. With this object they made a contract with a neighbouring doctor, which bound the latter for a yearly salary to afford any medical services required.‖ Still more convenient for them was it when there existed in their household a slave with medical knowledge whom they could trust with the care of the health of themselves and their relatives.¶ Slaves of this kind were much in request

* GELLIUS: Noct. Attic. xviii, 10.
† PLUTARCH: de sanitate tuenda præc. c. 24-25.
‡ LUCIAN: Abdicatus (The disowned son), c. 23.
§ SENECA: de benefic. vi, 15, 16, 17.
‖ VARRO: de re rustica. i, 16.
¶ SUETON: Nero, c. 2.—Calig. c. 8.—SENECA: de benef. iii, 24.

and commanded a higher price than most; they were even sold for larger sums than Eunuchs.* It occurred sometimes too that young and gifted slaves were instructed in medicine and trained up to be doctors at the cost of their masters. The dependent position of these doctors excused them somewhat if instead of confining the application of their medical knowledge to dressing wounds and curing diseases, they sometimes abused it by perpetrating horrible deeds and serious crimes at the command of their masters.† If the master was himself a doctor they served him in the capacity of assistant: if they treated patients independently they were obliged to hand over any fee received in this way to the master, forming for him by such means a highly lucrative source of income. Under these circumstances it is easily understood that he was very unwilling to confer freedom on a slave of this kind; for by doing so he not only diminished his income but raised up an opponent, doubly dangerous to him since he knew the master's patients. As little were the laymen inclined to deprive themselves of a slave possessed of medical knowledge since they thus lost a resident doctor always at hand and devoted to their service.‡ The law was compelled therefore to reconcile the mutually opposed interests of masters and slaves, laying down on the one hand the conditions under which the slaves were entitled to demand freedom and the scale by which the loss of income might be calculated, and on the other hand imposing obligations upon the freed men in respect of their former masters, which protected the latter from inordinate losses.§ The slaves educated in medicine, belonging to the State, who probably had the care of the ailing *servi publici*, appear to have been generally under more favourable conditions and in a better position than their colleagues who were the property of private people.

* Cod. Just. vi, tit. 43, 3. vii, tit. 7, i, 5.

† Cicero: ad Pison., c. 34.—Pro Cluentio, c. 14 *et seq.*—Tacitus Annal. xv, 63.

‡ Digest. xl, tit. 5, c. 41, 6.

§ Digest. xxxviii, tit. 1, c. 25-27.

Certain material advantages and privileges were granted to the free doctors as it was recognized how useful and important the healing art is to the general good. When CÆSAR, during a famine which fell upon Rome in the year 46 B.C., ordered the expulsion of foreigners he expressly excepted the doctors and teachers from this general rule "so that they should be all the more willing to dwell in the city and even should induce others to come and live there."* The Emperor AUGUSTUS granted to the doctors in 10 A.D. immunity from taxes and other burdens, professedly in recognition of the successful treatment of an obstinate rheumatic complaint carried out on him by his body-physician MUSA, an enthusiastic advocate of hydrotherapeutics.† VESPASIAN renewed or confirmed this privilege and HADRIAN published rules defining the immunities bestowed on doctors.‡

From this ordinance which was renewed under ANTONINUS PIUS, we learn that they were exempt from bearing various offices entailing expenditure of time and money, as that of overseer of the public games, the ædileship, and the priestly function: they were also free from having soldiers quartered on them and from military service: moreover they were not compelled to contribute to the purchase of grain and oil, when this was done by the State, to execute the functions of judge or legate or to perform any military or other public service.§ ANTONINUS PIUS ordained however at the same time that these extensive privileges should not be granted to all doctors without distinction but only to a certain definite number of them. It was decreed that in smaller towns only five, in middle-sized towns seven, and in larger ones ten doctors should enjoy this immunity and that at any time on their being

* SUETON: J. Cæsar, c. 42.

† DION CASSIUS liii, 30.—SUETON: Augustus, c. 59.—HORAT: Epist. i, 15.

‡ Digest. l, tit. 4. de muner. et honor. lex 18, 30.

§ Digest. xxvii. tit. 1. de excusat., c. 6, 8.—E. KUHN: Die städtische und burgerl. Verfassung des röm. Reiches, Leipzig 1864, i, S. 69 *et seq.*

found guilty of culpable negligence the magistracy might deprive them of such immunity.

Moreover in granting these privileges preference was shown in favour of doctors who practised in their native towns as against those who had emigrated from others. These immigrants were only respected when they had in some way prominently distinguished themselves. And in cases of exceptional merit the prescribed number of doctors receiving immunity might be exceeded. ALEXANDER SEVERUS made a decree that in the provinces the immunity should no longer be granted by the State magistracy but by the burghers and landowners who were the best judges of the character and ability of the doctors to whom they trusted themselves in sickness.* At a later period there was granted to the doctors the *extraordinaria cognitio* or the right to bring their actions for fees in arrear directly before the highest court in the province.† It would appear that at first all that was sought was to retain able and educated doctors, by such privileges, in a particular spot, as the example of ARCHAGATHOS teaches us. Soon however they may have had certain definite duties laid upon them in the interest of the public. When the institution of public medical officers as it existed in Greece was introduced into the Roman Empire, the rights bound up with the duties of public service were reserved for them. And the above mentioned privileges were at a later period bestowed chiefly if not exclusively upon the public medical officers. The number of the latter was dependent upon the size of the town and was, as it appears, settled in accordance with the law for the granting of immunities.

In Gaul there were public medical officers ‡ before the time of STRABO, in Asia Minor perhaps even earlier, § and in Latium at any rate under TRAJAN, as we learn from an

* Digest. l, tit. 9. de decretis ab ord. fac., c. 1.

† Digest. i, tit. 13, c. 1.

‡ STRABO iv, 1.

§ VERCOUTRE *op. cit.* p. 351.—ORELLI: Inscript. lat., No. 3507.

epitaph which is devoted to the salaried doctor of the town of Ferentinum.*

In Rome a doctor was appointed for every district of the city. The public medical officers were especially bound to attend the poor without being paid by them; but they were by no means debarred from private practice. Moreover they were called into consultation in epidemics and other occurrences which entailed an increase of sickness and mortality: in addition, the duty of medical teaching was included in the list of their obligations. From the community they received a salary which consisted chiefly of articles of natural produce. In large cities like Rome they formed colleges which when a place fell vacant completed the establishment by election. But their choice was subject to imperial ratification. The office seems often to have passed from father to son.† Under the rule of the Emperors VALENTINIAN I. and VALENS (368 A.D.) the qualifications for, and conditions of, holding office as public medical officer were settled in detail.‡

Since this period they bore the official title of *Archiatri populares* the origin of which dates from a still earlier time. The word Archiater is found in ARETÆUS§ and is obviously, by the analogy of other expressions, formed upon the root ἀρχ indicating dignity and high position.‖ At the earliest period it appears to have been used to designate the doctors of the imperial Court. STERTINIUS XENOPHON, on whose history an interesting light has been thrown by the discovery, a short time ago, of his gravestone covered with inscriptions,¶ bore the title of Archiater

* MARQUARDT *op. cit.* vii, 755.

† VERCOUTRE *op. cit.* p. 321.

‡ Cod. Theodos. xiii, T. 3. de med. et profess., c. 8-10—Cod. Justin. x, T. 52, c. 10.

§ ARETÆUS: de acut. cur. ii, 5.

‖ G. CURTIUS: Grundzüge der griechischen Etymologie, Leipzig 1879, S. 189.

¶ M. DUBOIS: Un médecin de l'empereur Claude. Bull. d. corresp. hellén. 1881, No. 7, 8.

and even before him probably M. LIVIUS EUTYCHUS.* In a similar way, NERO'S private medical attendant, ANDROMACHUS was denominated Archiater, the Emperor wishing by this to point out, as GALEN says,† that he surpassed other doctors in experience and knowledge. In another passage GALEN makes mention of the doctors MAGNUS and DEMETRIUS who at that time enjoyed the dignity of Archiater.‡ At a later period the Court doctors bore the title *Archiatri palatini* in contradistinction to the *Archiatri populares*—the public medical officers. At the Court of the Emperor ALEXANDER SEVERUS were seven doctors of whom however the first, the private body-physician, alone received a salary in money, the rest only receiving their board. Moreover they participated in the privileges and favours which were extended to Archiatri and to doctors in general.§ Like the Courts and Communities, so too Societies had their private doctors. Doctors were also appointed for certain classes of officials, for the *personnel* of the theatre, for the Circus and the Gladiators.‖

The various troops had their doctors who accompanied them into the field and treated the sick and wounded soldiers either in their tents or in the military hospitals. They bore arms like other soldiers¶ and enjoyed the immunities granted to other doctors. But little information exists as to the relative rank of military medical officers or their relations to those set over them.** At the head of the whole military medical establishment there was probably a general medical officer on the staff.†† In the same way the navy was provided with doctors: and

* R. BRIAU: Archiatrie romaine, Paris 1877, c. 2.

† GALEN xiv, 211.

‡ GALEN xiv, 261.

§ LAMPRIDIUS: Alexander Severus, c. 42.

‖ R. BRIAU: L'assistance médicale chez les Romains, Paris 1869.

¶ On TRAJAN'S column at Rome two military doctors are represented binding up wounds and drawing out arrows: they are armed.

** R. BRIAU: Du service de santé militaire chez les Romains, Paris 1866.

†† ACHILLES TATIUS: de Clitop. et Leucipp. amor. iv, 10.

amongst them were specialists, as a remark of GALEN informs us.*

Doctors who rendered important services by their ability were distinguished by titles and dignities, by promotion and other honours. In Rome, as elsewhere, it was chiefly the Court doctors on whom these marks of favour were bestowed.† MUSA was raised to equestrian rank by the Emperor AUGUSTUS, and his statue was placed in the temple of ASKLEPIOS. STERTINIUS XENOPHON received for his exertions as military doctor the *corona aurea* and the *hasta pura* at the hands of CLAUDIUS. As imperial body-physician he obtained such influence that he was nominated to the Secretaryship of State for Greek affairs. Thanks chiefly to him, his home, the island of Kos, was relieved from taxation.‡ In later times it not unfrequently happened that doctors accepted high positions at Court or in the government of the State and in that case they probably renounced the practice of their profession.

The decline of the Roman Empire smothered scientific effort, and annihilated many excellent arrangements which had been made in the spheres of teaching and of medical science; but the essential principles of organization were maintained, even if by ignorance and unfavourable circumstances they were misused or even entirely perverted. The rich medical literature which was saved, handed over to later times the acquisitions of a former age and pointed out to medical investigation the path it must follow in order to achieve success.

END OF PART I.

* GALEN xii, 786. † Cod. Just. xii, tit. 13.

‡ TACITUS: Annal. xii, 61.

II. MEDICAL TEACHING IN THE MIDDLE AGES.

THE INFLUENCE OF CHRISTIANITY.

THE organization of the Roman State became subject to insidious diseases which, attacking the vital parts, led to a long period of infirmity brought finally to an inglorious conclusion by the victorious assaults of external foes. Incapacity and profligacy upon the Throne, the division of the government among numerous rulers mutually envious and hostile, the corruption of officials and the venality of a haughty and overbearing soldiery, undermined the political basis of the State, while social life in Rome was poisoned by the loosening of family ties, love of pleasure, pride, the reckless squandering of riches by the wealthy contrasted with the misery of the great masses of the people, and finally the audacious effrontery with which vice manifested itself on all sides. The people of the North, those healthy children of Nature, coming to Rome first as mercenary soldiers, then as regularly engaged defenders, and finally as governing lords, accelerated this process of decay and gave, out of compassion, the death-blow to the Roman Empire worn to pieces as it was by internal troubles and bleeding and maimed by innumerable wounds. The courage and heroism, which had covered the name of the Romans with glory and had made their state powerful, were extinct, or if an isolated courageous act occasionally recalled past times it served only to illuminate with a momentary lightening-flash the dark night of the present. The struggles of the ambitious towards ideal perfection found outlets rather in the domain of theology and of self-sacrificing piety. This mode of thought, led up to by the severe simplicity of manners of the disciples of the Stoa, but which was first extended into more general acceptance by Christianity,

found in the patient bearing of suffering and in abstention from the pleasures of life the greatest and highest virtue it was possible for man to strive after. The Christian doctrine of Faith gave an effective spur to such ideas in offering to people an expectation of a life after death in which all injustice is reconciled, virtue receiving its reward and vice its punishment. The poor and miserable of this world were afforded the hope of a better and brighter future in store for them which might console them for the wretchedness of the present; pity was instilled into the hearts of the rich, and sinners were filled with fear and horror and by these means were urged to better things. This solution of social questions corresponded to the wants and conditions of civilization of that period and on that account was bound to obtain for itself general recognition. The first adherents of Christianity belonged to the circles of the oppressed and the poor: at a later period it found believers also amongst those blessed with worldly possessions, the so-called higher classes of society, members of which, disgusted by the moral depravity of the time, sought for comfort and edification in the doctrines of the new Gospel.

So long as the Christian Church consisted of elements such as these, its purity endured, and the religion of peace and love remained as conceived of in the mind of its revered Founder. But when, with its extension and increase, power and riches were added to it, and from this cause a number of ambitious and unprincipled adventurers were attracted, it became the battle-field of human passions and gave rise frequently to more evil than good.

Christianity concerned itself only with the moral culture of mankind: to the training of the intellect it remained indifferent, sometimes even openly hostile. This was only natural: for in a theory of life which like that held by the Christian Church saw its goal in the perfect ideal of a world invisible, and declared the moral improvement of man to be its principal or only task, no great importance

could be ascribed to scientific investigation. But science stood in direct opposition to Christian dogma when it made the manifestations of Nature, as for example the human body—which the Christian faith held as impure and worthless, if not despicable—the subject-matter of its study. The natural sciences and theoretical medicine consequently made no essential progress under the authority of the Christian Church.

On the other hand the science of medicine has to thank the initiative of the Church for the foundation of numerous hospitals and other benevolent institutions which satisfied the promptings of humanity and the requirements of the healing art in an equal degree. The development of the sciences was at this time also impeded by other conditions and circumstances. The constant wars and predatory expeditions of hostile races, the religious persecutions and controversies on points of dogma, the social changes called forth by the insecurity of property and life, the grievous pestilences which depopulated whole countries and turned them into wildernesses;—all these things diverted attention from scientific pursuits and deprived people who were inclined to such, of the repose required for successfully engaging in them. But the chief cause of the arrest of scientific progress was the fact that the peoples who had divided the Roman Empire among themselves were far inferior to the Romans in education and consequently had first of all the task imposed upon them of assimilating to themselves the culture of their predecessors. This process endured for centuries and was completely effected only at the end of the Middle Ages.

The division of the Roman Monarchy into an Eastern and Western half gave once more clear political expression to the old opposition between the Orient and the Occident which had never entirely disappeared. But a natural result was the disintegration of that great state organization of which one limb was thus separated from the other. The loose connections of the provinces with the central power at

Rome or Constantinople facilitated their acquisition of freedom. The German races, borne on by the tide of peoples setting from the North and East towards the South and West, soon made themselves at home in their new abodes and founded new States. At the close of the fifth century the Ostrogoths, followed later by the Lombards, ruled in Italy, the Visigoths in Spain and South West France, the Burgundians and Franks in the East and North of this district, while the Anglo-Saxon races crossed over into Britain, and the Roman province of Africa was the prey of the Vandals. Tribes of Saxons, Bavarians, Alemanni and Franks remained in Germany and the sway of the Byzantians was pressed upon in Asia by the Persians, and in Europe by the Goths, Huns, and Slavs in an ever increasing degree.

The conquerors preserved many of the political and social regulations which they found existing in the countries subdued by them. This was a triumph which those who had been defeated in a contest of physical strength, were, in consequence of their higher culture, able to celebrate over their less educated conquerors. The latter were able to recognize the great advantages which would accrue to them from an increase of knowledge and on this account took care that the Schools and Teaching-institutions should be as far as possible preserved. The civilizing influence of the Romans had been felt in all parts of the Empire, but especially in the western half. Numerous places of education in Gaul, Spain, Britain and North Africa bore witness to this. The literary efforts of the Roman authors who drew their origin from these lands show how successful in their work were these institutions.*

After the pattern of the establishments for advanced teaching in Athens, Alexandria, and Rome there arose also high schools both in the East and in the various larger

* Mommsen *op. cit.* Bd. v, S. 69 *et seq.*, 100 *et seq.*, 176 *et seq.*, 643, 655 *et seq.*—Gibbon: Decline and Fall of the Roman Empire. Vol. i, p. 49-50, Lond. 1828.

towns of Italy, Gaul and Spain,* in which, along with Greek and Roman literature, were also taught grammar, history, philosophy, rhetoric, jurisprudence, mathematics, physics and astronomy, and sometimes also medicine. The organization of these places resembled in many respects that of the English Universities. They had in view not so much preparation for any particular calling as the object of giving a general education embracing all subjects of knowledge then in the possession of mankind. The professors of these high schools were paid at the public cost and enjoyed immunities, freedom from taxation, and other privileges. Their number was limited and was regulated—as was that of the Archiatri—in accordance with the size of the town. Thirty-one professors were appointed to the high school at Constantinople which was founded in the fifth century A.D.† Besides the professors nominated by the authorities of the town or the Government there appear to have been other teachers who, like private tutors of the present day, made a profession of teaching without receiving any regular salary.

The sons of wealthy parents were generally accompanied to the high schools by attendants who, partaking of the characters both of governors and servants, in most cases belonged to the class of slaves either actual or recently emancipated. The teachers received from their pupils a fee settled by agreement. For such fees to produce a satisfactory income it was a matter of great importance to the teachers that they should have numerous pupils.

The student life, as it was developed in Rome and Athens, resembled in many respects the Continental student life of the present day. The students joined in societies according to the country of their birth, sought to attract and enrol new comers, "freshmen," by all means of per-

* F. CRAMER: Geschichte der Erziehung und des Unterrichts im Alterthum, Elberfeld 1832, Bd. i, S. 477 *et seq.*

† J. C. F. BÄHR: De literarum universitate Constantinopoli, Heidelberg 1835.—SAVIGNY: Geschichte des römischen Rechts, Bd. i, S. 396.

suasion, artifice and often even force, held drinking bouts and feasts and, on occasion, gave vent to the furious passions of youth. There was, indeed, no lack of outrageous and insolent conduct and deplorable excesses. In Antioch it happened once that the students wrapped in a rug a pedagogue who had incurred their dislike, and tossed him in the air and caught him again such a number of times that he finally fainted away. The philosopher LIBANIUS, who occupied a professorial chair at the same time and place, admonished his pupils who had probably participated in this rough sport in the following terms: "Bad enough were it for students to lay hands on ordinary citizens, to insult a goldsmith, to provoke a shoemaker, to beat a carpenter, to kick a weaver, to maul a shopkeeper, or to threaten an oil merchant: but to ill-use a pedagogue is an injury to one occupying a most respectable and useful position and deserves chastisement with the rod and the whip."*

For the rest, the students were subject to strict laws. According to an ordinance of VALENTINIAN (370 A.D.) they were obliged on entering upon their studies to produce testimonials from the magistrates of their native towns, and their names, addresses and the position of their parents were entered on a public register. They were forbidden to waste their time in pleasure-seeking. If they transgressed these injunctions they rendered themselves liable to corporal punishment and could be expelled from the school. The prefect of the town made a yearly report upon the ability and behaviour of the students to the superior imperial authority.†

With the twentieth year of age the studies had to come to an end. It thus appears that they began pretty early. In the *Isagoge in artem medicam*‡ falsely ascribed to

* LIBANIUS: Orat. et declamat. Ed. J. J. REISKE, Altenburg 1795, T. iii, p. 254, 259 (περὶ τοῦ τάπητος).

† Cod. Theodos. L. xiv, T. 1, 1.

‡ VAL. ROSE: Anecdota græca et græcolatina, Berlin 1864, ii, p. 169, 244 *et seq.*

SORANUS but certainly of ancient origin the proper time for the commencement of medical studies is declared to be the fifteenth year. The author takes the opportunity of remarking "that the student must be industrious, intelligent and of ready apprehension, in order to understand and learn quickly; that he needs also a strong body that he may bear the exertion to which he will be subjected." It was moreover required of him that he should possess a scientific preliminary training and that he should have been taught grammar, the history of literature, rhetoric, mathematics and astronomy. "The doctor," he adds, "must combine gentleness and modesty with becoming dignity, must possess an irreproachable character, must not act with haughtiness but must treat the poor and the rich, slaves and free all alike." The medical lectures which were delivered in the high schools by learned theorists, the Iatrosophists as they were called, consisted of philosophic examination and profound discussion of various questions of physiology and pathology: but they did not suffice to prepare those who attended them for the actual practice of medicine. This part of medical training was effected in a more satisfactory and practical way by the Archiatri and by practising doctors generally, who imparted instruction in the healing art.

The schools of the Sophists and the higher teaching institutions demanded no definite confession of faith from their teachers or pupils. Heathens and Christians taught at them, and in their lecture rooms the adherents of various churches and sects mixed freely. Only during the short reign of JULIAN were the Christians excluded from the position of teachers in the heathen schools. Already at that time weak attempts were made to free Christians from a heathen education but only one hundred years later did success crown the efforts of SALVIANUS, of PRUDENTIUS, OROSIUS and others to produce a literature containing Christian subject-matter and founded on the writings of the Old and New Testaments. The indifference and contempt

which the lights of the Christian Church manifested in regard to the intellectual creations of the Greeks and Romans,* the one-sidedness which moved them to confine their choice of material to what had been transmitted through Jewish and Christian channels, and the tendency to disparage the civilization acquired in ancient times, gave to these literary productions a very prejudiced character and make it clear to us why enlightened contemporaries, not affected by religious bias, were able to discern in them no sign of progress in the intellectual development of man.

If the struggle between the Christian training and that of the Ancients had been decided with the weapons of the intellect the superiority of the latter must have been proved: but it was soon transferred to the fields of political power where the victory falls to the strongest. When the Christians, after having for centuries been persecuted by the heathen, at length obtained dominion in the state, they on their side began to oppress their former oppressors. Eagerly labouring to dig up the roots which attached mankind to the heathen past, they attacked the system of teaching resting upon the study of the ancients, and endeavoured so to modify it in accordance with their way of thinking that it should assume a form compatible with Christian dogma. Failing in this they employed force and abolished the teaching-institutions. By an edict of JUSTINIAN of the year 529 the schools of philosophy at Athens and Alexandria were closed. The last of the Greek philosophers abandoned their homes and sought protection and freedom for thought in foreign lands. In Constantinople and other places, especially in the countries of the west, the temples of the Muses were transformed into Christian schools in which the study of religion was the predominant feature. The priests took over the direction of education and became the representatives of knowledge. To them

* Archiv. f. Geschichte u. Literatur; herausg. v. F. C. SCHLOSSER u. BERCHT i, S. 253 *et seq.*

religious faith was the highest law, and limits were imposed on investigation which no one dared to transgress.

In the schools which arose at the residences of the bishops and adjoining the cloisters, not only theology and Church history were taught but also all subjects belonging to general education or of importance and use in daily life. Medical science was frequently included in the list of subjects: and was especially cultivated in the schools of the East. ST. BENEDICT introduced this system into the lands of the West and aroused the members of the order which he founded to the study of medicine. CASSIODORUS also recommended the pursuit of medical knowledge to the monks into whose cloisters he had retired after having played an important part in political life for many years as Minister to THEODORIC, King of the Ostrogoths: he gave them detailed advice as to which medical authors of antiquity they should make the groundwork of their studies.*

Medicine was very zealously pursued, it appears, in the schools of the Nestorians. Prominent members of the priesthood in this sect were famed for their medical abilities and were taken into council by the princes.† The teaching establishments of the Nestorians were arranged like the schools of ST. ORIGEN at Alexandria.‡ Adherents of other Faiths and even heathen were employed as teachers at them but naturally only in profane sciences. The students had to pay a fee for being taught, sometimes a not inconsiderable one. The Church paid the fees for poor scholars and afforded them support besides. The best known educational establishments were at Edessa, Nisibis, Seleucia and Dorkena: at a later date schools of the same kind were founded in Baghdad, Messene, Hirta, Matotha, Jemama and other towns in Syria.§ Many were much

* CASSIODOR: Institut. divin. lect. i, c. 31.

† ASSEMANI: Bibliotheca orientalis, Rome 1728, iii, pars 1, p. 166.

‡ ASSEMANI *op. cit.* iii, pars 2, p. 919 *et seq.*

§ ASSEMANI *op. cit.* iii, pars 2, p. 924.

frequented; Nisibis at one time numbered 800 students, of whom some came even from Italy and Africa.

When the Nestorian men of learning were driven out of Edessa by the religious fanaticism of the Byzantine Emperors, they fled to Persia where they contributed essentially to the rapid progress which the sciences, and especially the science of medicine, made at the school of Gondisapur. While its origin dated probably three centuries earlier,* the period of its prime was under KESRA NUSCHIRVAN in the sixth century. This monarch was thoroughly acquainted with Greek literature and was the benevolent protector of all scientific effort. At his hands the exiled Nestorians found the same hearty reception as the philosophers of Athens; in the same way he supported and helped the Jewish and Syrian men of learning who were the means of transmitting to the Persians the culture of the Greeks. He sent his physician-in-ordinary, BURZWEIH, to India, in order that he might make himself acquainted with the medical practice of that country and bring back drugs and medical writings: and he imposed as a condition when concluding peace with the Emperor of Byzantium that the doctor TRIBUNUS of Palestine, one of the most celebrated practitioners of his time, should be given over to him for a year. In Gondisapur the knowledge of the West and the wisdom of the East came into contact. Greek medicine here walked hand in hand with that of the Persians and Indians, and this alliance concealed the germs of the rapid growth which the science experienced under the Arabs. Medical teaching at the School of Gondisapur was chiefly, if not exclusively, carried on by the learned Nestorians. It was not merely theoretical but more indeed of a practical nature and took place in the Hospital.† This hospital was maintained during the Arab rule and was mentioned even at the end of the tenth century.

* J. H. SCHULZE: De Gondisapora Persarum quondam Academia Medica in Comment. Acad. Petropolit. 1751, xiii, p. 437 *et seq.*

† ASSEMANI *op. cit.* iii, pars 2, p. 940 *et seq.*

Medical science made no remarkable progress during the time of the decline of the Roman Empire and the period following thereupon. The training of doctors was, speaking generally, less judicious and complete than at an earlier period. It was wanting in many excellent arrangements which had facilitated medical teaching among the Romans. Anatomical study was chiefly pursued by means of books. The dissection of human subjects was no longer to be thought of in view of the religious and social prejudices which saw in it the violation of the dignity of man. Even the dissections of bodies of the lower animals were not always possible: for they at least brought the student into the danger of being taken for a magician.* Anatomical knowledge made, in consequence, but small progress; the discovery of the olfactory as an independent nerve, and the doctrine that the development of the cranial bones and the vertebral column depends upon the formation of the brain and spinal cord are perhaps the only things worth mentioning.†

The anatomical and physiological writings of GALEN formed the groundwork for teaching in these subjects. The anatomical learning, which he had deposited there, in the opinion of the doctors of that time satisfied the highest demands which ought to be made upon their knowledge in these matters. The results which he had obtained in his anatomical investigations appeared to them to need neither correction nor enlargement. They ascribed the same character of completeness to GALEN'S physiological theories. The doctrine of teleology which he held sacred, and the sincere admiration he felt for the omnipotence and wisdom of God, to which he gave expression at every opportunity, made an impression upon the Christian mind and found ready acceptance at the hands of the Christian men of learning. GALEN owed it in a large measure, to this cir-

* APULEIUS MADAURENSIS: Apologia, c. 36.

† THEOPHILUS PROTOSPATHARIUS: De corp. human. fabrica ed. A. GREENHILL, Oxford 1842, p. 129, 151.

cumstance that his works were not destroyed by the theosophists of the Christian and Islamite eras, filled with rage and brutal fanaticism as they were against the literary memorials of antiquity; but that they were on the contrary carefully preserved and zealously studied and even given wider extension.

While the theoretical departments of the study of medicine were doomed to inaction, a prospect of successful scientific effort disclosed itself to practical medical science through the foundation of hospitals. The charitable institutions which Christian philanthropy called into existence afforded opportunities for the observation of diseases and injuries of all kinds and offered facilities to doctors for acquiring education in their art and for amassing experience. To assert that the foundation of public hospitals is exclusively a product of Christianity is certainly inaccurate. Even the Buddhists, as we have seen, were acquainted with such institutions, and the Iatreia of the Greek physicians and especially those maintained at the public cost, were essentially nothing but public hospitals. The convalescent institutions of the Romans which were fitted up for slaves and soldiers differed from them only in the fact that they were intended for particular classes of the community. The Spaniards on reaching Mexico after the discovery of America, found hospitals there too and even praised them* highly. VIRCHOW is right when he says that "every civilization which humanizes the manners and customs of people up to a certain degree and gives a more finished form to society, ends by being moved to the foundation of hospitals." †

Christianity however deserves the incontestable merit of having kindled into a clear flame of enthusiasm the sparks of true philanthropy which she found glowing in obscurity. No other religion, no political or social power

* PRESCOTT: The conquest of Mexico, London 1863, 2nd Ed., i, p. 26, 169.

† VIRCHOW: Über Hospitäler und Lazarethe in seinen gesammelten Abhandlungen, Berlin 1879, ii, S. 8.

has essayed or has effected so much for the human race as Christianity. Where it spread and found adherents, there works of mercy were practised and temples were erected to objects of charity. The extraordinary results which the Christian religion succeeded in effecting in the first centuries after its origin depended certainly in great measure on the humanitarian ideas which it proclaimed. To be sure, acts of philanthropy were conspicuous even in ancient times, acts which claim our admiration; but they were at best isolated and produced no enduring effect. Christianity united the humanitarian efforts of individuals and gave a collective character to charity. Ancient times saw in the slave, a beast endowed with human speech, a possession intended for profitable use; Christianity while unable, it is true, to do away with slavery had regard also to the dignity of man existing even in slaves. CATO advised cultivators of the soil to sell their old and sick slaves like cattle no longer able to work and old iron.* Many masters drove their slaves out of their houses when through sickness and old age they had become unprofitable; indeed, the Emperor CLAUDIUS in order to put a stop to this abuse caused the slaves, in this case, to be proclaimed freemen.† Christianity preached compassion for the oppressed, support for the poor and helpless, and care for the sick. Many adherents to this faith gave their possessions to the poor, or to the Church in order that she might give alms therewith. The Church in Rome in the third century provided 1,500 poor with daily sustenance ‡ and the Church at Antioch maintained over 3,000 at the time of St. Chrysostom.§ The erection of homes for the poor and sick, and of other charitable institutions appears to have begun in the East.

The slaves were treated better and with greater humanity in Greece than in any other country of the ancient world: ‖

* CATO: de re rustica, c. 2.

† SUETON: Claudius, c. 25.

‡ EUSEBIUS: Hist. eccles, vi, 43.

§ CHRYSOST.: hom. 66 in Matth.

‖ MOMMSEN *op. cit.* v. 250.

there, even in the times of heathendom poor people and strangers found a friendly welcome and medical care in the Xenodochia, in the event of sickness.

Christianity, in fine, organized the administration of charity and called institutions into existence which in size and prevalence surpassed previous experience. The institution at Cæsarea founded by ST. BASIL resembled a town; it contained numerous dwellings for the poor and sick, was excellently administered, and had special doctors and attendants for the sick in its service.* GREGORY of Nazianzus calls this institution "the treasury of piety, where disease becomes a school of wisdom, where misery is changed into happiness."† EDESSA possessed in 375 A.D. a hospital which was provided with 300 beds.‡ Similar institutions arose in other places of Asia Minor, as also in Alexandria and Constantinople, for the relief of the suffering and infirm.

The first Christian infirmary was, as ST. JEROME narrates, founded in Rome by the widow FABIOLA who belonged to the ancient family of the Fabii, at the end of the fourth century.§ Other rich private persons followed her pious example and the erection of charitable institutions became the fashion with distinguished Roman ladies. In any case, if PAULA built a hospital she conferred a greater blessing on humanity by so doing than by condemning her daughter to perpetual virginity, although she was for this act honoured by ST. JEROME with the title of the mother-in-law of God, as GIBBON says.‖ Elsewhere in Italy, as also in Gaul and Spain, asylums for the sick and poor were erected. The Bishop MASONA of Merida (573-606), a

* GREGORY of Nazianzus: Orat. funebr. in Basil. & Orat. de pauperum cura.—BASILIUS: Epist. 94.

† C. SCHMIDT: Die bürgerliche Gesellshaft in der altrömischen Welt und ihre Umgestaltung durch das Christenthum, Leipzig 1857, S. 246.

‡ E. CHASTEL: Die Christliche Barmherzigkeit in den ersten Jahrhunderten der Kirche, übers v. Wichern, Hamburg 1854, S. 135.

§ HIERONYMUS: Ep. 77, Ed. Vallarsi.

‖ GIBBON *op. cit.* c. 37. p. 398.

Goth, founded a hospital to which Christians and Jews, slaves and freemen found admittance, and he ordered that half of the gifts received by the Church should be given to this institution. He ordered the doctors who were appointed to it, to go round about the town and invite the sick to let themselves be taken to this establishment. The Hotel-Dieu at Lyons was founded in 542 A.D. by CHILDEBERT I. and was under the supervision of laymen.*

The Church pronounced the care of the sick to be a work pleasing to God. The faithful strove earnestly with one another in this matter how best to help the afflicted and did not shrink from performing the meanest and most disagreeable tasks. FABIOLA carried the sick to their beds in her arms and washed out wounds which others scarcely dared to look upon.† The Empress PLACILLA AUGUSTA undertook the duties of a maid-servant in the hospitals.‡ The Christians displayed a self-sacrificing activity in great epidemics such as at that period afflicted the human race. When in the third and fourth centuries contagious pestilences raged in Alexandria and Carthage the Christians took charge of the sick without distinction of creed, nursed them, and buried the dead.§ Many were consequently attacked by the disease and succumbed to it. The heroic spirit of love shown by the Christians on such occasions, filled with astonishment and wonder people of other faiths. Even JULIAN, the most zealous antagonist of Christianity recognized thus their charitable work, he wrote: "We see what it is that makes the enemies of the gods powerful; it is their kindness to strangers and the poor, their care for the dead, and their holiness of life—even if assumed."‖ He felt himself induced to copy the example

* C. F. HENSINGER in the Janus i, S. 772 *et seq.*

† HIERONYMUS: Ep. 84.

‡ THEODORET: Hist. Eccles. v, 19.

§ EUSEBIUS: Hist. Eccles. vii, 22. ix, 8.—SOZOMENOS: Hist. Eccles. v, 16.

‖ JULIAN: Epist. 49.

of the Christians, and decided to erect hospitals in all important towns.

Among diseases leprosy (under this name a number of different kinds of skin disease being included) engaged particularly the attention of the public. The lepers were shunned by the people on account of their horrible appearance, even indeed by their own relations and friends; they were also dreaded on account of the danger of infection to which others were exposed in their presence. The Christians felt pity for these unfortunate people also, and gave them protection and care in their hospitals. ST. BASIL "embraced them as brothers, not for the purpose of making a parade of his courage but to give an example to those whom he entrusted with the care of them."* He assigned to them a special department in his institution at Cæsarea. In Constantinople a hospital was devoted to lepers† and in Italy leper-houses arose in many places at an earlier period than institutions for other sick people.‡ In France there were leper-houses as early as the time of ST. GREGORY of Tours (560) and in a testamentary document of the year 636, institutions of this kind are mentioned at Verdun, Metz and Mastricht.§ One hundred years later ST. OTHMAR collected the lepers from the districts near St. Gall and erected a hospital for them. Christian philanthropy provided, besides asylums for the poor and sick, institutions in which the aged infirm, cripples, blind people, women lying in, orphans, and deserted and foundling children were received and taken care of.

The abandonment of newly-born babes was forbidden as early as the time of VALENTINIAN: but this criminal practice was supported by the public immorality.‖ In the fifth

* GREGORY of Nazianzus. *op. cit.* Orat. viii.

† DUCANGE: Constantinop. christ., Paris 1680, iv, 165.

‡ MURATORI: Antiq. ital. med. ævi, T. i, Dissert. 16.

§ R. VIRCHOW: Zur Geschichte des Aussatzes in VIRCHOW's Archiv, Bd. 20, Berlin 1861, S. 169.

‖ LECKY: Sittengeschichte Europas von Augustus bis zu Karl dem Grossen, Leipzig 1870, ii, 20 *et seq.* ('History of European Morals').

century the custom arose in certain towns of Gaul *e.g.* in Arles, Treves, Maçon and Rouen of laying children, of whom it was wished to be rid, before the Church doors. The priests took care of these poor abandoned infants and caused them to be reared. The first foundling hospitals appear to have arisen at Treves, Angers and Milan.*

Unfortunately the care which the Christians devoted to the sick and helpless did not always manifest itself in this noble and reasonable manner. The words of ST. JAMES:† "Is any sick among you? let him call for the elders of the Church and let them pray over him anointing him with oil in the name of the Lord. And the prayer of faith shall save the sick, and the Lord shall raise him up" display ignorance and superstition in so far as they pronounce the help of the doctor to be superfluous, and the power of prayer to be sufficient to heal the sick. It was a return to that theurgical point of view from which diseases were looked upon as punishments inflicted by God and only to be removed by penance and prayers. The sufferers came now to the Christian Church as they formerly did to the temple of ASKLEPIOS to request advice and aid from the priests. Happy recoveries, the cause of which was ascribed to the intercession of a saint, resulted in an increased throng of sick people. And thus, especially in Churches where the bones of saints reposed, there became developed a kind of worship, hardly distinguishable from that offered at the temples of ASKLEPIOS.‡ The sick spent nights there in fasting and prayer, hoping that the saint would appear to them in a dream or a vision and would indicate the remedy suited to effect their recovery, and the priests interpreted the hallucinations and dreams of the patients, wrote down the histories of the successful cases which occurred, and took care that by means of pictorial representations of

* CHASTEL *op. cit.* S. 53, 138.

† Gen. Ep. St. James, c. 5, v. 14, 15.

‡ ALB. MARIGNAN: La médecine dans l'église au sixième siècle, Paris 1887

the parts of the body which had been successfully treated the recollection of such cures should be kept fresh and enduring in the minds of the faithful. The reverence which was paid to the martyrs who had suffered death for their faith very easily led to great healing powers being ascribed to their remains. The sick hoped to obtain relief from their sufferings if they were allowed to see or to touch the saint's body or articles belonging to him, to visit his grave or to taste of the dust covering it. Amulets and miracles played a prominent part henceforth in the medicine of the Christians. The mystical enthusiasm of the Neoplatonists and the Neopythagoreans, which had just been employed as a weapon in the contest against the Christian Church, now found acceptance with the latter: and under ecclesiastical protection, fraud and superstition made their power felt in a sphere where not merely the progress of science but the health—even the life of men frequently depends upon the truth.

The medical literature of that period bore the character of dependence. Poor in original ideas, incapable in original research, writers were satisfied in collating what had been effected in bygone times and working it up into concise epitomes. The practising doctors demanded books of receipts answering to their daily requirements. Of this nature were the writings of QUINTUS SERENUS SAMONICUS, SEXTUS PLACITUS PAPYRENSIS, VINDICIANUS, MARCELLUS EMPIRICUS, LUCIUS APULEIUS, CASSIUS FELIX, THEODORUS PRISCIANUS and others, the Latin translations of certain works of the Hippocratic writers, of DIOSKORIDES, GALEN and SORANUS, and compilations from PLINY, CAELIUS, AURELIANUS and others. In their language as in their subject matter they indicate the rapid decline of intellectual aspiration after science which characterizes this period.

More valuable and richer in matter were the literary performances of the Greeks in this domain: yet it might here too be detected that the creative power of ancient times was gone. The judgment passed by the philosopher

LONGINUS upon his contemporaries in the third century was equally applicable to the Greeks. "In the same manner as some children always remain pygmies, whose infant limbs have been too closely confined; thus our tender minds fettered by the prejudices and habits of a just servitude, are unable to expand themselves or to attain that well proportioned greatness which we admire in the ancients."*

In the fourth century, ORIBASIUS by the wish and command of the Emperor JULIAN whose body-physician and friend he was, made a collection of extracts from the most important writings of the most famous medical authors of ancient times,† enriching the same with many interesting additions of his own. After the same plan AËTIUS in the sixth century collected a number of treatises upon the particular departments of medicine. Since many of these proceeded from doctors, whose works have been lost, and many things are alluded to therein which are not to be found elsewhere, this collection forms a priceless source of information not merely for the history of medicine but also for that of philosophy and other branches of knowledge. Unfortunately the use of it is made difficult if not impracticable by the fact that the Greek text of the work has not as yet been printed in its entirety.

ALEXANDER of Tralles, who lived about the same period as AËTIUS, is placed by FREIND by the side of HIPPOKRATES and ARETÆUS. Being the first doctor who for a long time had shown any originality in thought or practice he recalled to remembrance once more the mighty past of Greek medical science. His text-book of special pathology and therapeutics of internal diseases which has been edited by me,‡ contains a multitude of medical obser-

* LONGINUS: De sublim,, as quoted by GIBBON, *op. cit.* Vol. i c. ii, p. 76.

† This was edited by CH. DAREMBERG with the support of the French Government (Paris 1851-76).

‡ TH. PUSCHMANN: Alexander von Tralles, Originaltext und Übersetzung, Wien 1878-79, 2 Bde. On pp. 108-286 of the Introduction is a description of the scientific performances and services of A. of T.

vations and experiences, made by him in his practice of many years' duration and shows us in the author a man combining a correct judgment with extensive knowledge. The compendium of general medical science composed with great originality and independence by PAULUS ÆGINETA belongs to the seventh century and, particularly in its surgical sections, is of great value, since the operative attainments of the surgeons of that period are fully described therein.*

The medical writings of the Byzantines bore almost without exception the stamp of superficiality and consisted, like the works of MELETIUS, THEOPHANES NONNUS, SIMON SETH, NIKETAS, DEMETRIUS PEPAGOMENUS, NICOLAUS MYREPSUS and others, to a large extent of compilations made without judgment, and collections of receipts. A tendency to encyclopædic literature developed itself about the same time, finding representatives in PHOTIUS, MICHAEL PSELLUS and others: the same inclination was shown also in the Origines of ISIDORE of Seville and the Elementa Philosophiæ of the monk BEDA. The Encyclopædists skimmed over all sciences, discoursed of God and the world, of heaven and earth: they began with theology and ended with the art of cooking. They drew even medicine into the field of their observation; but they seldom did more than furnish a catalogue of names for things with which they were really but slightly acquainted.

The medicine of the Byzantines came to a worthy conclusion in the person of JOHANNES ACTUARIUS whose writings on the urine and on the physiology and pathology of the mind are allied both in substance and form to the best literary performances of the Greeks.† He appeared as HAESER says "like the last flickerings of a dying flame" shortly before the Turks erased for centuries the glorious name of the Greeks from the history of nations.

* F. ADAMS: The seven books of PAULUS ÆGINETA, London 1844-47.

† J. L. IDELER: Physici et medici Græci minores, Berlin 1841-42, i, pp. 312-386. ii, 1-193, 353-463.

If we survey the character of the intellectual activity of this period we cannot wonder at the dearth of production in original matter. On the contrary we feel a legitimate surprise that notwithstanding the heavy oppression, which weighed on the spirits of mankind, and despite the terrible confusion of all social conditions, energy and power were yet forthcoming, and equal to the accomplishment of independent intellectual tasks. Like desert-plants which are hardy enough to dare the arid conditions of life to which they are exposed, so the intellectual performances of that time were compelled, with painful endurance, to maintain the struggle for existence. We should not expect them to transform the bare wilderness into a place of luxuriant fertility, but must be thankful if they rejoice the eye of the weary wanderer with the green leaf of hope.

ARABIAN CIVILIZATION.

WHEN the Semitic hordes of the Arabian peninsula, accustomed as they were to a life of restless wandering and to unceasing campaigns and forays, set forth for the purpose of subduing the world, the attractions of art and science were far from their thoughts. Of these things they knew only as much as transient relations with the neighbouring peoples had taught them. Arabian literature consisted of little more than certain heroic poems in which as GOETHE says* "the love of home, the greed of fame, courage, and an unappeasable thirst for revenge" were the subjects of song "tempered by the woes of love, by charity and sacrifice." The Koran "chapters of which lying scattered about, scrawled on palm-leaves, pieces of leather, flat bones and other coarse material or even entirely entrusted to the memory of the faithful, ABU BEKR was the first to collect and OTHMAN to arrange in the existing order,"† laid the foundation of a literary Arabic language.

* GOETHE: Noten und Abhandlungen zum west-östlichen Divan.

† E. MEYER *op. cit.* iii, S. 90.

For the Koran, inasmuch as it was the religious and civic law book of the adherents of Islam, was read and spread wherever the doctrines of MUHAMMED found believers, and with it the Arabic language extended from country to country. It is owing to this fact that Arabic became the speech used in the religious worship of Islam and thus formed the link uniting the different peoples who professed the same faith. This circumstance as well as the care and perfecting which it consequently underwent, explain the fact that it became the language of the educated and learned. It gained the same importance in the Muhammedan world as the Latin tongue did in the Christian middle ages.

Gradually, a rich literature and a flourishing civilization sprang from it, embracing in its domain nearly one half of the earth as known at that time. The Indians in the East, the Goths in Spain, the Armenians and Tartars on the Caspian, and the Ethiopians at the outlet of the Red Sea adopted with their religion the language of the Arabs. To be sure, these various nations retained each its own language for national intercourse and exceptionally such language furnished a literary production, which while differing from Arabic literature in the form of the characters used, breathed in its contents the same spirit and the same mode of thought.

The Arabian people probably contributed but little to what we are in the habit of calling Arabian culture. The roots of this must be sought among the Persians, the Greeks of Asia Minor and of Alexandria, and in India: nearly all the peoples subdued by the Arabs took part in its development from the Pillars of HERCULES in the West to the Sea of Darkness, as the Arabs called the Indian Ocean, in the far East. During the first decades of their appearance as prominent actors in the world's history, they were so much occupied with quarrels among their rulers and wars of conquest that they had but little leisure for the arts of peace. It was "the day of ignorance." The anecdote

reported by ABULFARAG* is well known, how that OMAR, being asked after the conquest of Alexandria what should be done with the numerous books which were stored there, answered: "Either these writings contain what is given in the Koran, and in this case they are superfluous: or they contain other things and are consequently hurtful: in either case they must be destroyed." Perhaps there is no foundation for this tale, perhaps the far-famed libraries of the Ptolemies may for the greater part, as history tells, have fallen a prey at an earlier period to fire or to the mania for destruction of a Christian mob; be this as it may, the story indicates the characteristic spirit which animated the first Arab conquerors.

As soon as the political dominion of the Arabs was secured, under the dynasty of the house of OMMIYAH higher intellectual aspirations manifested themselves. The Caliph MOAWIYAH, who took up his residence at Damascus, founded schools, libraries, and observatories there. He invited the learned of foreign lands, especially Greeks, to come to his Court and gave them important works to carry out; even the mosques were built under the direction of Greek architects and artificers.

Greek culture reached the Arabs partly from Alexandria, partly was transmitted through Syria and Persia. Medicine chose the same routes. In the seventh century numerous medical schools existed in Alexandria in which instruction was imparted according to the doctrines of GALEN.† Among the teachers of medical science there was ALKINANI, a Christian doctor of Arabian origin, who at a later period was converted to Islam. He seems to have been the chief agent in bringing it about that medical studies and teaching were transferred from Alexandria to

* ABULFARAGIUS: Hist. dynast. ed. Pococke, Oxon. 1672, p. 114.—V. HAMMER-PURGSTALL: Literaturgeschichte der Araber, Wien 1850, Bd. i, Einl. S. xxxviii.

† L. LECLERC: Histoire de la Médecine Arabe, Paris 1876, i, p. 38 *et seq.*

Antioch and Harran.* About the same period lived the Greek THEODOCUS who took up an influential position as body-physician of HEDSCHADSCH, the sanguinary governor of Irak: as author he won approval for his excellent dietaries and as teacher of medicine he trained numerous pupils—among them FORAT BEN SCHANNATHA, a Jew—who became celebrated doctors.† The prince CHALID BEN JAZID, who had been taught in medicine by MARIANUS, a Christian Monk, probably once a teacher in the medical school of Alexandria, caused works on medicine, alchemy and astronomy to be translated from Greek into Arabic by the elder STEPHANUS, a Greek of Alexandria. These were the first translations from a foreign tongue, which were made under the rule of Islam, as is stated by the author of the Fihrist.‡ Greek literature had found many friends and admirers in Asia Minor where Hellenism had ever since the time of ALEXANDER THE GREAT of Macedon possessed an important influence which it was able to maintain under the political changes of the Roman period.

Learned Nestorians, who carried on teaching as a profession in the School at Edessa, translated the writings of ARISTOTLE from Greek into Syriac.§ Even at an earlier date Syriac translations of the New Testament and other theological works had been prepared. The Nestorians continued this meritorious work when they founded educational establishments in Persia, and displayed an aptitude for it, meeting with much success at the school of Gondisapur. They were however by no means the only people engaged in such work. Members of other religious societies

* v. HAMMER-PURGSTALL *op. cit.* Bd. ii, S. 194.—FREIND. Hist. Medicinæ, Venet. 1735, p. 89.

† LECLERC *op. cit.* i, p. 82.

‡ Fihrist means "the Index." It is an Arabic bibliographical work on the scientific treatises translated into Arabic from Greek, Ancient Persian and Sanscrit. Its author—MUHAMMED IBN ISHAK who died year 380 of the Flight. E. H. H.

§ J. G. WENRICH: De Auctorum Græcorum versionibus et commentariis Syriacis, Arabicis, Armeniacis, Persicisque commentatio, Lips. 1842, p. 8.

and sects distinguished themselves in a similar way. Numerous Jacobites made themselves known likewise as translators,* among them notably SERGIUS who lived at the court of KESRA NUSCHIRWANS. He was a friend of the Greek historian AGATHIAS, and as familiar with Greek as with Syriac; he was distinguished for his learning, and the best translator of his time.† By him numerous medical works—and to such, being a doctor, he devoted especial attention—were rendered into Syriac from the Greek, among them certain writings of HIPPOKRATES. Moreover he wrote explanatory notes to ARISTOTLE and completed the medical compendium of the Alexandrian doctor AHRON.‡

The numerous Jewish men of learning who had settled in Syria and Persia, were the means of bringing about an acquaintance with Hebrew culture and, in addition, must have contributed to an increased extension of Greek literature, especially in the domain of medicine. The system of teaching among the Jews was admirably organized and their high schools at Tiberias in Palestine, at Sepphoris and Nisibis in Syria, and at Sura and Pumbeditha in Persia acquired great fame.§

By the rendering of Greek works into the Syriac, Hebrew, and Persian languages, the study of these was put within easier reach of the Arabs. The mutual relations of kinship among these tongues facilitated the translation of the compositions from them into Arabic. This pursuit was systematically exercised and conducted under the Abbassides. AL MANSUR, the second Caliph of this line of rulers, the founder of the new capital of Baghdad, charged his body-physician GEORG BACHTISCHUA with the translation of medical works from Greek into Arabic, as is stated by IBN ABU OSEIBIA.‖ According to the statement

* WENRICH *op. cit.* p. 11.

† AGATHIAS: Histor. iv, c. 30.—ASSEMANI *op. cit.* T. ii, p. 315, 323.—ABULFARAG *op. cit.* p. 94, 172.

‡ WENRICH *op. cit.* Index xxxv.

§ CRAMER *op. cit.* i, S. 109 *et seq.*

‖ WENRICH *op. cit.* p. 13.—LECLERC *op. cit.* i, p. 124 *et seq.*

of HADJI KHALFA he is said to have sent envoys to Constantinople, in order to fetch from thence the writings of EUCLID and works on natural science. One of his successors HAROUN AL RASCHID, celebrated in story, the contemporary of the Frankish Emperor CHARLEMAGNE with whom he had communications, imposed as the condition of peace after the defeat of the Byzantine Emperor NICEPHORUS that manuscripts of Greek literary masterpieces should be delivered up to him. The treasures of this kind, also, which fell into his hands at Ancyra and other Greek towns as well as on the island of Cyprus were to him welcome prizes of war. He commanded that they should be translated into the Arabic language. In this work one of his doctors, JOHANNES MESUË (MASEWEIH) a Syrian Christian, who attained a prominent position under AL MAMUN, assisted him with advice and personal effort.

This prince erected an establishment for translating where works were rendered into Arabic from foreign tongues. "To this end he brought together" as LEO AFRICANUS writes* "a great number of learned men acquainted with various languages, and made inquiries about the authors and writings in the Greek, Persian, Chaldæan, and Egyptian languages, many of which were known to himself. Thereupon he sent many of his servants to Syria, Armenia, and Egypt to buy the books indicated, and they brought together immense loads of them. And now AL MAMUN caused the useful books—such as dealt with medicine, physics, astronomy, music, cosmography and chronology to be selected, and appointed as superintendent of the translators from the Greek, JOHANNES, son of MESUË, for at that time Greek studies flourished among the Christians; many others being placed under his direction. For Persian literature he appointed MAHAN and the above-mentioned MESUË. These and many other

* LEO AFRICANUS in Fabricius Bibl. Græca, Hamburg 1726, xiii, p. 261.—MEYER *op. cit.* iii, 115.

learned men translated the Medicine of GALEN and afterwards all the works of ARISTOTLE."

From the Byzantine emperors AL MAMUN obtained a number of Greek manuscripts, the learned PHOTIUS who lived for a long time at the court of Baghdad transmitting them to him. Moreover Indian works—such as the treatise on poisons by CHANAK and the Ayur-Veda of SUSRUTA and CHARAKA—were translated and, as it appears, first into Persian and then into Arabic. The Indian doctors who, like MANKAH, SALEH BEN BALEH and others, had settled in Baghdad, rendered in this way important services.* Thus too certain literary productions of the Chaldees found their way to the Arabs.

This establishment for translating continued to exist under the successors of AL MAMUN; among the men of learning who were appointed to it, HONEÏN (JOHANNITIUS) who translated the most important Greek authors, made himself especially remarkable.

On these foundations an independent medical literature gradually developed. The commencement of it reaches back into the ninth century; but only in the eleventh did it attain its prime. The progress of Arabian culture was favourably influenced in an extraordinary degree by the disintegration of the empire into numerous independent states. The princely residences of the Samanides at Bokhara, of the Ghasnawides at Ghasna, of the Buides in Persia, of the Hamadanites in Mesopotamia and Syria, of the Edrisites in Magreb, of the Aglabites in Kairwan and of the Fathimites in Egypt formed so many centres for artistic and scientific efforts, like points of crystallization in a saturated liquid. They found the most effective protection however among the Ommiades in Spain, who obtained dominion there after being driven from their home about the middle of the eighth century. ABDERRAHMAN, the

* At the time of MUHAMMED there existed at Senaa in Southern Arabia a famous medical school, the Principal of which, HARIT BEN KALDAH, had acquired his knowledge in India as LASSEN (Indische Alterth. ii, 519) narrates.

first prince of this house, enlarged his seat at Cordova and adorned it with buildings the remains of which even now excite wonder. He planted there the first palm—an incident which he has celebrated in an elegy which gives touching expression to the longing he felt for distant Baghdad.*

The brilliant period of the Arabian dominion in Spain began with ABDERRAHMAN III. He caused great buildings to be erected, aqueducts and streets to be made, and induced men of learning from the East to come to Spain. Learned men stood in high respect at his Court, and held conferences, being separated into departments according to their respective sciences. His successor HAKIM II. devoted still greater attention to scientific effort. He was himself a man of learning and took a personal part in discussing the burning questions of the day. Above all, he bought up scarce books which he studied thoroughly and added notes to them. His library is said to have contained 600,000 volumes and the catalogue alone to have filled 44 volumes. He founded in Cordova a sort of Academy, the members of which were entrusted with special researches on the history of the country, the history of literature and the natural sciences.†

If the sciences flourished under circumstances such as these, it was due certainly in a great measure to the sympathetic assistance which was extended to them by the reigning sovereigns; but, the memories of Roman culture still cherished in Spain, the care taken by the Visigothic conquerors for what remained of it, the settlement in the country of industrious and enterprising Jews who built schools and spread education on all sides, and finally the happy coalescence of the Semitic character with Roman and Germanic elements, all exercised, without doubt, a noteworthy influence in the same direction.

* v. HAMMER-PURGSTALL *op. cit.* iii, 31.—MEYER *op. cit.* iii, 126.

† *Cf.* R. DOZY: Geschichte der Mauren in Spanien, deutche Übers., Leipzig 1874, ii, S. 68 *et seq.*

And thus it came about, that at a time when the rest of Europe was sunk in ignorance, superstition, and barbarism, on the Spanish peninsula an intellectual life was unfolding itself, rich and fruitful in every path of mental activity. In the twelfth century Spain possessed 70 public libraries and 17 teaching institutions of a higher class. Cordova produced 150 authors, Almeria 52, Murcia 61, Malaga 53.* The performances of the Arabs in mathematics† and physics,‡ especially in mechanics and optics, and again in chemistry,§ astronomy‖ and geography¶ are well known. They were the first to introduce measurement and experiment into the investigation of Nature. The excellent work of ALHAZEN on refraction prepared the way for a rational comprehension of the physiology of vision, and GEBER was the founder of scientific chemistry.**

MEDICAL SCIENCE AND MEDICAL TEACHING AMONG THE ARABS.

ATTENTION and care were even in the earliest periods of Islam devoted to medicine, as ABULFARAG observes.†† And yet the Arabs made but little progress in this domain and no discoveries of primary importance. This is owing to the absence, in their nation, of an independent development of medical or indeed of any other science. Hence sprang also that unlimited belief in authority which both deterred them from testing the accuracy of scientific results

* MICH. CASIRI : Bibl. Arab. Hisp. Escur., Madrid 1760, T. ii, p. 71.

† M. CANTOR: Geschichte der Mathematik, Leipzig 1880, i, S. 593 *et seq.*

‡ J. C. POGGENDORFF: Geschichte der Physik, Leipzig 1879, S. 56 *et seq.*

§ H. KOPP: Geschichte der Chemie, Braunschweig 1843, i, S. 51 *et seq.*

‖ W. WHEWELL: History of the Inductive Sciences. New Edition. London 1847. Vol. i, p. 236 *et seq.*

¶ O. PESCHEL: Geschichte der Erdkunde, München 1877. S. 104 *et seq.*

** H. KOPP: Beiträge zur Geschichte der Chemie, Braunschweig, 1875, iii, S. 13 *et seq.*

†† ABULFARAG *op. cit.* p. 160.—*Cf.* A. SPRENGER: De origin. med. arab., Leyden 1840, p. 6.

as received by them, and also took away from them all courage for independent investigation. And then came social and religious prejudices, which nipped in the bud every attempt which was made in this direction.

Anatomy and physiology remained, therefore, essentially at the standpoint they had reached under GALEN. The dissection of human subjects being forbidden by the religious creed of the Muhammedans, clearly any increase in anatomical knowledge was not to be thought of. Incidental observations, as those made by ABDEL-LETIF on the occasion of an epidemic in Egypt, in which by the examination of the skulls of the dead he succeeded in correcting* numerous osteological mistakes of GALEN, formed an exception to the rule. Generally speaking, anatomical literature was limited to abstracts and short compendiums founded upon the works of GALEN. In the same way his physiological theories were slavishly followed. Even the promising results, which physics and chemistry arrived at in the way of experiment, produced scarcely any reform in this matter. Students were not in the position to make them thoroughly profitable for the study of human physiology and failed to apply these methods of inquiry to that science.

The Arabs manifested greater independence in practical medicine. Their numerous writings upon this subject are certainly also dependent upon the works of the ancients and consist for the most part of extracts, commentaries and translations of the same; but here and there we do find an independent observation, a personal experience, which serves to show that the author was master of the subject and was in a position to advance the knowledge of it. The scientific work accomplished by such men as RHAZES, ALI ABBAS, ABULKASEM, AVICENNA, AVENZOAR, AVERROES, MAIMONIDES, IBN EL-BEITHAR, OSEIBIA and others† holds an honourable position in the history of medicine, and

* ABDOLLATIPHII Hist. Ægypt. ed. WHITE, Oxon. 1800, p. 277.

† WÜSTENFELD: Gesch. der Arab. Ärzte u. Naturforscher, Göttingen 1840.

deserves recognition all the more, inasmuch as the authors lived at a time, when the development of medicine was nowhere making any progress.

The Arabian doctors gave great attention to the examination of the body of the patient. They noted all the symptoms of disease, but attached most importance to the character of the pulse and the peculiarities of the urine. They attained to a remarkable ability in prognosis. They paid a fitting attention* to dietetics and enlarged the pharmacopœia by the addition of numerous remedies. They were zealously anxious to discover the causes of disease and obtained some success in this quest. AVENZOAR drew attention to the *Sarcoptes hominis*, pointing out its relation to scabies.† ABULKASEM left behind him an excellent description of the *Dracunculus medinensis* and the conditions of disease arising therefrom.‡ Special pathology has to thank the Arabian doctors for many contributions: they gave valuable information as to the causes and character of certain diseases, for example, the malignant epidemics, small-pox, measles and other exanthemata,§ consumption,‖ face-ache¶ etc. On the other hand, operative surgery certainly lost ground among the Arabs. The neglect of anatomy and the dislike peculiar to Orientals of any interference with the human body which is attended with bleeding were to blame for this. Caustics and cauteries took the place of the knife. Where surgeons incised before, they now were satisfied with cauterizing and burning. Even ABULKASEM deplored the decline of

* *Cf.* EL-ANTERI's admirable verses in v. HAMMER-PURGSTALL *op. cit.* Bd. vii, S. 499.

† RASPAIL: "Memoire sur l'histoire naturelle de l insecte de la gale" in the Bull. gén. de therap., Paris 1834, T. vii, p. 169.—F. HEBRA (Acute Exantheme u. Hautkrankheiten in VIRCHOW's Handbuch, Bd. iii, S. 413, Erlangen 1860) did not believe that AVENZOAR was acquainted with the Sarcoptes.

‡ ABULKASEM; Chirurgie ii, 93, Edit. LECLERC, Paris 1861, p. 230.

§ RHAZES: De variolis et morbillis, Edit. CHANNING, London 1766.

‖ WALDENBURG: Die Tuberkulose, Berlin 1869, S. 25.

¶ AVICENNA: Canon iii, fen. 1, tract. 1, c. 12.

surgery. "The operative Art" he writes "has disappeared from among us almost without leaving any trace behind. Only in the writings of the ancients do we find some references to it but these, by bad translations, by errors and alterations, have become nearly unintelligible and useless."* On this occasion he mentions numerous occurrences of practice which throw a strong light upon the ignorance of his surgical colleagues. Cauteries were the most frequently used and most important instruments for the treatment of wounds. The hot iron was recommended† for the arrest of bleeding, besides compression, the application of cold, and the ligature; it was employed in a multitude of affections—for instance in palsies,‡ wounds and fistulæ,§ gangrene,‖ cancer and other new growths,¶ in psoriasis,** for the opening of hepatic abscess,†† in carious inflammation of the hip joint, in the vertebral disease of children,‡‡ and many more. The use of heated instruments in surgery was brought to a high stage of development by the Arabian doctors. A large number of the 151 surgical instruments, representations of which are added to the manuscripts of ABULKASEM, were used in this way. In contradistinction to the use of cauteries, the art of operative surgery receded into the back ground and was unable to maintain that stage of perfection which it had reached under the surgeons of the Roman Empire. Amputation was ventured upon only in the case of the forearm or leg or at most only just above, at the elbow or knee joint: never in the upper arm or thigh.§§ The skin was fixed by bandages above and below the place where it was purposed to make the incision and before the beginning of the operation was drawn up with the object of securing as large a flap as possible to cover the bone. The bleeding accompanying

* ABULKASEM: Introd. *op. cit.* p. 1.
† *Idem op. cit.* i, 56 p. 56.
‡ *Id. op. cit.* i, 6, 9, p. 17, 19.
§ *Id. op. cit.* i, 17, 19, 36, p. 25, 27, 38.
‖ *Id. op. cit.* i, 52, p. 54.
¶ *Id. op. cit.* i, 50, 53, p. 53, 54.
** *Id. op. cit.* i, 47, p. 50.
†† *Id. op. cit.* i, 28, p. 33.
‡‡ *Id. op. cit.* i, 43, p. 46.
§§ *Id. op. cit.* ii, 89, p. 219.

the amputation ABULKASEM arrested by styptics and cauteries; in describing the operation he says not a single word about tying the vessels. In another passage he narrates that he made a resection of part of the bone in a case of necrosis of the tibia.*

Tracheotomy was no longer practised in his time. He only knew it from the descriptions of the ancients, but considered it indicated in cases in which the danger of suffocation was imminent by reason of new growths.† AVENZOAR performed the operation on a goat, as he informs us, with the object of observing the result.‡ Lithotomy was described by ABULKASEM who in the same place alludes to lithotrity.§ MOSES MAIMONIDES improved the method of circumcision, which custom was in use among the Arabs, and introduced several precautionary measures to be observed in this operation.‖ In the treatment of fractures and dislocations which ABULKASEM considered in his third book, the approved principles of the doctors of antiquity were pursued.¶ It only deserves mention that AVICENNA recommended the reduction of the dislocated humerus by direct pressure, *i.e.* direct reposition.**

Cataract was removed by depression of the lens into the vitreous.†† Extraction was considered, if not impossible, at least very dangerous.‡‡ ABULKASEM alludes, as RHAZES did before him, to the curing of cataract by suction and remarks that this procedure was practised in Persia.§§ So

* *Id. op. cit.* ii, 88, p. 216.

† *Id. op. cit.* ii, 43, p. 120.

‡ AVENZOAR: Altheisir., Lib. i, Tr. x, c. 14, Venet. 1542.

§ ABULKASEM ii, 60 *op. cit.* p. 151 *et seq.*

‖ J. B. FRIEDREICH: Zur Bibel, Nürnberg 1848, ii, S. 46 *et seq.*—H. PLOSS: Geschichtliches und Ethnologisches über Knabenbeschneidung im Deutschen Arch. f. Gesch. d. Med. Leipzig 1885, viii, S. 324 *et seq.*

¶ ABULKASEM iii, *op. cit.* p. 270-342.

** AVICENNA: Canon iv, fen. 5, tract. 1, c. 11, 14.

†† ABULKASEM ii, 23 *op. cit.* p. 92 *et seq.*

‡‡ AVENZOAR: Altheisir., Lib. i, tract. 8, c. 19.—AVICENNA *op. cit.* iii, 3, tract. 4, c. 20.

§§ ABULKASEM ii, 23 *op. cit.* p. 93.

too the ophthalmic surgeon ISA BEN ALI makes mention of this method of operating; a manuscript of his work gives on the margin an illustration of the hollow needle used for this purpose.* CANAMUSALI who frequently performed this operation, made a preliminary incision in the cornea so that the hollow needle could be more easily introduced.†

Midwifery was the business of midwives, who rendered the required help in normal confinements and even undertook obstetric operations. The strict seclusion of women agreed to by the custom of society prevented doctors occupying themselves with practice of this kind. They had only occasional opportunities ‡ in this respect; in their writings they concerned themselves chiefly with advising the midwives what remedies to employ for the relief of women seeking their aid and with giving them counsel in the performance of certain operations.§ Among the instruments specified by ABULKASEM as being used in the extraction of the dead fœtus, we find a dilator, bearing some resemblance to midwifery forceps ;|| but it is clear, as MULDER has remarked, that it was never used for the extraction of a living child.¶ Another illustration shows the form of the cephalotribe used for a similar purpose.**

One pleasing symptom is the active interest, which the Arabian doctors took in the history of their science. The works of IBN DSCHOLDSCHOL and of IBN ABU OSEIBIA†† form a priceless source of information, though unfortunately one but little used, for the study of the history of medicine, as indeed also for that of the history of civilization in general. The taste for history which was instilled

* SICHEL in the Archiv. f. Ophthalmol. 1868, Bd. xiv, 3, p. 9.

† LECLERC *op. cit.* i, p. 535.

‡ C. J. v. SIEBOLD: Geschichte der Geburtshilfe, Berlin 1839, i, S. 272, note.

§ SIEBOLD *op cit.* i, S. 298 *et seq.*

|| ABULKASEM ii, 76, 77, *op. cit.* p. 180 *et seq.* and Appendix Fig. 103.

¶ J. MULDER: Geschichte der Zangen u. Hebel in der Geburtshilfe, Leipzig 1798, S. 9.—SIEBOLD *op. cit.* i, S. 295, Note 1.

** ABULKASEM *op. cit.* Fig. 106.

†† WÜSTENFELD *op. cit.* S. 132 *et seq.*—LECLERC *op. cit.* ii, 187 *et seq.*

into the Arabs in their education, induced them to adorn their writings with a multitude of quotations through which many important matters have been saved from oblivion. What surprising disclosures on the civilization, and particularly on the medicine, of antiquity may we expect, as soon as the literary treasures of the Muhammedan seats of learning in the East and in North Africa, such as Kairwan, are thrown open to science!

Even in the earliest ages of Islam elementary schools were universally erected near the mosques, in which children learned to read the Koran. To this was added later on the reading of other compositions, besides grammar and instruction in writing. Attendance at school began in the sixth year of age.* Religion formed the basis of the higher teaching as well as of the more elementary. The higher teaching institutions, too, were at first in connection with the mosques. In the niches and corridors of these or in adjacent halls, the learned gathered a circle of inquiring students around them and held discourses upon theological, philological, philosophical, legal and medical questions. During the first centuries any one might act as a teacher without being obliged to show his qualifications; from the teachers of theology and law only was it demanded that they should give account of their own education by a teacher of publicly recognized ability in the branch of knowledge they professed. Many teachers carried on some other calling as well: they worked as readers and preachers in the mosques, as officials, judges, secretaries, overseers at the markets, and even as tradesmen and mechanics.† The teachers of medical science were no doubt in most cases skilled as practical doctors. The lectures being gratis, it was natural that teachers not possessed of private means should be careful to get their

* D. Haneberg: Über das Schul- und Lehrwesen der Muhamedaner im Mittelalter. München 1850, S. 4 *et seq.*

† F. Wüstenfeld: Die Academien der Araber und ihre Lehrer, Göttingen 1837, S. 6.

living by other pursuits. Many supplied the students with board and lodging, in order to earn, by the presents and money they received from them, something towards defraying their expenses. Sometimes they selected a son-in-law from among them.* The lectures were delivered either with or without the use of a copy or notes. SAMACHSCHARI made the witty remark: "The reputation of the learned man lies in his lecture-book like that of the merchant in his money-box." The words of the teacher were copied down by the students, and the latter even subjected themselves to reproof if they neglected this. The teacher ascertained for himself by questions whether the students had understood the substance of his discourse. Discussions often ensued, in which it occasionally happened that an able scholar, finding himself by chance among the listeners, achieved a victory over the teacher himself.† Entrance to the lectures was free to all, without distinction of nationality. In the lecture halls were to be seen youths, hardly outgrown their boyhood, beside middle-aged and even white-bearded old men. Many came from far off in order to learn the opinions of a noted teacher. Since Arabic was used in teaching in all countries subject to Islam, it was easy for the learned of the several nations to make themselves understood by one another,—to increase their own knowledge or to communicate it to others. The love of travel manifested by the Arabs, aroused by religious pilgrimages, was thus promoted among the men of learning and students. In their wanderings from one high school to another they effected an exchange of intellectual acquisitions and contributed in this way to produce an equal development of culture in all countries subject to the Arab sway. The students often had drawn out for them by the teachers testimonials of attendance at their lectures and the permission was accorded them in writing to spread abroad by tongue or by pen the knowledge they had acquired. Some

* HANEBERG *op. cit.* S. 31.

† HANEBERG *op. cit.* S. 12.

teachers were in this respect very ready to come forward. Of one of these it is said in a somewhat exaggerated strain that "he covered the earth with certificates of attendance and licenses to teach."*

Many schools and mosques possessed large libraries. QUATREMÈRE has described 40 and v. HAMMER-PURGSTALL made important additions to this number.† The love of possessing books was moreover widely spread among private people. The doctor ALGIZAR (IBN DSCHEZZAR) left behind him when he died in the year 1009 at Kirwan a library which weighed 25 hundredweight.‡

In the 11th century the Madaris began to arise: these may be compared either to European Academies, according to WÜSTENFELD or to Gymnasia as MEYER suggests. They most of all resembled English Colleges. They were, in fact boarding establishments devoted to the higher teaching, in which teachers and pupils lived together. Some possessed imposing buildings; all were provided with libraries. The most celebrated Madaris were at Baghdad, Basra, Bokhara, Nisabur, Damascus, Samarcand and Cairo;§ Spain at the most flourishing period possessed 17 of such institutions. WÜSTENFELD has described 37 of these places and has given detailed information about the conditions of life amongst the teachers engaged at them and their literary works. If we peruse the copious list of their writings we find that they deal chiefly with theology, law, philosophy, and philology; only a few treat of mathematics, chemistry, the natural sciences, and other subjects, but not one with medicine. It appears therefore that these institutions served chiefly for education in the humanities, theology, and

* HANEBERG *op. cit.* S. 22.

† QUATREMÈRE: "Sur le goût des livres chez les Orientaux" in the Journal. Asiat. Ser. iii, t. iv, p. 35, Paris 1838, and Ser. iv, t. xi, p. 187 *et seq* Paris 1848. —LECLERC *op. cit.* i, 583 *et seq.*—A. v. KREMER: Culturgeschichte des Orients unter den Khalifen, Wien 1877, ii, S. 434.

‡ LECLERC *op. cit.* i, 584.

§ WÜSTENFELD *op. cit.* S. 6.

law, while other establishments were provided for instruction in the natural sciences and in the science of medicine.

The Society of the "Brethren of Purity" which arose in the 10th century at Basra did not reckon teaching among its peculiar tasks. It certainly endeavoured to extend education by the publication of treatises in theology, philosophy, mathematics and the natural sciences; but the goal it had in view was the alliance of reason and faith and the establishment or purification of faith through knowledge. F. DIETERICI has illustrated their efforts and their performances in a series of valuable writings.

The "House of Wisdom" founded by the Caliph HAKIM BIIMRILLAH in the year 1105 at Cairo exhibited in many respects the character of a University. There medicine was taught in conjunction with other sciences, and amongst the well paid teachers who were appointed to the institution were not only theologians, grammarians, philosophers, and lawyers but also mathematicians, astronomers, and doctors. Moreover, it was permitted to non-Muhammedans, for instance, Jews and Christians to attend the lectures which were given there and to make use of the library belonging to the institution which filled 18 rooms.*

The study of medicine was conducted in various ways. Whoever wished to devote himself to the medical calling, could acquire the special knowledge by placing himself under the personal guidance of a senior doctor of experience, or else in the medical teaching establishments, or finally in the medical schools connected with many hospitals. Many may have combined all three methods in order to get a thorough education in the healing art. The medical lectures which were held in the higher teaching institutions attached to the Mosques and in similar establishments, for instance in the "House of Wisdom" dealt, in all probability, chiefly with theoretical subjects and made the students acquainted with literature, whereas practical medical knowledge was acquired principally in the hospitals. According to

* v. HAMMER-PURGSTALL *op. cit.* Bd. i, Einleit., S. lxiv.

MACRIZI* there were, even in the pre-Islamite time, hospitals in Egypt, provided with doctors and drugs. Amongst the Muhammedans the mosques and the buildings belonging to them frequently served as shelters for poor strangers and as hospitals for the sick. Under the rule of Islam the first hospital for the sick was erected in the year 707 by the Caliph EL WELID BEN ABD-EL-MALIK who took care that travellers without means if they fell ill should receive medical assistance. "He appointed doctors to the hospitals and defrayed their expenses: he commanded that lepers should be shut up so that they should not go into the streets, and provided for their wants and also for those of blind people."

At a later period hospitals and infirmaries were erected in all the larger towns, owing their foundation to pious legacies. The majority of them served also for medical teaching. The arrangements existing in the medical school at Gondisapur and in the medical teaching establishments connected with the hospitals of the Nestorians were taken for a pattern. The hospital doctors worked here as teachers of medicine, and gave their pupils instruction in the various branches of medical science. The information which has reached us concerning the hospitals of the Arabs gives us some insight into their condition and circumstances. The hospital at Gondisapur, which for many generations was under the direction of members of the BACHTISCHUA (BOCHTJESU) family, maintained its good reputation under the Arab dominion. It was connected with a well-managed dispensary over which the elder MESUË, the founder of another famous medical family, presided for more than 40 years. In the year 869 SABUR BEN SAHL, who rendered great services to materia medica, was the director of this establishment. It probably continued to exist down to a later period, passing, however, into the shade as the splendid, endowed hospitals

* MACRIZI's Description of hospitals in Cairo according to WÜSTENFELD'S translation in the Janus, Breslau 1846, i, S. 28 *et seq.*

of the Arabs in Baghdad and other places came into prominence.

In Baghdad as early as the 9th century there existed a hospital and medical school.* The Vizier ALI BEN ISSA in the year 914 founded a second. He learned to recognize the want of doctors and of medicines during an epidemic which prevailed among the troops and throughout the country, and decided to do something to improve this state of affairs. He commanded that the sick should be visited daily by the doctors, and should have medicine and food given them, and he caused a new hospital to be opened. When he was told that certain villages, chiefly inhabited by Jews, were entirely without medical assistance, he replied that the unbelievers also must be cared for. At the instance† of SINAN BEN TSABET BEN CORRA yet other hospitals were erected in Baghdad. The rich bequests of SEDJAH, the mother of the Caliph MOTTAWAKL, which were intended for charitable purposes, afforded the means for this. The largest and most famous of these hospitals was established in the year 977 by ADHAD ED DAULA, an Emir of the Buides dynasty, or perhaps having fallen into decline (being of earlier origin) was by him restored and its usefulness extended.‡ According to the statement of IBN ABU OSEIBIA, RHAZES is said to have assisted in its original foundation, inasmuch as he selected a situation for it suitable in hygienic respects. To this hospital 24 doctors were appointed, who ranked according to their ability. There were specialists among them, some devoting themselves only to the treatment of fevers, others to the healing of wounds, to the reduction of dislocations, or to diseases of the eyes. The sick were separated into different sections, according to the nature of their ailments. Noteworthy observations made by the

* M. STEINSCHNEIDER in VIRCHOW's Archiv, Bd. 52, S. 372.

† From his biography in LECLERC, *op. cit.* i, 365, 559 *et seq.*

‡ v. HAMMER-PURGSTALL, *op. cit.* iv., 358.—WÜSTENFELD: Gesch. d. Arab. Ärzte, S. 42, Anm.—LECLERC, *op. cit.* i., 561.

doctors in particular cases of disease were written down and preserved. A high official—a kadi—carried on the administration of the hospital; under him was a treasurer. IBN EL MARISTANIA, who worked as doctor for some time at this institution, composed a history of it, which has unfortunately been lost. This hospital existed certainly up to the 13th century, perhaps to a still later time.

There were hospitals also at Merv, at Ray, the birthplace of RHAZES, at Ispahan, Schiraz, Jerusalem, Antioch, Mecca, and Medina. In Damascus there were several; the largest, it is supposed, owed its origin to NUREDDIN. It served also as an institution for medical teaching. In the carpeted courtyard medical lectures were given after the visits to the sick; they often lasted for many hours. A medical library in this institution supplied the literary requirements of the teachers and the taught. The number of students was very large. In the list of teachers are names among the most famous in Arabian medical science.* The sick were separated according to their ailments: for instance there was a special department for those suffering from diseases of the eyes.† Such admirable care was taken of the sick that many, as ABD EL LETIF states,‡ feigned sickness so as to be allowed to remain in the institution; for there they were regaled "with tender chicken, pastry, sherbet, and fruits of all kinds." In Damascus there existed also other medical schools: sometimes the same professor taught at two such establishments. The medical schools of Damascus held the first rank in the 13th century among their sister institutions, and surpassed in fame even those of Baghdad and Cairo.

MACRIZI has left complete information concerning the hospitals of Egypt and their organization. He states that the first hospital was established by IBN TULUN about the

* If this hospital was first established by NUREDDIN, who died in 1173, some of the facts mentioned here probably refer to other hospitals of Baghdad.

† LECLERC, *op cit.* i., 565 *et seq.*—ABULFARAG *op. cit.* p. 343.

‡ ABD-ALLATIF: Rélation de l'Egypte, ed. SILV. DE SACY, Paris 1810, p. 441.

year 875, and was provided with abundant means for its maintenance. "He made it a rule of the hospital that neither soldier nor slave should be received in it; he erected also two baths, one for men and the other for women, and bequeathed both of them to the hospital and other institutions. He commanded further, that when a patient was brought there, his clothes and money should be taken from him and given into the charge of the hospital steward, then that other clothes should be put on him, that he should be put to bed, have some food given him, and that he should have medicine, diet, and professional attendance until he recovered; then after receiving a chicken and a cake to eat, he should be discharged, taking with him his money and clothes."* In the hospital there was a department for people of unsound mind. This institution does not seem to have existed for long; in MACRIZI'S time it was almost completely forgotten.

He then mentions KAFUR'S hospital, which was erected in the town of Misr, in the year 957, and the one which was named after the street El Magafir and apparently only existed for a short time. A hospital existed in Fostath as early as the 10th century; another, to which for a short time IBN ABU OSEIBIA gave his medical services, owed its origin to NASR SALADIN.

The most remarkable of all these foundations was the great Mansurian hospital at Cairo. The Sultan, EL MANSUR GILAVUN constructed this at great expense by altering a noble castle which had up to that time served as the residence of a princess. The foundation walls, the stones and marble columns of that part of the castle which was pulled down, were used in building the hospital. All artificers of Misr and Cairo were compelled to work at it and were not allowed during the time it was being built to undertake other work. The Sultan rode daily to the site, inspected the workmen, even assisted

* MACRIZI in WÜSTENFELD'S translation, *op. cit.* S. 30.

with his own hands and compelled the passers-by to drag stones or to perform other services. He met, also, with remarkable good fortune in the work: in excavating the ground a workman discovered a box filled with gold and precious stones the value of which was sufficient to cover the whole cost of building. Four large wards enclosed the court, in each of which was a fountain, fed by a reservoir situated in the middle of the court. At the completion of the building the Sultan said: "I have founded this place for those of my own station and for those of lower rank. I have intended it as an establishment for kings and for servants, for soldiers and emirs, for the great and the little, for freemen and for slaves, for men and for women." He provided medicines, doctors, and everything else that anyone could require in any sickness whatsoever. The Sultan appointed male and female ward attendants for the service of the patients and furnished them with wages. He had beds constructed for the sick and provided them with every kind of covering which was required in different kinds of sickness. Each class of patients had a separate room. He designed the four wards of the hospital for those suffering from fevers or similar diseases, he appointed one court for those suffering from diseases of the eyes, one for those with wounds, one for those afflicted with diarrhœa, and one for women. A room for convalescents he divided into two compartments, one for men and the other for women. Water was laid on in all these places. A special room was appointed for cooking food and preparing drugs and syrups, another for mixing confections, balsams, and ointments for the eyes, and the like. The provisions were preserved in distinct places; the syrups and drugs in a room by themselves. The principal doctor had a room for himself where he could give lectures. The number of patients was not limited, but every one in distress and poverty who came there found acceptance; nor was any limit fixed to the time a patient might be kept there, and anything required by those who lay sick at their own homes was sent to them

from the establishment.* This hospital, in course of time, underwent many improvements and enlargements. A large pavilion was erected in the garden, where the patients could take walking exercise in the shade. A cistern lying at the door of the hospital, out of which animals were wont to drink, was removed, "since the people were injuriously affected by the offensive smell of the filth," and a water-conduit was laid down. The founder of the institution bequeathed it so much landed property that the yearly revenue belonging to it amounted nearly to one million dirhem. Two officials were commissioned to collect the money pouring in from the landed possessions of the institution: others had control over the expenses and superintendence over the buildings and the kitchen. According to LECLERC,† at first only patients of unsound mind were admitted into this hospital and not till a later period sufferers from other ailments. They were well cared for there and enjoyed a comfortable existence. If they suffered from sleeplessness the time was passed with music, tale-telling, and other diversions. On leaving the institution each convalescent received five gold pieces so that he was not compelled to engage immediately in heavy work. Connected with the hospital was a mosque in which the Koran was constantly read and expounded. Moreover there was a library to which six eunuchs were appointed as servants, an orphan-asylum, with a school in connection, and an institution for the higher teaching. There could have been no charitable foundation at that time existing in the world able to vie in magnificence, grandeur, and extent with this structure.

MACRIZI goes on to describe the Muajjid Hospital at Cairo which was opened about the year 1420, but only served for a short time as an institution for the sick. There were hospitals also in Fez, as we are told by LEO AFRICANUS: some had special departments for the insane.

* MACRIZI in WÜSTENFELD, *op. cit.*, S. 34.

† LECLERC *op. cit.* i, 570.

Spain is said to have been rich in hospitals; but the information concerning them is very meagre. There was a hospital in the 12th century at Algesiras and according to a report bearing the stamp of oriental exaggeration, Cordova is said to have possessed as many as 50 of these institutions.

The loving care which the Muhammedans took of the mentally afflicted, had its foundation in religion. They saw frequently in the hallucinations and disordered speech of these patients manifestations of a supernatural world, and paid a fitting respect to the recipients of such favours. The Christians embraced a similar opinion; only they discerned in these things the punishments of God and the workings of the Devil and of evil spirits. The insane found therefore in the countries subject to Islam friendly words and careful attention in the hospitals; whereas by the Christians they were treated as criminals, were cast into prison and beaten, or were exterminated with fire and sword as wizards and witches.* In Baghdad and Cairo institutions for the insane existed long before it was thought of erecting them in the lands of Christendom, and the first in these lands arose in Spain, the intellectual development of which country was greatly influenced by Arabian civilization. The balance inclines decidedly in favour of the Muhammedans, as regards the humane treatment of the insane; Christianity here exhibits an ugly blemish, for which the religious zeal of its adherents must bear the blame.

The Arabs had separate departments in their hospitals for the various kinds of diseases afflicting mankind; there were even separate institutions for certain diseases, for instance those of the eyes. The students who visited these hospitals were, under the guidance of experienced doctors, initiated into the art of recognizing and treating diseases. They assisted at the performance of surgical operations and were frequently able to acquire a practical acquaint-

* LECKY *op. cit.* ii, 68 *et seq.* DESMAISONS: Des Asiles d'aliénés en Espagne, Paris 1859.

ance with midwifery, as ALI BEN ABBAS advised them to do. In the apothecaries' shops they had the opportunity of becoming acquainted with the preparation of medicines. The Arabs introduced apothecaries' shops; it seems that they were made acquainted with them through the Nestorians.* The Arab apothecaries dealt not only in drugs (notably sandalwood, on which account they were also named Szandalani), perfumery, cosmetic, and other applications, but also were occupied in compounding drugs into medicines: and they introduced dispensaries. They deserve commendation for their systematic use of distillation and for the discovery of certain remedies. Their chemical and botanical studies were very useful to them in their work. Botany formed, as HADJI KHALFA says,† a science ancillary to medicine. Many doctors were zealous botanists; it is narrated of RACHID EDDIN IBN ASZURI that he was attended on his botanical excursions by a painter, who made pictures of the plants in their various stages of development.‡ MUHAMMED BEN ALI BEN FARAK, the body-physician of the prince of Cadiz, is said even to have laid out a botanical garden.§ The Arabian doctors strove not only to acquire a thorough knowledge of medicine and natural science, but showed a keen interest in the teachings of the philosophers, and were at the head of all liberal intellectual efforts.

The names of AVICENNA, of AVERROES, and of MOSES MAIMONIDES are almost more conspicuous in the history of philosophy than in that of medicine. The groundwork of their philosophical ideas was formed by the system of ARISTOTLE, which they carried to a further development in various directions. While AVICENNA was led by this path to a teleological Theism which recommended him to the

* K. SPRENGEL: Geschichte der Botanik. Leipzig 1817, i, S. 205.

† HADJI KHALFA: Lexicon bibliographicum et encyclopædicum ed. G. FLÜGEL, London 1845, T. iv, p. 114.

‡ HADJI KHALFA: *op. cit.* T. i, p. 227, No. 361.—LECLERC *op. cit.* i, 564.

§ CASIRI *op. cit.* T. ii, p. 89.

Christian schools of the Middle Ages, AVERROES attained to a pantheistic naturalism, which, on account of its rationalistic character, was not only condemned by the Christian Churches but also raised him up many adversaries among his own countrymen and co-religionists. When AVERROES declared that religion existed only for the benefit of the weaker intellect, that man could by his reason alone and without any revelation arrive at a knowledge of the essence of things; when in the place of a creation brought about by the almighty will of the Godhead, he set up Nature, which, by a kind of Aristotelian *ἐντελέχεια*, he conceived to have been promoted from potentiality to actuality; when finally he preached the permanency of the world and of matter, the mingling of God with Nature, and the consubstantiality of reason,—in all this he shook the foundations of a monotheistic system of religion and was bound to expect bitter opposition from its adherents.*

His pupil and disciple the Jewish doctor MOSES MAIMONIDES experienced this too when he made the attempt to reconcile the precepts of the Talmud with the demands of reason. He opened broader paths of intellectual activity for the Jews. As MUNK says: "From SPINOZA down to MENDELSSOHN, the Jews have produced no advanced thinker who has not received the first sanction for his philosophy in MAIMONIDES."

A religious toleration towards people of other faiths prevailed in the countries under Islam during the first centuries of its existence, such as was not found anywhere at that period among the Christians. The high teaching institutions and medical schools numbered among their teachers and students many Jews, Christians and followers of other religions. Not only Muhammedan, but Christian and Jewish doctors also were appointed to their hospitals, and patients who did not hold the prevailing belief found at them nevertheless welcome admittance and kind attention. Even the prophet MUHAMMED himself had re-

* E. RENAN: Averroës et l'Averroisme, Paris 1860.

commended an unbeliever to his adherents as a doctor.* Jews and Christians and especially Nestorians played an important part as body-physicians at the Courts of the Caliphs and Muhammedan princes; they were even advanced to influential positions in the sanitary service.

Medical practice was at first free to all; it gradually, however, became customary that the doctors should obtain certificates from the teachers who had instructed them in the healing art, since they thus instilled greater confidence into the mind of the public.† A professional blunder which resulted in the death of a patient was the occasion, in the year 931, of calling upon all the doctors of Baghdad and the neighbourhood to submit themselves to examination; this examination was waived only in the case of the Court doctors and of practitioners whose ability was generally recognized. All other practitioners, reaching 860 in number, had to prove their fitness for the medical calling by an examination, held by the body-physician of the Caliph, SINAN BEN TSABET BEN CORRA.‡ MEYER§ thinks that this was a temporary police regulation directed against charlatanism, since no successor to this examiner is mentioned; but similar arrangements existed in Baghdad in the 12th century and in Cordova even at an earlier period.‖ To me it appears therefore that we cannot doubt that the beginnings of the system of medical examinations are to be sought for among the Arabs.

It was a frequent occurrence amongst the Arabs, as amongst other Orientals, for the son to choose the profession of his father. Certain families, as the Bachtischua, whose pedigree has been arranged by MEYER,¶ the Corra,**

* v. HAMMER-PURGSTALL *op. cit.* ii, S. 192.—ABULFARAG *op. cit.* p. 99.

† LECLERC *op. cit.* i, 574.

‡ CASIRI *op. cit.* T. i, p. 438.—LECLERC *op. cit.* i, 576.

§ MEYER *op. cit.* iii, 122.

‖ LECLERC *op. cit.* i, 577.

¶ MEYER *op. cit.* iii, 109.

** WÜSTENFELD: Gesch. d. Arab. Ärzte, S. 34 *et seq.*

the Honein, and the Zohr* families, to the last of which AVENZOAR belonged, furnished doctors through many generations, among them some very celebrated. This was the case too in other departments of learning, as the example of the Sobki family adduced by WÜSTENFELD,† proves. Many doctors confined their practice to a special department of medicine as for example ophthalmology. Even at an earlier period the regulation was made of nominating Proto-medici‡ who, unless this was merely a title, no doubt exercised supervision over the other doctors. Probably this office was always joined with that of body-physician. Are we at liberty to assume that it was connected with the introduction of medical examinations? IBN BEITHAR, the author of the best Arabian work on materia medica, who was body-physician at the Egyptian Court was nominated the chief of all doctors and herbalists (apothecaries?) of that country.

The doctors enjoyed a superior position in social life: many acquired great influence as the friends and advisers of rulers. The physicians in ordinary at the Court of the Caliphs received higher pay and richer presents than the other learned men and officials§ and were loaded with honours and distinctions. Not a few attained the dignity of Vizier which was equivalent to the rank, if not always of minister, in any case of privy counsellor or aulic counsellor.‖

On the other hand there seems to have been by no means an absence of those members of the medical profession who decoy the public by the unclean means of charlatanism. RHAZES felt himself induced in consequence to compose a treatise "upon those conditions and circumstances of the medical art which turn the hearts of the

* *Id. op. cit.* S. 88 *et seq.*

† *Id.*: Akademien der Araber, S. 119.

‡ LECLERC *op. cit.* i, 576.

§ v. HAMMER-PURGSTALL *op cit.* Bd. i, Einleit., p. l.

‖ LECLERC *op. cit.* i, 578.

majority away from the most respectable doctors and induce them to resort to the lowest class of practitioners."* The Arabian doctors gave full attention to the theoretical problems of their calling; but they entertained a temperate and modest conception of life and took things as they are, not as they ought to be. In the "Doctor's guide," the author of which is said to have been the Jew ISAAC ISRAELI, rules of life are laid down for them which bear testimony to this. There it is said: "The most important problem for the doctor is, how to avert illness." "The majority of diseases are cured by the help of Nature without the aid of the doctor." "If you can cure the patient by dietetic means, forbear to order drugs." "Never rely upon magic means in the treatment of a patient, since they mostly rest on folly and superstition." "Hold forth the prospect of recovery to patients, even when you are not assured of it yourself; so shall you at least second the efforts of Nature to cure them." "If a doctor has come from afar, and speaks a foreign language, then the multitude think him a clever man, come to him in crowds, and seek his advice." "Never speak unfavourably of other doctors; for everyone has his successful and his unsuccessful times. Let your deeds speak your praises, not your tongue." "Visit your patient when he is at his worst. At that time come to an understanding with him about your fee: for if the patient is well he takes no thought of the matter." "Make your fee as high as possible, for what is done gratis is considered of little value." "Bestow the greatest attention upon the cure of princes and rich people; for after their recovery they will be munificent to you, will always value and love you, whereas common people when they are cured hate you if they think of the fee."† Might we not readily believe that this book was written yesterday?

* M. STEINSCHNEIDER in VIRCHOW's Archiv, Bd. 36, S. 574 *et seq.*

† SOAVE in the Giorn. Veneto di scienze mediche 1861, ser. ii, T. 18, p. 393 *et seq.*—D. KAUFMANN in the Magazin f. d. Wissensch. d. Judenthums, Berlin 1884, S. 97 *et seq.*

Arabian culture fell from its high elevation almost as rapidly as it had climbed to it. The celebrated schools of the Nestorians were declining even in the 9th century.* The higher teaching institutions of the Arabs lasted till the 14th century and then disappeared more or less rapidly, and with them disappeared that scientific life which had borne such rich fruit for the human race. The religious wars which, in the East under the name of Crusades, were carried on by adventurers eager for booty, and in the West led Christian princes to the conquest of Spain and of the Italian islands in the Mediterranean, evoked† the religious fanaticism of the Muhammedans and paralyzed their intellectual efforts. The Mongolian and Turkoman tribes which in the 13th century burst in with fire and sword upon the Aryo-Semitic world crushed to fragments the ancient homes of civilization in Asia and turned flourishing towns into desolate wastes. The East never recovered from this blow and Turkish dominion became the symbol and sign of intellectual death. But in the Christian lands of the West the seeds of Arabian culture germinated into that vigorous growth of intellectual effort which showed its first high development in the Schools of Salerno and Montpellier.

MEDICINE AMONG THE GERMANS AND TEACHING IN THE MONASTIC SCHOOLS.

THE German tribes, which attained to power, after the so-called migration of the nations, in the western half of the Roman Empire had in the fifth century, already for some time past raised themselves above that low grade of civilization on which they stood when TACITUS wrote his description of them.‡ They had entered into relations with the Romans both in war and peace and had learnt to recognize their superiority in science and art. As soldiers

* ASSEMANI *op. cit.* iii, pars ii, p. 940.

† v. KREMER: Ibn Chaldun und Seine Culturgeschichte, Wien 1879, S. 39.

‡ TACITUS: Germania, c. 5, 19 *et seq.*—GIBBON *op. cit.* c. 9.—Rev. scient., Paris, Oct., 1873.

in the Roman Army, as joyfully welcomed allies, or as hostages, they had the opportunity of enjoying the advantages of Roman civilization and of acquiring knowledge which they transmitted to their countrymen who remained at home. The germs of a noble civilization in the German race, which excited the astonishment and praise of TACITUS, were brought to greater perfection and to further development by the higher education.

When the tribes of the Goths and other German peoples were driven from their homes by hordes of Huns pressing in upon them from the East, and when, thirsting for action and longing for riches and power, they began their world-famed wanderings, they possessed already a literary language, an orderly system of government, an assured administration of justice, and manifold acquirements in the various spheres of intellectual life. In medicine they held the view that diseases are produced by supernatural powers, which should be propitiated by prayers and magic; but they did not neglect the use of healing herbs and other means, the favourable action of which experience had taught. It was especially incumbent upon the women, who played a very prominent part in the life of the Germans, to bind up wounds and to nurse the sick.* Only by degrees and chiefly under the influence of Roman civilization a special medical profession became developed among this people. The Greek and Roman doctors, who in the capacity of military surgeons came among them or, like ORIBASIUS and ANTHIMUS, stayed in their country in exile or as envoys, must have contributed to this in no small degree.

GUIZOT † remarks that it is difficult to picture the intellectual condition of the Germans before the migration of the nations, and we may add that in regard to their medical acquirements this is especially the case. It is clear from comparative philology however that they had special

* TACITUS *op. cit.* c. 7, 8, 18.

† GUIZOT: Cours d'histoire moderne. Histoire de la civilization en France, Bruxelles 1829, i, p. 204.

designations for particular diseases,* and we are permitted to draw many inferences from the analogy of the development of civilization among other peoples and especially by looking to the contemporary condition of the Germans of the North. There too, wise women practised the healing art, and people went so far as to worship a goddess of medicine, EIR by name.† BRUNHILDA, "the doctoress," and the "Norns," ‡ understood the art of delivering women. When SIGRDRIFA (BRUNHILDA) tells SIGURDR that he must know runes of a certain kind for the child to be delivered from the mother and when it is said of JARLSSOHN KONR that he knew the runes and gave assistance to women in childbed, reference is obviously made to mystical formulæ to which immense importance was attached in connection with the act of giving birth to a child. Even the hero GÖNGUHROLF gave aid in child-birth by a laying on of hands. Princes and heroes—indeed even ODIN himself, "the doctor"—were esteemed as especially experienced in medicine; § this indicates perhaps that it was practised chiefly by men of position who were the heads of large households, just as was the case in CATO'S time at Rome.

Among the named diseases, we find derangement of the mind, impotence, but most frequently chronic suppuration of the leg which frequently ended fatally. These people were well acquainted with the treatment of wounds. Even amputation was performed and the loss of the leg was made good by an artificial limb of wood. Wooden legs were, as it appears, not uncommon. Mention is also made of gastroraphy. This information has its source however from the period of the voyages of the Vikings, when already com-

* AD. PICTET: Die alten Krankheits-Namen bei den Indogermanen in der Zeitschr. f. vergl. sprachforschung, Bd. v, S. 321 *et seq.*

† K. WEINHOLD: Altnordisches Leben, Berlin 1856, S. 385 *et seq.*

‡ The three Fates in Northern Mythology.

§ Sigurdhar-koida i, 17. Fafnismal 12. Sigrdrifumal 9. Rigsmal 40. Fornalda sögur iii, 276. Saxo Gramm. i, 1, 25, 33, 128. Prof. R. HEINZEL of Vienna had the kindness to call my attention to these passages.

munication existed between the North Germans and the more highly developed civilization of other peoples. SNORRI STURLUSON and HRAFN SWEINBÖIRNSSON obtained great reputation by their successful cures. The latter is even said to have performed lithotomy with success.* The mystical VITOLF passed as the patron of the surgeons of the North.† INGIGERD, daughter of the Russian King INGVAR, founded a small hospital and consigned the nursing of the patients to gentle-handed women.‡

In the 10th century there were already in Norway a number of doctors, who practised their art as a profession. Even at that early period people had private medical attendants who were highly paid.§ There existed also even then a medical tax. The amount of the medical honorarium depended upon the gravity of the suffering which was relieved.

In the Sudermanian law-book which, although first published in 1327, rests upon the authority of ancient enactments it was ordained that he only should be recognized as a doctor who had cured an incised wound, a fractured bone, an internal injury, a mutilation or a deep stab. Midwifery was naturally delegated to women. Mention is already made however of Cæsarean section. It would not be right to apply to the Germans of the first centuries, as many medical historians do, the accounts here given, some of which clearly bear the stamp of later periods of civilization. They, at the most, authorize us to make certain presumptions as to the state of medical science among them.

The knowledge and customs brought by the Goths,

* Sagenbibliothek des skandinav. Alterthums, herausg. von P. E. MÜLLER, übers. von K. LACHMANN, Berlin 1816, S. 176.—L. FAYE: Rafn Sweinbjörnsens liv og verksomhed, Kristiania 1878.

† GRIMM: Mythолog. 994, 1101.

‡ WEINHOLD *op. cit.* S. 390.

§ Vapnfirdlinga saga, c. 13, 29.

Lombards, Franks, Burgundians, and other German races from their homes into the countries subdued by them soon became mingled with all which had been bequeathed to these countries by former periods of civilization. The readiness with which the conquerors took to the higher education of the conquered shows that they were sufficiently prepared and ripe to receive the same. Their medical science grew up into that system of medicine, which the Greeks and Romans had established. Only among the people were certain traces preserved of the therapeutic lore of the Celtic, Basque, Gaelic, Gothic, and Anglo-Saxon races.

In the laws of the Visigoths, which, partly committed to writing in the fifth century, contained without doubt much matter of Roman origin, it was laid down,* how much the doctor should demand for different cases *e.g.* the operation for cataract. Before undertaking such a case, he made an agreement with the patient or his relatives, in which the professional fee was fixed; but he could only claim it if the treatment proved successful. In the other case he had to answer for an unfortunate issue. If the death of a slave resulted from his treatment he was obliged to replace the loss; if it was a question of injury inflicted on the health or life of a free-born citizen, he was condemned to a corresponding fine or given over for punishment to the relatives of the injured or dead. It is indicative of the social position of the doctor that he might see and examine females of the position of freewomen only in the presence of their relatives, for fear he should misuse such occasions by improper behaviour.

The Visigothic law contains also rules concerning moral responsibility, as to the punishment for crimes against the person *e.g.*, wounding and mutilation, about cases of procuring abortion, and in regard to sexual transgressions.

* Leg. Wisigoth, lib. xi, tit. 1, de medicis et ægrotis.—F. Dahn: Westgothische Studien, Würzburg 1874, S. 3, 61, 145, 220, 222, 230 etc.

Of especial interest is the rule contained therein, that the doctor was entitled to demand a fee of 12 solidi for the instruction in medicine which he gave his pupil; it is clear from this that doctors were educated in their art under the personal supervision of a master, just as was the case in ancient times.

The law books of the Alemanni, the Salii, Ripuarii, Burgundians, Bajoari, Frisians, Saxons, and Lombards contained also regulations as to punishments for wounds inflicted upon, and other offences committed against, the person.*

The training of doctors was consonant to the method of teaching a trade. The tyro in medicine resigned himself to a respectable doctor, who furnished him with medical information. Many doctors sought to complete their knowledge in the large towns of the Byzantine empire and Italy. Many Greeks, Romans, and Jews were to be found among them, and were especially in request at the courts of princes.

The Greek doctor, PETRUS† was physician in ordinary to the Visigothic King, THEODORIC II. MARILEIF of Poictiers filled this post at the court of the Merovingians, having raised himself to this position from the lowest social circumstances, and REOVAL, who had acquired his medical training in Constantinople, enjoyed the same honour.‡ The latter performed an operation for removal of the testes with success.

The work of a physician in ordinary at the Frankish Court was certainly very profitable, as the riches acquired by MARILEIF testify, but it was also attended with many dangers. When AUSTRIGILDIS the wife of King GUNTRAM was carried off by a pestilence which raged in the year 580, she expressed a wish before her death that after that event her two doctors, NICOLAUS and DONATUS, should be executed as a punishment for not having saved her; and

* Corpus juris German. antiq. ed., F. WALTER, Berol. 1824, T. i.

† FREDEGAR: Chron., C. 27, O. ABEL'S translation.

‡ GREGORY of Tours v, 14. vii, 25. x, 15.

the pious GUNTRAM considered himself bound to give effect to the last wishes of his spouse.*

CHARLEMAGNE is said to have consulted Arabian physicians, as is stated by BULÆUS and FREIND:† but these assertions, although not sounding improbable considering the respect which Arabian medicine enjoyed at that time, are, nevertheless, not authenticated by reference to the sources from which they are derived. It is certain that one of his private physicians bore the German name of WINTARUS.‡ In the life of LOUIS THE PIOUS it is narrated, that the wife of CHARLES, HILDEGARD by name, bore him two sons, of whom one died as soon as he was born, and the other, namely LOUIS, was taken from his mother's womb and reared by artificial nourishment.§ It is uncertain whether allusion is here made to Cæsarean section or to a labour completed by manual aid. CHARLEMAGNE had at any rate a mean opinion of medicine,‖ which is probably explained by the neglected condition of the medical science of his time. It was therefore intelligible, that he should be moved to raise up this science from its debased condition, and to spread the knowledge of it more widely. On this ground, at the capitulation of Diedenhofen (Thionville) in 806 he issued an order that boys should be instructed in the healing art.¶ MEYER** thinks that they had only to receive an introduction to the art of nursing the sick, since one "does not let children study medicine."

But the study of this science was in ancient times begun quite in early youth. And in the schools of this period

* *Idem* v, 35.

† FREIND: Hist. med., p. 148.

‡ EIGIL's Leben des Abtes Sturm von Tulda, C. 25, ed. MIGNE, T. 105, p. 443.

§ J. L. W. SCHMIDT, im Progr. des hess. Gymnas. zu Giessen, 1872, S. 5.

‖ EINHARD: Vita Caroli Magni, C. 22, ed. PERTZ, Hannov. 1863.

¶ PERTZ: Mon. Germ. iii, p. 131, De medicinali arte ut infantes hanc discere mittantur.

** MEYER *op. cit.* iii, 413.

boys of 14 or 15 years of age were to be found.* For the rest, this teaching may have almost entirely been limited to the reading of the medical writings of antiquity, and to explaining the meaning of these, as was also the case in many monastic schools. Later on, the students learnt how to recognize the medicinal plants, opportunities being afforded for this in the imperial gardens.† They seem to have drawn into the domain of teaching even the practice of medicine itself. The words in ALCUIN'S poem on CHARLEMAGNE‡ can hardly be understood otherwise than to imply that in the neighbourhood of the court there was a hospital in which doctors performed different functions. "One let the patients' blood, another mixed herbs in a pot, that one cooked some pap, while this one prepared a drink."

Probably the infirmaries attached to many monasteries served as examples for such arrangements. The monks took a keen interest in the care of the sick. "Learn to know the properties of plants and the art of mixing remedies," said CASSIODORUS to them§ "but place all your hope on the Lord who preserves life eternally. If the language of the Greeks is not unknown to you, you have the book of herbs of DIOSKORIDES, who has described and pictured forth the plants of the field with surprising accuracy. Afterwards, read HIPPOKRATES and GALEN in the Latin translation, that is to say, the Therapeutics of the latter which he has addressed to the philosopher

* J. CH. F. BAEHR: De literarum studiis a Carolo Magno revocatis ac schola Palatina instaurata, Heidelberg 1856, S. 26, Anm. 33.

† Capit. de villis. *Cf.* MEYER *op. cit.* iii, S. 397 *et seq.*

‡ Alcuinii carmina, ed. E. DÜMMLER in Mon. Germ. Poet. lat., T. i, p. 245, No. xxvi, v. 12-16.

Accurrunt medici mox Hippocratica secta;
Hic venas fundit herbas, hic miscet in olla,
Ille coquit pultes, alter sed pocula præfert;
Et tamen, O medici, cunctis impedite gratis
Ut manibus vestris adsit benedictio Christi.

If in the first line we read *tecta* for *secta*, the allusion to a hospital is still plainer

§ CASSIODORUS: Inst. divin. lect. i, C. 31.

GLAUCON, and the work of an anonymous writer, which, as the examination of it shows, is compiled from various authors. Furthermore study the medicine of AURELIUS CÆLIUS, the book of HIPPOKRATES upon herbs and methods of cure, and various other writings on the healing art, which I have installed in my library and have bequeathed to you." Certain members of the Benedictine order came into profitable notoriety as doctors, like the Abbot BERTHARIUS at Monte-Casino in the 9th century.* Perhaps even at an earlier period pious pilgrims and patients were admitted and cared for at that place; ST. BENEDICT the founder of the order having observed this custom in the East and having accordingly imposed it as a duty on his followers. But the more certain information on this point namely that institutions of this kind existed in Monte-Casino, dates from the 11th and 12th centuries and not before.†

The custom of bringing helpless sufferers into the Churches and Monasteries, for the priests to sprinkle them with holy water and to offer up prayers for their recovery found universal acceptance in the first centuries of the Middle Ages. From this the rule gradually came into existence of erecting institutions there in which the infirm and ailing found shelter. The priests and monks who superintended these, in addition to psychical means of cure, employed also healing herbs and other remedies the favourable action of which they had learnt to recognize from medical literature or from private experience. In this way medical knowledge came to form an essential part of the education of the priest, of which he felt the need in the practice of his profession.

The schools of the Middle Ages, regarding as they did the training of the cleric as their most important task, endeavoured to satisfy this want when they accepted

* DE RENZI: Storia docum. della scuola medica di Salerno, 2 Ed., Napoli 1857, p. 64 *et seq.*

† TOSTI: Storia della badia di Monte Casino, Napoli 1842, i, 229, 341 *et seq.* ii, p. 193, 209, 289.—Reg. S. Bened. 36 in MURATORI script. rer. Ital.

medical science as a part of their curriculum as far as it could be taught in a purely theoretical manner. This was the case in many monastic schools notably those of Gaul for instance at Rheims, Chartres, Fleury, Dijon, Bec in Normandy, and St. Denis.* Moreover, the stores of medical manuscripts possessed by many of these monasteries,† and the literary activity of the monks, all point to the fact that medicine was assiduously practised and studied at the places and by the persons in question. When the students, by teaching and by the reading of medical treatises had acquired some general knowledge of the healing art, they may perhaps also have received some practical training in the same, while seeking and collecting medicinal plants under the supervision of their teacher, or compounding medicines and giving their services during the treatment of the patients. It is very likely that these relations assumed some such form as the author of the Journal‡ of Walafridus Strabo describes with fruitful imagination, and knowledge which must be recognized as valuable.

Many teachers of medicine obtained great renown. Thus RICHER relates that in the year 991 he travelled to Chartres to hear HERIBRAND'S exposition of the Aphorisms of HIPPOKRATES. HERIBRAND gave him instruction also in the semeiology of diseases and taught him in what subjects HIPPOKRATES, GALEN, and SORANUS are agreed. He possessed considerable knowledge of materia medica, botany, and surgery as RICHER declares with high commendation.§ From the school of Chartres many celebrated doctors issued, among them JOHANN, the private physician of

* J. B. L. CHOMEL: Essai historique sur la médecine en France, Paris 1762.

† The library at Tegernsee contained, for example, in 1500, 281 medical treatises, as we are told by LAMMERT (Volksmedicin u. medecin. Aberglaube in Bayern, Würzburg 1868, S. 4).

‡ This was published (1856-57) in the yearly report of the training institution of the Benedictine Monastery at Maria-Einsiedeln. It is however an imaginative work of P. MARTIN MARTY and by no means true, as some authors have strangely thought.

§ PERTZ: Monum. Germ., T. v. (Script. iii), p. 643.

HENRY I. of France. GERBERT D'AURILLAC,—when Pope known as SYLVESTER II.—worked at the Episcopal School of Rheims for some time as teacher of medicine.

At the Court of CHARLEMAGNE besides the Palace School in which the children of the Emperor and of certain distinguished dignitaries were taught, there was a kind of Academy numbering among its members the chief men of learning of the time. In this capacity they bore special names; ALCUIN was called FLACCUS, CHARLES himself was KING DAVID. They devoted themselves to theology, philosophy, arithmetic, geometry, astronomy, Latin, Greek, history, geography, and poetry.* This Academy appears however to have existed only for a short time, whilst the Court-school was still flourishing in the middle of the 9th century. In the year 789 the Synod of Aix decided that at the monastery and cathedral of that town there should be formed a school in which boys might be able to learn the Psalms, writing, singing, the reckoning of ecclesiastical festivals, and Latin grammar.† The pattern for this institution was the school at Tours, where ALCUIN lived from 796 as Abbot of St. Martin's Monastery. There were celebrated schools of this kind at Fulda, Hersfeld, Corvey, Reichenau, St. Gallen, Mainz, Worms, Speyer, Köln, Münster, Bremen, Hildesheim, Magdeburg, Paderborn, Halberstadt, at Salzburg, Freising, Passau, Tegernsee, Benedictbeuern, Regensburg, at Milan, Parma and other places in Italy, as also in many monasteries of France, in England, as at Canterbury, and in Ireland.

The curriculum of the Roman schools formed the foundation of the teaching in these institutions. Instruction was given in orderly succession and included in one department the three elocutionary subjects of grammar, rhetoric, and dialectics, and in the other arithmetic, geometry,

* W. F. C. SCHMEIDLER: Die Hofschule und die Hof-Akademie Karls des Grossen, Breslau 1872.

† F. A. SPECHT: Geschichte des Unterrichtswesens in Deutschland von den ältesten Zeiten bis zur Mitte des 13 Jahrhunderts, Stuttgart 1885, S. 21.

astronomy, and music. These were called the Trivium and the Quadrivium. The conceptions formed of these subjects of education did not however by any means correspond with those of to-day; thus, in rhetoric, for example, not only the elementary principles of oratory were taught, but the Latin official style was practised, for the priests of that time drew up documents and attended to the affairs of government offices. The study of jurisprudence and of the laws was frequently added to this. By geometry was understood chiefly geography and physical geography, a knowledge of which HRABANUS MAURUS considered especially useful for doctors, since they might thus be able to learn the special climatic conditions of different localities and the position of particular places, and to make use of such knowledge in giving directions to their patients.* Instruction in the natural sciences was combined with these subjects, the most important of the matters known at that time in the three natural kingdoms, in anthropology, and in meteorology, being taught. Later on, schools were founded wherever there was a parish. The instruction was limited to elementary subjects. When towns began to come into a flourishing state, at the end of the 12th century, town-schools arose, aiming at the same objects in education as the monastic and religious schools, and even surpassing them in performance.

Such was the preliminary training, which the educated doctors of that time possessed, especially when they belonged to the priestly order. That alongside of these there were many practitioners who were devoid of such, admits of no doubt. The great majority of empirics had no knowledge of medical literature and learned medicine as a handicraft. Scientific work in medicine was in an extremely low state. The treasures of knowledge, inherited from ancient times were not increased, nay, were not even preserved intact. No experimental investi-

* SPECHT *op. cit.* S. 145.—ST. FELLNER: Compendium der Naturwissenschaften an der Schule zu Fulda im 10 Jahrhundert, Berlin 1879, S. 28.

gation, hardly any observations of nature can be credited to this period.

The literature of medicine and the natural sciences consisted chiefly of extracts from and commentaries on more ancient works. Independent ideas and experiences hardly ever found a place therein. To this category the following compositions belong: the book of recipes of the Milanese Archbishop BENEDICTUS CRISPUS, the encyclopædic work of HRABANUS MAURUS, Archbishop of Mainz and *primus præceptor Germaniæ* which K. SCHMID translates as "the first schoolman of Germany," the description of plants by WALAFRIDUS STRABO, Abbot of Reichenau, the medical writings of the Abbot BERTHARIUS, the book on the healing virtues of plants by the enigmatical MACER FLORIDUS, the Lapidarius of Bishop MARBOD of Rennes, the Bestiarius of the Englishman PHILLIP DE THAÜN, the Natural Philosophy of his fellow-countryman ALEXANDER NECKAM, the Physica of ST. HILDEGARD, Abbess of the monastery on the Rupertsberg near Bingen,—"a treatise on materia medica unmistakably founded on popular traditions" as MEYER* appropriately designates this work,—and the far-famed Physiologus.

The intellectual life of Christian Europe at that time resembled a landscape which fatigues by its uniform flatness and desolate sterility, while only at rare intervals there breaks upon the traveller's view a bit of scenery able to engage his eye. Then in the south of our portion of the globe arose pictures, entrancing men with their gorgeous colouring, giving courage new life, and filling all hearts with hope. The bright constellation of Arabian culture shed its light over these lands and sent some rays to the other parts of the Christian West—rays which served to foster intellectual development and at the same time to illuminate the path of its advance.

* MEYER *op. cit.* iii, 518.

THE SCHOOL OF SALERNO.

AT Salerno, in Lower Italy, where the influence of the Arabs first made itself felt, in consequence of the neighbourhood of Sicily which had for long been subject to their rule,* there arose a medical school which as early as the 10th century enjoyed a widely spread reputation. The origin of it is unknown although already much has been written on the subject.

If we disregard the barren speculations which some authors have given utterance to on the subject, the following opinions come to the front.

Some think that it existed as early as the 7th century and was associated with traditions of the Greek predominance which both in language and customs was maintained in that locality for a longer period than in other parts of Italy;† others, as K. SPRENGEL, PUCCINOTTI ‡ and for some time also S. DE RENZI, derive its origin from the Benedictines who had founded monasteries in Monte-Casino, in La Cava and Salerno; while HALLER and others ascribe its foundation to the Arabs. MEYER § proposed the hypothesis that in Salerno at first there existed a Guild or Corporation of Doctors who carried on their teaching secretly until it was made public by CONSTANTINUS AFRICANUS, and that in this way the foundation was laid for the development of a medical teaching institution in our sense of the word.

Convincing evidence in support of these views has not been adduced by anyone.

The historical facts connected with medicine in Salerno reach back to the middle of the 9th century; in documents of the years 848 and 855 JOSEPH and JOSHUA are named

* *Cf.* A. F. v. SCHACK: Poesie und Kunst der Araber in Spanien und Sizilien, Berlin 1865, ii, 1-252.

† G. MOROSI: Studii sui dialetti greci della terra d'Otranto, Napoli 1870.

‡ Storia della medicina, Livorno 1855, ii, p. 247 *et seq.*

§ *Op. cit.* iii, 451.

as doctors practising there.* There in the year 900 lived RAGENIFRID, a Lombard as his name indicates; who was private physician to the Prince WAIMAR of Salerno; and half a century later the doctor PETRUS who stood in high favour with Prince GISULF and was raised to the bishopric of Salerno. In this period we meet with many doctors belonging to the priestly order, but alongside of these, Jewish doctors practised the healing art in Salerno, as is authenticated by historical testimony.†

The doctors of Salerno had such a reputation in the 10th century that they were brought to foreign Courts to be made body-physicians to the rulers. One of these played a remarkable part at the court of LOUIS THE SIMPLE of France. He was doctor to the wife of this monarch when a scientific quarrel arose between him and his colleague DEROLDUS who was serving as medical attendant to the king and was afterwards Bishop of Amiens: this dispute resulted, as RICHER narrates,‡ in a mutual attempt to poison one another out of envy. Patients of the higher class already at that time repaired to Salerno in order to obtain the advice of doctors residing there. For this purpose the Bishop ADALBERON went thither in the year 984 from Verdun, but found no cure for his sufferings.§ Again, the Abbot DESIDERIUS, who afterwards ascended the papal throne under the name of VICTOR III., hoped to regain at this place his health shattered by night watches and fasts.‖ The Duke GUISCARD sent his son BOHEMUND there, that his wound received in war might be healed; for a similar reason WILLIAM THE CONQUEROR who became King of England passed some time in Salerno.

* S. DE RENZI: Storia docum. della scuola med. di Salerno, Napoli 1857, p. 157 *et seq.*

† S. DE RENZI: Collectio Salernitana iii, 325, Napoli 1852.

‡ RICHER: Hist., lib. ii, c. 59 in PERTZ: Monum. German., T. v (script. iii), p. 600.

§ Gest. episcop. Virdun. in PERTZ: Mon. Germ., T. vi (script. iv), p. 47 & HUGO FLAV. Chron., lib. i in PERTZ: Mon. Germ., T. x (script. viii), p. 367.

‖ DE RENZI: Storia doc. della scuola, p. 150.

The fame of its doctors increased more and more, and patients came from distant countries to be treated by them. The lyric poet HARTMANN VON DER AUE laid the scene of his famous poem "Der arme Heinrich" here but made his knight recover from his leprosy not through the skill of the doctors but by a miracle.

Even as early as the 11th century no certain information existed about the age and origin of the school of Salerno. ALPHANUS, well known both as poet and physician who afterwards was raised to the bishopric of Salerno, states that medicine flourished there even before GUAIMARUS II., that is in the 9th century.* The Norman historian ORDERICUS VITALIS who lived about the year 1140 narrates that when the famous RODOLFUS known as MALA CORONA came to Salerno, even for a long time previously important medical schools had existed there.† On yet another occasion this author bears witness to the long existing reputation of the place. In the ancient Chronicle of Salerno, made use of by ANT. MAZZA and rediscovered by S. DE RENZI,‡ it is stated, that the medical school there was founded by four doctors, namely, the Jewish Rabbi ELINUS, the Greek PONTUS, the Saracen ADALA, and a native of Salerno, who lectured each in his native language. Amongst the first teachers are mentioned GUGLIELMUS DE BONONIA, MICHAEL SCOTTUS, GUGLIELMUS DE RAVEGNA, ENRICUS DE PADUA, TETULUS GRÆCUS, SALOMONUS EBRÆUS, and ABDANA SARACENUS.

It is clear that these reports should not be regarded as historical facts; but some grains of truth probably lie hidden in them. There was a desire to point out that persons belonging to different nations—Jews, Arabians,

* DE RENZI: Collect. Salern. i, p. 95, note.

† Ord. Vit. Hist. eccles. iii in Hist. Normann. scriptor. ed. DUCHESNE, Paris, 1619, p. 477 "*ubi maximæ medicorum scholæ ab antiquo tempore habentur.*"

‡ MAZZA: Urbis Salern. hist. et antiq., Nap. 1681, printed in GRÆVIUS et PURMANN: Thesaur. antiq. et hist. Italiæ, Lugd. Bat. 1723, t. ix, pars 4.—DE RENZI: Storia docum., p. xxvi *et seq.* & Collect. Salern. i, p. 106 *et seq.*

Greeks, and Latins contributed to the foundation of the school of Salerno, that the instruction there was at first given in different languages and that the medical doctrines of the Salernians were developed out of the scientific knowledge acquired by the Greeks and Romans, the Hebrews and the Arabs. Some of the names quoted are marred by incorrect calligraphy; it is easy to understand that ELINUS arose from ELIAS, and PONTUS must be improved into GARIO-PONTUS and ADALA into ABDALLAH.

It is clear then from these considerations that we do not know, when and how the School of Salerno arose. The beginnings of it were either so unpretentious that they were unnoticed, or they reach so far back into antiquity as to be beyond the historian's grasp. The political fortunes of this town, constantly changing as they were, and bringing its inhabitants into touch with the Romans, the Greeks, the Lombards, the Arabs, and the Normans, were bound to leave deep traces in the development of their civilization and to exert a powerful influence on all departments of intellectual life.

The custom usual in ancient times, of men of learning privately taking in pupils and instructing them in the sciences, obtained also in Italy in the middle ages.* If the doctors followed this example there can never have been any dearth of students to live with them in Salerno, the mild climate and the noble situation of which, on the shores of a bay not far from shady woods and healing mineral springs, attracted patients from far and wide.

It is not known when the doctors who learned the healing art in Salerno joined together into a common activity and gave themselves an organization. At first, as it appears, any doctor might act as a teacher of medicine without distinction of nationality or religious

* W. GIESEBRECHT: De litterarum studiis apud Italos primis medii ævi sæculis, Berol. 1845, p. 15.—S. DE RENZI (Storia docum., p. 161) cites a great number of doctors who were practising in Italy during the time of the Lombards; one of these was designated as *Magister Scolæ*.

faith. At a later period many priests were found amongst the teachers of medicine there, of whom some attained to high dignity in the Church. But these never gained the exclusive right to teach as was the case in most of the other high schools of the middle ages. The institution throughout maintained that lay character which it had had from the beginning.

In Salerno, women were admitted to the profession of teaching and some of them became prominent also as medical authors. Among the female doctors the best known was TROTULA the authoress of a frequently quoted work on the diseases of women and the treatment of them before during and after labours. In her writings she discusses all branches of pathology even the diseases of the male sexual organs—a truly painful subject for female sensibility. Her colleague ABELLA wrote *de natura seminis humani.* COSTANZA CALENDA the daughter of the Prior (Principal) of the medical school, distinguished alike for her beauty and her talents, and MERCURIADE and REBECCA GUARNA belong to a later period.

In the early times of the School of Salerno the teachers were probably dependent for their pay upon the fees which students gave them for instruction. Afterwards they received regular stipends, differing in amount and in some cases producing a yearly income of 12 ounces of gold; in course of time the stipends were naturally increased. Teachers enjoyed freedom from taxes also and sometimes the usufruct of houses and ground property as well.* Many teachers were engaged in giving medical instruction at the same time, as is evident from the list of them given by S. DE RENZI.† To their lectures representatives of all nations had access; neither sex nor religion raised any impediment. Jewish students were very numerously

* DE RENZI: Collect. Salern. i, 366 *et seq.*—Storia docum. *op. cit.* Appendix Docum. No. 296 *et seq.*

† DE RENZI: Collect. Salernit. i, 517. iii, 326 *et seq.* It contains 340 names in a period of about 1000 years.

represented in the 11th century, as MAZZA informs us. When on the other hand the Jewish traveller. BENJAMIN VON TUDELA narrates that on visiting Salerno in 1160 he met not one single doctor among the numerous members of his faith living there, his assertion contradicts all other reports, in which we either find it expressly stated that certain Salernian doctors *did* belong to the religion of MOSES, or else we are at liberty to assume this fact from the names.*

Students came to Salerno from far and wide, even from Germany and France, to devote themselves to medicine. A student from Köln who had attended medical lectures in Salerno in the 12th century, but, owing to illness was obliged to return home, gives vent in a poem to complaints about the treacherous people of Salerno who were hateful to him.† Another student, ÆGIDIUS (GILLES) VON CORBEIL, who afterwards lived in Paris as canon and private physician to PHILIPPE AUGUSTE, King of France, proclaimed there with tongue and pen the fame of the medical school of Salerno.

Of the kind of teaching in the several subjects the following is known: Anatomy was taught on the pig. In the *Demonstratio Anatomica*, proceeding from an anonymous author and which obviously formed a college-lecture, rules are given how to proceed. According to this the animal was killed by severing the vessels of the neck, then was hung up by the hind legs and after the blood had escaped the carcass was made use of for teaching. This, as it appears, was limited to opening the great cavities of the body and demonstrating the organs lying therein. Some remarks were added on the form and the presumed

* *Cf.* M. STEINSCHNEIDER in VIRCHOW's Archiv, Bd. 38 (1867), S. 74 *et seq.*

† *Laudibus eternum nullus negat esse Salernum;*
Illuc pro morbis totus circumfluit orbis.
Nec debet sperni, fateor, doctrina Salerni
Quamvis exosa mihi sit gens illa dolosa.

JAC. GRIMM: Gedichte des Mittelalters in Kleine Schriften, Berlin 1866, S. 64.

function of such organs in man; reliance being placed upon the writings of GALEN, RUFUS, and THEOPHILUS PROTOSPATHARIUS, although the scientific elevation of these men was beyond the lecturer's reach. So too COPHO'S Anatomy of the Pig consists essentially only of an enumeration of the most important parts of the body. And yet we find therein certain indications of more searching inquiry and some observations in pathological anatomy. Thus it is said, for instance, that it is possible to inflate the lungs by introducing a pipe into the trachea.* Again, mention is made of effusions into the pericardium and pleura.

More attention was devoted to practical medicine. As early as the year 820 a public hospital was founded in Salerno by the high priest ADELMUS, which was brought into connection with the Benedictine monastery. At a later period several other infirmaries and charitable institutions arose, which were endowed with valuable property and conducted by members of charitable orders.† It is uncertain whether clinical instruction was imparted at these places or not.

ARCHIMATTHÆUS gives in a treatise ‡ complete advice as to how a doctor should comport himself on visiting a patient. He should place himself under the protection of God, he says, and implore the assistance of the angel who guided TOBIAS. On the way to see the sick person he should question the messenger who has summoned him upon the circumstances and the conditions of the illness of the patient; then if not able to make any positive diagnosis after examining the pulse and the urine, he will at least excite the patient's astonishment by his accurate knowledge of the symptoms of the disease and thus win his confidence. The author also considers it a matter of great importance

* DE RENZI: Collect. Salern. ii, 389.

† DE RENZI: Storia docum. della scuola med. di Salerno, p. 563, Doc. 329.

‡ Anomymi Salernitani de adventu medici ad ægrotum ed. A. G. E. TH. HENSCHEL, Vratist 1850.—DE RENZI: Collect. Salernit. ii, 74-81, v, 333-349.

that the patient should confess to the priest before the doctor comes to him; for "if mention is afterwards made of this matter the patient believes that there is no hope for him." "When the doctor enters the dwelling of his patient he should appear neither haughty nor covetous, but must greet him with a modest demeanour, and then seat himself near the sick man, accept the drink which is offered him and praise in a few words the beauty of the neighbourhood, the situation of the house, and the generosity of the family, if it should seem to him suitable so to do." Hereupon the way of examining the pulse and the urine is described. "When the doctor quits the patient, he should promise him that he will get quite well again, but should inform his friends that he is very ill; in this way if a cure is effected the fame of the doctor will be so much the greater, but if the patient dies people will say that the doctor had foreseen the fatal event."

The author then discusses the treatment of the patient and especially his diet, the employment of baths and bleeding and explains how the doctor should act if he is asked to dinner by the patient "as is usual," and when he demands the fee for the services rendered.

This treatise is a strange mixture of valuable medical experience, deep piety, and sly calculation. It is, as is clear from the way in which it is written, obviously intended for beginners in the healing art and throws a remarkable light on the social position of the medical practitioner of that period.

The medical principles of the Salernian school rested upon the theories of ancient times. The doctrine of juices of the Hippokratic writers, the "Communities" of the Methodists, and GALEN'S teaching formed their foundation; while the progress made in materia medica, for which thanks are due to the Arabs, maintained its place. The descriptions of diseases are true to nature and are illustrated by many original observations. The accounts given of intermittent fever, of disturbance of the mental faculties,

of pneumonia, phthisis, psoriasis, lupus (malum mortuum) ulcers on the sexual organs (among which it is easy to recognize the chancre) especially deserve mention.

The Salernian doctors were well acquainted with the evil significance of many symptoms in regard to prognosis; thus they declared that where diarrhœa supervened in phthisical cases the patients soon died. In treatment they laid great value upon a reasonably regulated manner of living and a suitable diet. If, for example, a commencing pulmonary phthisis was suspected, they ordered good and strengthening nourishment for the patient. People subject to pneumonia were directed to live in an atmosphere of even temperature; in winter, for example, in a heated room.*

For cooling the air of the sick room AFFLACIUS recommended that an arrangement should be made so that drops of water should continually fall to the ground and there evaporate.† Iron was ordered for enlargement of the spleen.

Surgery had a position inferior to that occupied by it in the time of the Greeks and Romans. This was due partly to the neglect of anatomy, partly to the fact that surgery was practised less by educated doctors than by empirics, especially since many members of the medical profession belonged to the priesthood.

In earlier times surgical knowledge was chiefly confined to the treatment of wounds, the cure of fractured bones, and the reduction of dislocations.

It was not till the end of the 12th century that a doctor undertook to represent in writing the principles of surgery as they had been preserved by tradition. This work, the author of which was RUGGIERO, but which is generally named after ROLANDO, a later editor, shows that the surgeons of the Salernian school sought for instruction not

* DE RENZI: Collect. Salern ii, 215 *et seq.*

† DE RENZI: Collect. Salernit. ii, 741 *(fiat etiam artificialiter pluvialis aqua circa ægrum).*

so much in the writings of the ancients as in their own experience. They were in this way saved indeed from that uncritical acceptance of the observations of strangers which is a frequent feature of Arabian literature, but at the same time they were deprived to a certain degree of those important suggestions and corrections which a knowledge of history affords in the study of any branch of knowledge. It is certainly noteworthy that among the means recommended for the arrest of hæmorrhage, in addition to styptics mention is made of suturing and applying ligatures.* The internal use of sea-sponge was recommended for the removal of bronchocele or the operation of excision was performed with the use of hair-ligatures; to avoid relapses, the whole capsule was extirpated. Massage of the bronchocele was also employed.†

Among other operations are mentioned trephining, the removal of nasal polypi, resection of the inferior maxilla,‡ the operation for hernia, which was performed according to the directions of PAULUS ÆGINETA, and lithotomy according to the precepts of CELSUS. The operation for cataract was performed by puncture of the sclerotic. Allusion is also made to ulcerative loss of substance in the palate and on the penis which refers to cancer and syphilis, and malignant tumours of the rectum and uterus are mentioned. The decline of operative surgery and the frequent employment of the cautery demonstrate the influence of Arabian medicine.

It fared even worse with midwifery than with surgery although this branch was practised by scientifically trained women. TROTULA alludes to turning in but one single

* Chirurg. ROGERI in DE RENZI: Collect. Salern. ii, 436.

† A. WÖLFLER: Die chirurg. Behandlung des Kropfes, Berlin 1887, S. 10 *et seq.*

‡ DE RENZI: Collect. Salernit. ii, 445, 513, 628, 650 (lib. ii, of the Commentaries of the four Masters). The mysterious four Masters remind one of the four Doctors of Law at Bologna, of whom SAVIGNY speaks (Geschichte des römischen Rechts, Bd. iv, S. 68).

passage of her book.* In a general way, midwifery consisted chiefly in the employment of internal remedies and psychical aids.

The School of Salerno was the first to establish a fixed and exclusive organization by the introduction of examinations in obedience to the order of the civic authorities. King ROGER (RUGGIERO) as early as the year 1140 promulgated the law: "Whoever from this time forth desires to practise medicine must present himself before our officials and judges, and be subject to their decision. Anyone audacious enough to neglect this shall be punished by imprisonment and confiscation of goods. This decree has for its object the protection of the subjects of our kingdom from the dangers arising from the ignorance of practitioners."†

The Emperor FREDERICK II., of the Hohenstaufen family, confirmed this law and in the year 1240 gave to the medical school of Salerno complete rules in regard to the subjects studied there. He says in his orders: "Since it is possible for a man to understand medical science, only if he has previously learnt something of logic, we ordain that no one shall be permitted to study medicine, until he has given his attention to logic for three years. After these three years he may, if he wishes, proceed to the study of medicine. In this study he must spend five years during which period he must also acquire a knowledge of surgery, for this forms a part of medicine. After this, but not before, permission may be given him to practise, provided that he passes the examination prescribed by the authorities and at the same time produces a certificate showing that he has studied for the period required by the

* DE RENZI: Collect. Salern. i, 149 *et seq.*—v. SIEBOLD *op. cit.* i, 317.

† *Quisquis admodo mederi voluerit, officialibus nostris et judicibus se presentet, eorum discutiendus judicio; quod si sua temeritate presumpserit, carceri constringatur bonis suis omnibus publicatis. Hoc enim prospectum est, ne in regno nostro subjecti periclitentur ex imperitia medicorum.* Hist. diplom. Frid. II, imperat. ed. HUILLARD-BRÉHOLLES, Paris 1854, T. iv, pars 1, p. 149, tit. 44.

law."* "The teachers must during this period of five years expound in their lectures the genuine writings of HIPPOKRATES and GALEN on the theory and practice of medicine." "But even when the prescribed five years of medical study are passed, the doctor should not forthwith practise on his own account but for a full year more he should habitually consult an older experienced practitioner in the exercise of his profession."

Concerning the motives which brought about the introduction of medical examinations it is said: "We further the cause of the individual, while caring for the public good. Accordingly, in view of the grievous loss and irremediable injury which may arise from the ignorance of doctors, we decree that in future no one is to assume the title of doctor or to proceed to practise or to take medical charge, unless he has previously been found competent in the judgment of teachers at a public meeting in Salerno, has moreover by the testimony in writing of his teachers and of our officials approved himself before us or our representatives in respect of his worthiness and scientific maturity, and in pursuance of this course has received the state-license to practise. Whoever transgresses this law and ventures to practise without a licence, is subject to punishment by confiscation of property and imprisonment for a year."†

In regard to the education of surgeons it was decreed, "that no surgeon shall be allowed to practise, until he has submitted certificates in writing of the teachers of the Faculty of Medicine, that he has spent at least one year in the study of that part of medical science which gives skill in the practise of surgery, that in the colleges he has diligently and especially studied the anatomy of the human body, and is also thoroughly experienced in the way in which operations are successfully performed and healing is brought about afterwards."‡

* Hist. diplom. Frid. II. *op. cit.* p. 235, lib. 3, tit. 46.

† *op. cit.* p. 150, tit. 45.

‡ *op. cit.* p. 236.

If the doctor had passed the examinations and received the state-license to practise, a diploma was made out for him which ran thus: "*Notum facimus fidelitati vestræ, quod fidelis noster N.N. ad curiam nostram accedens, examinatus, inventus fidelis et de genere fidelium ortus et sufficiens ad artem medicinæ exercendam, extitit per nostram curiam approbatus. Propter quod de ipsius prudentia et legalitate confisi, recepto ab eo in curia nostra fidelitatis sacramento et de arte ipsa fideliter exercenda juxta consuetudinem juramento, dedimus ei licentiam exercendi artem medicinæ in partibus ipsis: ut admodo artem ipsam ad honorem et fidelitatem nostram et salutem eorum qui indigent, fideliter ibi debeat exercere. Quocirca fidelitati vestræ præcipiendo mandamus, quatenus nullus sit, qui prædictum N.N. fidelem nostrum super arte ipsa medicinæ in terris ipsis, ut dictum est, exercenda impediat de cetero vel perturbet.*"*

In the oath which the young doctor had to take on this occasion, he was bound "to give advice to the poor, gratis, and to inform the magistrates of apothecaries who made up medicines not corresponding to prescriptions." It was, moreover, laid down by law how much he might demand for a visit to a patient. According to this the highest payment for a visit in the daytime within the town amounted to half a gold tarenus;† if the visit was outside the district the fee was three or at most four tareni exclusive of travelling expenses.

The doctor was forbidden to enter into partnership with apothecaries, or himself to keep an apothecary's shop. The apothecaries were directed to prepare the medicine according to the prescription of the doctors, and to furnish it at a regular price. Before they were permitted to practise their business they had to bind themselves by oath to provide drugs according to prescribed form, and to

* Peter de Vineis: Epist., lib. vi, c. 24, Basil 1740.—Hist. dipl. Frid. II, *op. cit.* p. 150, Note 2.

† A gold tarenus was a gold coin weighing 20 grains.

be guilty of no fraud in this matter. At the same time it was specified what advance of price they might allow themselves to make on medicines which perhaps had to be kept in stock for a long time before being used, and a prospect was given of a law being made regulating the number of apothecaries' shops in the various towns of the country.* Moreover inspectors were nominated who had to supervise the preparation of medicines, and to attest the satisfactory character of this by their certificates; in Salerno itself the teachers of medicine exercised supervision in this matter.† "At the same time we ordain," it is said in the same passage, "that no one shall give lectures on medicine and surgery elsewhere than in Salerno, or assume the title of teacher, unless he has been carefully examined in the presence of our officials and of the teachers of these arts." The punishment of death was imposed on the officials who violated their duties in giving effect to these laws.

The rules of the Emperor FREDERICK II. served as a pattern for succeeding arrangements in medical studies. They formed the first attempts at a state organization for the same. Unfortunately in the following centuries the influence of the secular power was in this as in other domains thrust into the background by the increasing authority of the clergy. This fact gave a distinct colouring to civilization, and governed the development of universities up to the most recent times.

The medical school of Salerno flourished in the 11th and 12th centuries. In this period it displayed an important literary activity to which witness is borne by the works of GARIOPONTUS, PETRONCELLUS, ALPHANUS, the two COPHOS the Platearii, of CONSTANTINUS AFRICANUS, who by his translations contributed greatly to make Salernian doctors acquainted with Arabian medicine; by the Dispensatory of BARTHOLOMÆUS, which soon after was translated into German,‡ the writings of AFFLACIUS, ARCHI-

* Hist. diplom. Frid. II, *op. cit.* p. 236. † *op. cit.* p. 151, tit. 47.

‡ Jos. HAUPT in den Sitzungsber. d. K. Akad. d. Wiss., Philos-histor. Kl., Wien 1872, Bd. 71, S. 451 *et seq.*

MATTHÆUS, MUSANDINUS, and ÆGIDIUS VON CORBEIL, the collection of recipes of NICOLAUS PRÆPOSITUS, the Uroscopie of MAURUS, but above all the famous Rules of Health of the school of Salerno, which were translated into all languages, and lived through more than 200 editions.

In the year 1252 King CONRAD decided to enlarge the school of Salerno into a university in which law and the *artes* might be fostered. But his plan came only partially into effect. King MANFRED in the year 1258 restored the university of Naples, which had shortly before been abolished, and in Salerno only the medical school remained. Certainly the science of law was taught there along with that of medicine, but no academical honours were granted in that branch of learning.*

When medical schools arose in Naples and in other towns of Italy and France the number of students in Salerno diminished. It came to this, that the quality of the teaching given there was gradually surpassed in excellence by that of the other schools, and the scientific activity of Salerno declined. ÆGIDIUS VON CORBEIL complained of this, saying that there beardless, immature youths received the honours of doctors and dared to act as teachers of medicine.

"Far from the height of thy fame art thou sunk to the depths, O Salerno!
Once adorned with such fame, thou art sunk to the very foundation,
Dost thou suffer that now on the site of thy past noble structure
Seedlings should sprout prematurely: of medicine sons, but unworthy?
Schoolmaster's cane so persuasive and training severe of an elder
Better would suit their case than, young as they are, to be mounting
Steps of professorial chairs in pompous procession."†

In the 14th century PETRARCH said: "The story goes that medicine took its rise in Salerno, but all alike falls a prey to withering age." Subsequently the school of Salerno declined more and more, and all attempts to

* J. A. DE NIGRIS in J. C. G. ACKERMANN'S Regimen sanitatis Salerni, Stendal 1790, p. 83.

† ÆGIDIUS V. CORBEIL: de medicam. compos., v, 569 *et seq.*, nach H. HAESER in Nord u. Süd 1877, iii, 7, S. 145.

instil new life into it by privileges and endowments were in vain. A decree of the French Government, which for some time guided the destinies of the country, on the 29th of November, 1811, put an end to the oldest medical school in Europe.

THE MEDICAL SCHOOL OF MONTPELLIER.

THE origin of the medical school of Montpellier is also veiled in the obscurity of tradition. It is unknown at what period the doctors there began to instruct students in the science of medicine. Among the doctors who practised medicine in the 10th and 11th centuries at Montpellier there were probably many Jews and Arabs; the fact that a large proportion of the population of this town consisted of members of these nations, and the vicinity of Spain, where Jewish doctors existed in great numbers and in high respect under the dominion of the Arabs, justify this assumption.

The Jews had a large share in the triumphs which Arabian medicine celebrated in Spain. The names of MOSES MAIMONIDES, CHASDAI SCHAPROUT, JUDAH HALEVI, NACHMANIDES and others speak as to their work in the different paths of intellectual life. The Rabbis and learned men among the Jews interested themselves in medicine, and the medical schools of the Jews at Toledo, Granada, and Cordova stood in high esteem. The Arabian princes of the Iberian peninsula as well as their Christian successors chose Jews, by preference, for their private doctors.* But the Jewish doctors earned the greatest merit in acting as mediators between Arabian medical science and Western Christendom. Partly by translations of Arabic works which they prepared, partly by word of mouth, they made the inhabitants of the adjoining Christian countries acquainted with the scientific acquisitions of that nearly related Semitic race.

* J. MÜNZ: Über die jüdischen Ärzte im Mittelalter, Berlin 1877, S. 17 *et seq.*

The Arab and Jewish schools of Spain preserved, for a long time even after the conquest of the country by the Christians, the reputation of learning. So late as in the 11th and 12th centuries philosophers thirsting for knowledge made pilgrimages to Spain, especially to Toledo, there to be initiated into the wisdom of the Arabs. Such were GERBERT, known later as Pope SYLVESTER II., HERMANNUS CONTRACTUS, DAVID MORLEY, PIETRO VON ABANO, ARNALD VON VILLANOVA and others.

An important influence upon the origin and development of the school of Montpellier must, without doubt, be ascribed to these circumstances. There has even been an attempt to show that a Jewish doctor from Narbonne was the first to teach medicine there.* When BENJAMIN of Tudela visited Montpellier in the year 1160 he found as he says many Jews amongst the inhabitants. But even then the reaction against the Jewish power was making itself felt. Count WILLIAM of Montpellier in 1121 made an order in his will that no Saracen or Jew should be admitted to the dignity of high bailiff (bailli), and in 1146 and 1172 this interdiction was renewed in respect of the Jews, it probably appearing no longer necessary with regard to the Saracens. In any case the fact indicates that before that time the Arabs and Jews in Montpellier possessed rights like those of their Christian fellow citizens and ventured to lay claim to the most important posts.

Up to the time of the conquest of Spain by the Christians a spirit of toleration reigned there, furthering the best interests of humanity and of science: the foundation of the Montpellier medical school took place during this period, as history testifies. When Bishop ADALBERT of Mainz came thither in the year 1137 the school already existed and even already possessed buildings of its own as we learn from the words of Bishop ANSELM of Havelberg

* RAVEL in the Révue thérapeut. du midi, Montpellier 1855.—CARMOLY: Histoire des médecins juifs, Bruxelles 1844, p. 77.—A. GERMAIN: Histoire de la commune de Montpellier, Montpellier 1851, T. i, p. lxix.

who lived at that time.* Bishop ADALBERT obtained instruction, from the doctors who taught medicine in Montpellier, upon the causes of natural phenomena and of diseases, certainly "not with the object of making money from the knowledge of these matters but only in order to learn to understand the deeply hidden meaning of things" as his biographer adds.

In a letter of ST. BERNARD written in 1153 it is narrated that the Archbishop of Lyons, being ill, repaired to Montpellier, to be under the treatment of the doctors there, and on this occasion not only spent what he had with him but ran into debt.† JEAN DE SALISBURY, who also belonged to that period, stated that those who wished to devote themselves to medicine acquired the knowledge necessary for this at Salerno or Montpellier. So too, ÆGIDIUS VON CORBEIL and HARTMANN VON DER AUE have borne witness to the ancient renown of the school of Montpellier.

The Monk CÆSARIUS VON HEISTERBACH called Montpellier the "Fountain of Medical Wisdom" and remarked with regret that the doctors of that school would not believe in miracle-healing even speaking of it in an ironical way.

In the year 1180 WILLIAM IV., Count of Montpellier promulgated a decree that anyone "whoever or of whatever origin he might be, should have the right of giving medical instruction there without being called to account by anyone."‡ Although as a result of this the medical school arose into great prominence, still unlimited freedom

* Anselmi episcopi Havelbergensis vita Adelberti Moguntini in Bibl. rer. german. ed PH. JAFFÉ, Berol. 1866, iii, 592.—A. DUBOUCHET: Un document curieux sur l'école de médecine de Montpellier in the Gazette hebd. des sciences méd. de Montpellier, 10 Juli 1886.

† *Expendit et quod habebat et quod non habebat* in BERNARD. Epist. 307, according to ASTRUC: Mémoires pour servir à l'histoire de la faculté de médecine de Montpellier, Paris 1767, p. 7.

‡ *Mando, volo, laudo atque concedo in perpetuum, quod omnes homines quicunque sint vel undecunque sint sine aliqua interpellatione regant scolas de fisica in Montepessulano.* ASTRUC *op. cit.* p. 34.

in teaching could not be supported, since by its means many undesirable persons were attracted. Teachers and students alike desired that to meet this difficulty certain rules should be laid down. It is indicative of the power which the clergy had in the meanwhile acquired that the papal legate was applied to, who in conjunction with the bishops of Maguelone and Avignon and others made the wished for regulations in the year 1220.

Cardinal CONRAD, who laid the foundation for the larger development of the school of Montpellier, was a German, and descended from the Swabian family of the Counts of Urach. In the statutes devised by him he first of all referred to the fact that medical science had for a long time flourished and had acquired renown in Montpellier, and then he laid it down as a law that from that time forth no one should act as a teacher of this science who had not been examined in it and received the license at the hands of the Bishop of Maguelone with the assistance and by the interrogatories of his teachers; that no one should be regarded as a student who did not in his studies follow the direction of his teacher; that the Bishop of Maguelone in association with three respectable senior teachers should elect a Chancellor to preserve discipline and adjust differences between masters and students; that the Bishop should support the Chancellor with his authority; and that teachers and students should assist one another and take care that no harm should come to the school.* Many students, as we learn from section 14 of these statutes,† interrupted their studies in order to engage in practice, returning later to Montpellier to continue their studies. The students paid their teachers fees for the instruction they received. It is true no mention at all is made in the

* ASTRUC *op. cit.* p. 37.

† *Quando scholaris redit à locis, in quibus practicaverit, libere sibi addicat, quemcunque voluerit, magistrum, dum tamen priori suo magistro non teneatur ratione salari vel alterius alicujus rei.* ASTRUC *op. cit.* p. 39.—A. GERMAIN *op. cit.* T. iii, 424.

laws of CONRAD about excluding persons professing other than the Christian faith from the school; and yet such were doubtless to a certain extent repelled by the powerful influence which the bishop was allowed to possess there. Nevertheless there were still in the 13th and 14th centuries many Jewish students and doctors at this place, among them JACOB BEN MACHIR, better known under the name of PROFATIUS, who was probably even engaged as a teacher.* In the year 1230 it was decided that no one should practise medicine until he had been examined and found competent by two masters in medical science, chosen as examiners by the bishop. The successful result of his examination was notified to him by a certificate bearing the signatures of the bishop and of the examiners. Whoever practised medicine without submitting to this examination was threatened with the punishment of excommunication. The surgeons however were not bound to submit themselves to examination. The laws against quacks, it would seem, were not stringently observed; yet from time to time they must necessarily have been recalled to men's minds.

The statutes and lists of lectures, which were issued in the year 1240, were framed upon the regulations of the Emperor FREDERICK II. published for Salerno.† The medical school was thus completely organized.

Instruction was also given in law at Montpellier from the end of the 13th century; and in like manner there were as early as 1242 teachers of philosophy. Pope NICOLAS IV. in 1289 decided to erect there a *Studium generale, i.e.*, a University. But he did not succeed in merging the medical school with the other faculties into one large establishment for teaching. It preserved its rights jealously and maintained its independence. And thus it came about that in Montpellier henceforth there

* CARMOLY *op. cit.* S. 90. He mentions other Jewish teachers of medicine, *e.g.*, SAMUEL BEN TIBBON.

† GERMAIN *op. cit.* T. iii, p. 424.

were, properly speaking, two distinct universities, one comprising the medical, the other the remaining faculties. Each formed a distinct institution, had its own Chancellor, and bore the name of a University. And each was entitled to such a name; for in the Middle Ages by the *Studium generale* was meant, not the union of all faculties in one place, but an institution for the higher teaching which was generally accessible, and gave certificates which were universally recognized.* The expression *Studium generale* was in the 14th century replaced by that of University, with which was associated the idea of a corporation, of an organized society. And even at that time the terms "Gymnasium" and "Alma mater" were made use of to apply to the High Schools. While the bishop filled the dignity of Chancellor henceforth in the University at Montpellier, which represented the legal, philosophic and theologic faculties, and which was first founded in 1421, the same office at the School of Medicine was conferred on one of its teachers. All attempts which were afterwards made to subject the medical school to clerical influence were fruitless. The medical faculty maintained its autonomy even under the centralizing power of the French kings, and LOUIS XIV. felt himself obliged to withdraw a decree ordering the union of the medical with the other faculties.† As the election of the chancellor by the bishop and three teachers appointed by him had many disadvantages attached to it, Pope CLEMENT V. in 1308 ordered that the candidate must secure from that time forth, in addition to the consent of the bishop, the votes of two-thirds of all the masters of the medical high school.

It was at the same time laid down what books should

* H. DENIFLE: Die Entstehung der Universitäten des Mittelalters bis 1400, Berlin 1885, S. 15 *et seq.*—*Cf.* on the other hand G. KAUFMANN: Geschichte der deutschen Universitäten, Stuttgart 1888, i, 98 *et seq.*

† A. DUBOUCHET: Documents pour servir à l'histoire de l'université de médecine de Montpellier in the Gaz. hebd. des sciences méd. de Montpellier 1887, No. 4.

form the foundation for teaching, and the order of study and examination in them was explained. Every student had to attend medical lectures for at least five years and to practise medicine for eight months or two summers* before being allowed to graduate. In 1350 it was laid down by law that no one should practise medicine before attaining the degree of Magister.† It is clear from the list sent to the Pope in 1362 that all students of medicine at Montpellier were graduates *in artibus*,‡ and consequently possessed a preliminary education in general knowledge. The statutes of this medical school for the year 1340§ afford us a glimpse into its condition. They deal with the high office of the Chancellor, who administered the government of the school; with the office of Dean,—which was conferred on him who had longest acted as teacher there, and was really an honorary post, the chief duty of its incumbent being to represent the Chancellor;—with the election of two Procurators from among the teachers, to superintend the management of the property and possessions of the university; with the general meetings of teachers taking place twice every year, in which they took counsel together upon matters affecting the teaching and the finances of the school; and with the duties of teachers and students. The latter were obliged to present themselves directly after their arrival to the Procurators who entered in a book their names and the date of the commencement and termination of their studies, receiving a fee for this which varied in amount according to whether it was question of a Student or of a Bachelor:

* *In locis famosis quinque annos, si in artibus magistri existant idonei, alioquin per sex annos, pro quolibet anno octo duntaxat mensibus computatis ejusdem facultatem audiverint medicinæ, ac in similibus locis per octo menses aut per duas æstates adminus ejusdem medicinæ praxim duxerint exercendam.* Astruc *op. cit.* p. 46.

† Astruc *op. cit.* p. 54.

‡ Denifle *op. cit.* S. 355, note 562.

§ A. Dubouchet *op. cit.* Gaz. hebd., No. 6 *et seq.*

this corresponded to the fees for immatriculation and ex-matriculation of our times.

The students on their acceptance into the society of the high school promised to observe conscientiously its laws. They were bound during the first three years of their student-life to attend medical lectures, holidays excepted, for 24 full months. Hereupon followed an examination, in which each of the teachers set a question, and then the degree of Bachelor. In this capacity the student continued his studies for at least two years, but delivered at the same time lectures upon certain extracts from the medical writings of the ancients. The candidature for the degree of Master of Medical Science formed the conclusion of study.

He who gave regular instruction at least for the whole winter through was looked upon as a teacher in ordinary. The teachers chose in their meetings the subjects they wished to discourse upon; the elder had precedence of the younger in this matter. Moreover, scrupulous care was taken, that a subject, which ought to be thoroughly considered within the space of a year, should not be spread over several.

At first every Master and, within certain limitations, even every Bachelor was authorized to teach, without however receiving any remuneration at all for such teaching. It was not till the year 1498 that four regular chairs of medicine were founded, the incumbents of which for a stipend of one hundred livres had to lecture the whole year through without further pay! The appointment to these professorships was in the hands of the Bishop after nomination by the other teachers of the medical school. The stipend of the Professors was raised under CHARLES IX. to 400 and under HENRY IV. to 600 livres. Besides this they were, like other members of the University, free from taxes and many other burdens.

The medical school of Montpellier passed the period of its greatest lustre in the 13th and 14th centuries. From

far and wide at that period came the sick, as the Bishop of Hereford from England and King JOHN of Bohemia, to seek help from the doctors there who were especially valued for their practical skill.* But a competition dangerous to their interests gradually waxed greater, as the universities, founded at that time in Italy, France and Germany arrived at a state of maturity.

THE MOST ANCIENT ACADEMIES OF ITALY.

THE Emperor FREDERICK II. created the academy at Naples† in the year 1224, in which all the sciences were to be taught, in order that young men, thirsting for knowledge, should not be compelled "like beggars to seek intellectual food away from their own country." ‡ At first, as it appears, all the faculties were represented here; but as early as 1231 the medical disappeared, since, by an imperial decree, medicine from that time forth might be taught only in Salerno. In 1252 the other faculties were also transferred to Salerno and united with the medical school there into a university.

Still, the high school at Naples was restored in 1258. Situated, as it was, in the chief town of the country, more easily accessible from the north and east and endowed with greater privileges and more money than its elder sister at Salerno this institution afterwards surpassed the latter in the number of its students as well as by its importance and its achievements.

The story of the birth of the high school of Bologna like that of the schools at Salerno and Montpellier is lost in the

* ARNALD VON VILLANOVA: Breviar. iv, 10.—GUY VON CHAULIAC: Chir., tr. vi, d. 2, c. 2.

† MURATORI: Rer. It. script. viii, p. 496.

‡ HUILLARD-BRÉHOLLES *op. cit.* T. ii, p. 450. *Disponimus apud Napolim doceri artes cujuscunque professionis et vigere studia, ut jejuni et famelici doctrinarum in ipso regno inveniant unde ipsorum aviditati satisfaciat, neque compellantur ad investigandas scientias peregrinas nationes expetere nec in alienis regionibus mendicare.*

earlier ages.* The Emperor FREDERICK I. promised his protection to the university there in 1158, and bestowed upon it independent jurisdiction.† It was at that time really nothing but a school of law; but other sciences were taught there in the 12th century, and the doctors were probably already associated in a college. ‡

In the 13th century the medical and philosophical faculty was organized, as "a University of Artists." The school of law in the meanwhile continued to maintain preponderance over the other faculties by the number of its teachers and students.

It was only after 1280 that the medical faculty, when THADDÆUS FLORENTINUS was a teacher in it, became known and celebrated in wider circles. For the rest, the organization of the university at Bologna was centred not so much on its faculties as on the incorporation of its students. These were at first divided into the Citramontani and the Ultramontani each division being composed of several "nations." These territorial societies of students, the antitypes of which are found in the associations which existed in the high schools of antiquity, *e.g.*, at Athens, sprang from the necessity felt by the students of joining themselves together in a foreign land with the mutual ties of a common home: they were organized after the fashion of the Italian corporations.

At the head of each of the two student-corporations was a Rector, who was originally not exactly the head of the university but only managed the affairs of the students who had chosen him as their representative. At first, this dignity was bestowed on professors as well as on students, but after the middle of the 13th century only on the latter

* F. C. v. SAVIGNY: Geschichte des römischen Rechts im Mittelalter, Heidelberg 1834, Bd. iii, S. 164 *et seq.*

† Cod. Auth. Habita.—GIESEBRECHT in den Sitzungsber. d. K. b. Akad. d. Wiss., histor. Klasse 1879, Bd. ii, S. 285.

‡ M. MEDICI: Compendio storico della scuola anatomica di Bologna 1855, p. 3.

and in the statutes of the university of the 14th century this was even officially recognized.* After the 16th century there was only one Rector for the two student-corporations.

As the Italian towns possessing high schools competed with one another, by the bestowal of privileges and distinctions, in attracting foreign students, the latter gradually acquired a position of extraordinary power and the professors came to hold a place of relative dependence. In Bologna and Padua the students even had the right† to elect the Professors. In Montpellier their representatives, the Procurators, were allowed to stop the pay of Professors if they did not lecture with sufficient assiduity.‡

The Rector, chosen from among the students, who at first had jurisdiction only over the corporation to which he belonged, exercised it later over the whole university, even over the Professors and their families. It is true that he had at hand a member of the legal faculty as Chancellor, and a state of things must have been developed similar to that which for a while existed in the 16th and 17th centuries at the German universities when the Rectorship was conferred on students of distinguished families. The Rectors had no influence over the systems of study and examination; this was left entirely to the Professors. The latter received fees from the students for the instruction which they gave; from the beginning of the 13th century the town also granted them a certain stipend.

According to a report made in 1371 by the Cardinal-Legate ANGLICUS§ three Magistri were teaching at that time in Bologna the theory of medicine, three the practice

* *Ad rectoratus igitur officium eligatur scolaris nostræ universitatis*, in the statutes of Bologna University. SAVIGNY *op. cit.* Bd. iii, S. 643.

† C. MEINERS: Geschichte der Entstehung und Entwickelung der hohen Schulen unseres Erdtheils, Göttingen 1802.—SAVIGNY *op. cit.* Bd. iii, S. 292 *et seq.*

‡ THOMAS U. FELIX PLATTER: Zwei Autobiographien her. v. Fechter, Basel 1840, S. 155.

§ DENIFLE *op. cit.* S. 208 *et seq.*

of medicine, and one surgery. They were paid by the town; there were also with these other teachers who drew no pay. In 1388, 68 Professors were employed there, 14 teaching medicine, 27 civil law, 12 canon law, and 15 the arts, grammar, and the business of the notary; in 1451 the number of teachers reached even more than 170, and as a result there was a reduction in the number of professorial chairs.* Among the Professors engaged there in the middle ages were Frenchmen, Germans, Spaniards, Englishmen, Portuguese, Poles, and Greeks,† and among the students, too, all European nations were represented.

The Professors, on entering on their duties, had to bind themselves by oath not to teach their science anywhere but in Bologna, and to contribute to the success of the high school of that place with all their powers.‡ This did not, however, prevent both students and teachers withdrawing on various occasions in considerable numbers from Bologna and seeking another place for their studies. This happened as early as 1222, and furnished an opportunity for the foundation or extension of the high school at Padua, where perhaps, long before this, schools for certain sciences had already existed.

The university of Padua was formed after the pattern of that of Bologna. There, too, the Rector was at the head of the student-associations, of which there were four, distinguished by their nationalities, namely, those of the Italians, the French, the Provençals and the Germans.§ There, also, the Rector was chosen from among the students; it was only demanded of him that he should possess an unimpeachable reputation, should be at least 22 years of age, and should have lived for a year in Padua upon his private means. The university of Padua,

* E. Coppi: Le università italiene nel medio evo, Firenze 1880, S. 257.

† Mazetti: Repertorio di tutti i professori dell' università di Bologna, Bologna 1847.

‡ E. Coppi *op. cit.* S. 78, note.

§ F. C. Colle: Storia dello studio di Padova, 1824.

like that of Bologna, was frequented chiefly by jurists. In 1268 there were in Padua three teachers of medicine and of the natural sciences. It was really not until the 15th and 16th centuries that medical science attained to a flourishing condition in Padua and Bologna.

The academy of Vercelli, which existed in 1220, owed a sudden popularity to the fact that in consequence of quarrels in the year 1228 a number of professors and students of Padua left that town. The town council of Vercelli made an agreement* with them, and they were induced, by various advantages held out to them, to settle down there. All branches of learning were represented at Vercelli; medicine had two professorial chairs. Yet the academy existed not much longer than one century.

The university at Vicenza originated probably in a similar manner, students and teachers coming thither from Bologna. It enjoyed a favourable reputation as a school of law in the beginning of the 13th century. In 1261 a teacher of medicine was appointed there for the first time, receiving a yearly stipend of 150 *libræ denariorum*. In Modena, where, as early as the 12th century, legal science was largely pursued, a teacher of medicine was appointed first in the 14th century. Reggio (Emilia) had a school of law, though one of no great importance, since 1188. The academy of Arezzo, in which medicine, among other subjects, was taught, existed as early as the 13th century,† but was formally declared a university only in 1355, and decayed in the 16th century.

Siena was known for its excellent school as early as 1203. In 1241 medicine was taught there in addition to other sciences, and in 1247 there were already three teachers of this subject. When the appointing of foreign professors came to be discussed in the town council in 1285 an endeavour was made to secure RANUCCIUS, who had great experience in surgery; moreover, a Magister ORLANDUS

* COPPI *op. cit.* S. 109 *et seq.*—SAVIGNY *op. cit.* Bd. iii, S. 666 *et seq.*

† SAVIGNY *op. cit.* Bd. iii, S. 312 *et seq.*

taught medicine there.* In 1321 the university of Siena was enlarged, receiving accessions from Bologna. DINO DI GARBO, who at that time represented medicine at Siena, drew a yearly stipend of 1,155 lire. At a later period the university decayed, and its decline was not materially retarded in consequence of its official recognition by the Emperor CHARLES IV. in 1357 as a *studium generale*. It was not till the end of the 15th century that it recovered itself.

Piacenza possessed a school of law at the end of the 12th century, which was raised into a university in 1248. The Magister HUGO, a clergyman, taught medicine there at that time. The academy obtained first under GALEZZA VISCONTI a certain reputation; in 1399 it possessed 71 teachers, 22 of them being medical. It was abolished in 1403.

At the seat of the papal Court there arose in 1244 an institution for teaching, endowed with the privileges of a university, in which theology, law, oriental tongues, and afterwards medicine were taught. Situated first at Avignon and then at Rome, it was united with the academy which had existed in the latter place since 1303. Here, in 1514, 88 Professors were engaged in teaching, namely, 4 teachers of theology, 11 of canonical, 20 of civil, law, 15 of medicine, and 38 of philosophy, mathematics, rhetoric and German; on the other hand, the number of students was relatively small. Under Pope ALEXANDER VI. the building of the Sapienza was begun, the halls of which serve for the seat of the university of Rome at the present day.

In Perugia a school of law existed in the 13th century; but other sciences also and especially medicine were taught there. In 1308 the Pope proclaimed the school a university. Here at first one but, after 1314, two teachers of medicine were appointed, only however for a period of three years. In the roll of 1339, alongside of four doctors

* DENIFLE *op. cit.* i, S. 437.

of canonical and three of civil law, one of philosophy, and one of logic, appear also three of medicine, and against 119 students of law we find 23 medical students; these however were exclusively from distant parts; the native students were not counted.* The majority certainly were of Italian origin, many however came from Germany. It is noteworthy that the teachers and students of law bore the title of Dominus, those of medicine and philosophy that of Magister. In 1342 the number of teachers was increased and in the statutes of 1366 we find a regulation that there should be at least seven teachers of medicine. In 1431 there were eight, of whom one had to teach osteology as a speciality.

Treviso had in the 13th century an institution for the higher teaching which was transformed into a *studium generale* in 1314: this received the imperial favour in 1318. The town decided to found twelve scholarships, three of them being devoted to medicine. Only a short duration of life was destined for this university; as early as the beginning of the 15th century it had ceased to exist.

The academy at Pisa arose in 1343 out of a school of law. It had to contend with many adverse circumstances: thus, for instance, in 1359 all the professors were discharged, there being no money for their salaries. In 1403, the university was broken up for a time and opened again only in 1473, under LORENZO DE MEDICI, who showed it great favour. From that time it made rapid advances and attained to a position of high importance at the end of the 15th century. This was due in a large measure to the circumstance that the university of Florence which as early as the 14th century had renowned medical teachers on its staff and possessed charters of foundation from the Pope and Emperor, was in 1473 removed to Pisa.

The university of Pavia was also developed out of a school of law. It was raised into a *studium generale* in 1361 by the Emperor CHARLES IV. Medical science was zealously

* DENIFLE *op. cit.* i, S. 546.—COPPI *op. cit.* S. 127, note.

cultivated and promoted there.* Among the students were many Germans. In Ferrara there were in the 13th century celebrated schools for instruction in the liberal arts. They were united into a university in 1391 and care was taken, at the same time, that the sciences of law and medicine should be represented. In 1474, 51 professors were teaching there, among them being several lecturers on medicine. Turin became possessed of an academy in 1405, and Catania of one in 1445. In Parma also, in Cremona, Lucca, and other towns of Italy, instruction was given temporarily in certain sciences, for instance in law and medicine, without however the development in these places of regular universities endowed with legal privileges.

THE MOST ANCIENT ACADEMIES OF FRANCE.

In France, at this period, a great number of academies arose.† At Orleans, Angers and Rheims there were, as early as the 13th century or even earlier, much-frequented schools of law which were afterwards proclaimed universities. The authorities were anxious to attract foreign students and on this ground bestowed on them many privileges. Thus the German students at Orleans were subject to special jurisdiction, had free entry to the theatre and were all treated as noblemen, without distinction of birth.‡ Instruction in medicine was given only exceptionally and at no time attained to any importance. For example, Angers in 1362 had among 44 teachers only one who lectured on medicine. A similar state of affairs existed at Toulouse where in 1229 a *studium generale* was founded. Medicine was regarded with as little respect in the academies at Avignon, Cahors, Grenoble and Orange

* Alf. Corradi in the Memorie e documenti per la storia dell' università di Pavia, Pavia 1878, i, 99-145.

† E. Pasquier: Recherches de la France, Paris 1633, p. 888 *et seq.*

‡ Savigny *op. cit.* Bd. iii, S. 402 *et seq.*

which were founded in the 14th century.* Regarded singly, none of these academies had at any time many students. The witty remark was made about Orange, as we are told by Gölnitz, that the whole university consisted of three persons, the Rector, the Secretary and the Beadle.† So too the academies at Perpignan, Aix, Dôle, Caen, Poitiers, Valance, Lyons, Bordeaux, Bourges and Nantes which arose before or during the 16th century never attained to any greater importance.

The political and social development of France was of such a nature as to cause the small provincial universities to give way on all sides to Paris which formed the centre of all intellectual life. This university arose from the union of the mutually independent schools for higher education in Paris in which, as early as the 12th century, law, medicine and several other sciences were taught. JOHN of Salisbury has left us accurate information about the management of these schools, and the studies which were pursued at them.‡ It is not known how it came about that the teachers of these subjects entered into an alliance among themselves and formed an association. Probably it was in 1209, at the instance of Pope INNOCENT III., who ordered the masters in the various sciences to frame laws for their own use.§ In 1215 the Magistri of the four chief branches of learning represented corporations—faculties in our sense of the word—and had their own separate statutes.‖ It was not, however, until 1254 that they were united into a university. Besides being divided into faculties, another division into four "nations" existed at Paris as early as the 13th century, an arrangement obviously modelled upon that of the Italian universities. This appears to have exercised greater influence on academic

* G. BAYLE: Les médecins d'Avignon, Avignon 1882, p. 43 *et seq.*

† A. GÖLNITZ: Ulysses Belgico-Gallicus, Leyden 1631, p. 468.

‡ JOHANNES SARESBERIENSIS: Metalog., lib. ii, c. 10, Ed. MIGNE (Patrol. lat. Bd. 199, p. 867).

§ A. F. THÉRY: Histoire de l'éducation en France, Paris 1858.

‖ BULÆUS: Historia universitatis Parisiensis, Paris 1665-73, T. iii, p. 81.

administration than the division into faculties. The study of the *artes liberales* formed the preliminary step to the study of theology, law and medicine, the "philosophical faculty" forming, as it were, a foundation for the three others.

By "medical faculty" was understood not only, as is now the case, the staff of teachers of the medical school, but the whole body of legally qualified doctors in Paris. Since originally every doctor who had passed the examination was at liberty to teach in the high school it was natural to identify the two classes, the more so that frequently the same persons played a leading part in both. But not every doctor was able or willing to act as teacher of his art. The medical corporation decided, therefore, to depute annually certain of its members to the duty of teaching. This, however, demanded knowledge and ability not possessed by everyone; it was, therefore, very natural that a class of doctors who made teaching their profession was gradually formed. These circumstances must be carefully considered if we wish rightly to understand the state of the university of Paris at this time and of the medical studies pursued there. They explain the independent position held by the medical faculty in regard to the university, the influence exerted by the doctors who held themselves aloof from professorships upon medical teaching, and many other facts which, as they are transmitted by history, appear singular and enigmatical. In Paris, too, the Rector was originally the head of the associations of students—of the "nations." Since the members of these "nations," either as students or graduates, belonged to the philosophical faculty, or stood in relation to it, it ensued of its own accord that the Rector gradually came to have the management of this faculty. The faculty of the liberal arts, however, formed the foundation of the whole university; thence came it that the Rector afterwards advanced to the head of this. As early as 1280 he was looked upon as head of the whole

university; the theological faculty alone formed an exception; but in the middle of the 14th century this also came under his authority.

He alone could be elected to the office of Rector who possessed an academical degree in the philosophical faculty, in other words, a good general education. The usage gradually came into vogue of conferring this dignity upon a man in a prominent position of life, who sometimes if not always belonged to the teaching-staff. A similar arrangement prevailed afterwards at the academies at Vienna, Prague, and other places. A Dean of the medical faculty is mentioned in the year 1267; this was PETRUS LEMONENSIS.* The Dean was elected by the medical corporation, the President of which he was. He was not allowed, at least in later times, to give lectures lest the administrative business which was entrusted to him should cause him to neglect them.

The teachers in the faculty of medicine were divided into those whose duty it was to give lectures and demonstrations—thereby satisfying a definite want in the plan of studies—and into those who lectured of their own free will. The former presided at discussions and on solemn occasions, and were called *Doctores*, or *Magistri actu regentes*; their position corresponded nearly to that of our professors in ordinary. The other members of the teaching staff, the *Doctores non regentes*, were not bound to employ themselves actively as teachers, and in consequence had no participation in the various privileges and sources of income which the class just mentioned enjoyed. The teachers of the university generally gave instruction at their dwellings. The medical faculty had a building of its own for the first time in 1505. Up to that time its meetings were held in the church of the Mathurins, or in the cathedral of Notre Dame. We get information as to the numerical relations of the several faculties from the fact

* BUCHEZ: De la faculté de médecine de Paris in the Journal des progrès des sciences et institutions médicales, Paris 1822.

that in the year 1348 there were in Paris 32 magistri of theology, 18 of canon law, 46 of medicine, and 514 of *artes liberales*.* The number of doctors belonging to the medical faculty of Paris, reached 29 in the year 1311, 31 in 1395, and 36 on an average from 1391 to 1431. When the English besieged Paris in 1442 there were only 10 or 12 qualified doctors in the city; but around these a number of students were gathered who practised under their supervision. At a later period also the medical faculty did not increase in the same proportions as the city of Paris; for in 1500 the former consisted of 72 doctors, in 1566 of 81, in 1626 of 85, in 1634 of 101, in 1675 of 105, and in 1768 of 148.† With these there were in Paris a great number of practitioners who had the right, it is true, to practise, but had not obtained the title of doctor, and consequently could not be members of the medical faculty; so, too, there were numbers of surgeons who had passed examinations, and other medical men recognized by the law. The organization and arrangements of the university of Paris formed the pattern for the majority of the academies which were founded in the following centuries in Germany, England, and other countries.

THE OTHER UNIVERSITIES OF EUROPE EXISTING IN THE MIDDLE AGES.

THE most ancient universities of Spain arose probably under the influence of Arab traditions. At Palencia, even in the time of the Goths, there were celebrated schools: in the beginning of the 13th century ALPHONSO VIII. erected a university there in which however there was no medical

* DENIFLE *op. cit.* i, S. 123, from whom I borrow these figures, considers all these magistri to be *regentes*; but this assumption is contradicted by all other circumstances.

† A. SPRINGER: Paris im 13. Jahrhundert, Leipzig 1856.—J. C. SABATIER: Recherches historiques sur la faculté de médecine de Paris, 1835.

faculty. But this educational establishment existed only for a short time. The university of Salamanca which was founded in 1243 by FERDINAND III. was developed, as it appears, out of a cathedral-school. There all branches were represented with the exception of theology which was not added until the 14th century. Two teachers, as was the case also in other academies of that period, gave instruction in medicine. Salamanca acquired a reputation which spread far beyond the boundaries of Spain and was declared by Pope MARTIN V to be one of the four chief academies of Christendom, the others being Bologna, Naples and Paris.*

The other universities of the Iberian peninsula were of less importance. In Seville the study of the Oriental tongues, especially of Arabic, was chiefly pursued; the academy there served for the training of missionaries and was first provided with the other faculties in the beginning of the 16th century. The university of Lisbon was founded in 1288 but was removed to Coimbra in 1308. This fate befel it several times for it came back to Lisbon in 1338, was transferred to Coimbra again in 1354, then to Lisbon once more in 1377, to return to Coimbra in 1537. It almost gives one the impression that the two towns had agreed between them that the seat of the university should change from one to the other about every 20 years. All branches of knowledge were taught there; yet in 1400 there was only one professorial chair for medicine.

In addition to those above mentioned Spain possessed universities in the following places: about the year 1260 there was one in Valladolid, in 1300 one at Lerida, in 1254 at Huesca, in 1411 at Valencia, in 1446 at Gerona (?), in 1450 at Barcelona, in 1474 at Saragossa, about 1480 at Siguenza, in 1482 at Avila, in 1483 at Palma, in 1499 at Alcala. The faculty of medicine was not represented at some of them. The Spanish universities appeared as much

* V. DE LA FUENTE: Historia de las universidades en España, Madrid 1884-85, 2 Vols.

by political events as by the geographical position of their country to be especially called to the great task of transmitting the culture of the Arabs to Christian Europe; and they might well hope that as a result of the stimulating effect of the rich treasures of knowledge left them by their Semitic predecessors they would long sustain an important part amongst the establishments for advanced teaching. If, notwithstanding this, they produced no enduring influence on the development of the sciences and if, after a brief period of prosperity, which like a friendly gleam of light illuminates the history of the 16th century, they sank into a condition of intellectual torpidity which robbed them of the power of independent movement, the fault lies in that political and religious oppression which here reached an unexampled height. Even in the worst days of despotism and of superstition there was no lack of latent intellectual life ever ready to bloom afresh; but the buds were crushed under foot and could only advance to maturity if removed from their native soil.

The old English universities of Oxford and Cambridge were gradually developed out of the schools which existed in those places as early as the 12th century.* It is uncertain when they assumed the academic character. In the first decades of the 13th century they appear already as organized corporations—in fact as universities. Medical science was certainly taught in these institutions along with other branches of knowledge, but only as part of a general philosophical education. For this purpose one teacher of the subject sufficed to point out to the students the most important facts in connection with it. The same conditions obtained at the universities of St. Andrews founded in 1411, Glasgow founded in 1450, and Aberdeen founded in 1494.

The first university on German soil was erected in the

* H. C. Maxwell Lyte: A History of the University of Oxford from the earliest times to 1530, London 1886.—James Bass Mullinger: The University of Cambridge, Cambridge 1873.

year 1348 at Prague, the residence of the Emperor CHARLES IV. An ardent friend and patron of all scientific and artistic effort, this prince was anxious to make the subjects of his empire and especially of his patrimonial possessions in Bohemia, acquainted with the advantages of Italian and French civilization. On this account, he created in his capital a *studium generale* which was arranged after the pattern of the university of Paris. It comprehended four faculties in all, and fixed stipends were assigned to the professors. The students, as in Paris and Bologna, were divided into four nations namely Bohemian, Bavarian, Saxon, and Polish. At their head was the Rector, who had to belong to the clergy, though not to any monastic order, *i.e.*, he was obliged to have received one of the lower forms of consecration; also to be of at least 25 years of age, of legitimate birth and to have passed a blameless life.* Even students could be elected to this dignity. The supreme control of the university was conferred on the Archbishop of Prague—on a high prelate, as was usual in many academies at that period. The university of Prague rose quickly into prominence. BENESCH DE WAITMUEL an author of the 14th century said that "in no place in Germany did the sciences receive such careful cultivation as in Prague, students coming thither from England, France, Lombardy, Hungary, Poland and the adjacent countries, among them being the sons of nobles and princes, and high prelates from the different parts of the world."† Even if the reports of the number of students, which the academy mustered at that time are exaggerated,‡—and in

* W. TOMEK: Geschichte der Prager Universität, Prag. 1849.

† DENIFLE *op. cit.* i, S. 600.

‡ According to these there are said to have been in Prague at that time 30,000 students; similar reports exist in the cases of Bologna, Oxford, and Louvain. Probably not only the students and scholars who were being prepared for university studies, were included, but also all who had studied there in former years as well as the officials and artificers who had business relations with the academy. *Cf.* PAULSEN in SYBEL'S histor. Zeitschr. 1881, Bd. 45, S. 291 *et seq.*

any case they are very uncertain,—still we are at liberty to assume that the number was not insignificant.

In 1372 the faculty of law constituted itself a separate university and chose its own Rector; it consisted at that time of 37 members of the Bohemian, of 48 of the Bavarian, of 41 of the Polish, and of 29 of the Saxon nations.

Medical study met by no means with its due recognition; it was represented by one or at most two teachers. NICOLAUS DE GEVICKA, BALTHASAR DE TUSCIA and WALTHER are mentioned as the first.

The national and religious quarrels which afterwards broke out in Prague resulted in many foreign students quitting the university and in the neglect of study there. Thus its decline commenced, and in the sphere of medicine became somewhat marked as early as at the close of the 15th century.

The university of Vienna was founded in 1365, but really only in 1385 came into actual existence. It was organized in imitation of the university of Paris. Its members, like those of that university, divided themselves into four "nations" at the heads of which were Procurators, who elected the Rector. The Rector was the head of the whole university, representing it before the outside world and holding jurisdiction in it. The Provost of the Church of ST. STEPHEN filled the office of Chancellor. The general assembly of the doctors who had taken diplomas constituted the medical faculty; their principal, the Dean, was elected by them. All were entitled to teach; yet but few devoted themselves to teaching, indeed, seldom more than six or eight.* The *Doctores regentes* received regular stipends. The first teachers of medicine were JOHANN GALLICI of Breslau, HERMANN LURCZ of Nürnberg, HERMANN VON TREYSA of Hessen, CONRAD VON SCHIVERSTADT and MARTIN VON WALLSEE.

In the year 1364 King CASIMIR of Poland founded an

* J. ASCHBACH: Geschichte der Wiener Universität, Wien 1865, i, S. 326.

academy in Cracow to which two professorial chairs of medicine were allotted. But these plans were not realized until 1400.

A papal document of foundation was drawn out for Culm also in 1387, but the university appears never to have come into existence. The university of Heidelberg arose in 1386. It had at first only four professors for all the faculties. The first teacher of medicine was appointed in 1390. He remained for long the only representative of this science.* At Köln on the Rhine an academy was founded in 1388, which made a splendid start. It existed until 1798 and was only abolished under the French rule at the same time as the universities of Treves and Mainz. The academy of Erfurt which as early as 1379 received the privileges of a *studium generale* and, in any case, existed as such from 1392 obtained a great reputation in the 15th century, especially for its attention to legal science. It existed till 1816. The two Hungarian academies of Fünfkirchen and Ofen, which were founded in the 14th century, had but a short duration of life; the latter was restored at the end of the 15th century. The university of Würzburg only existed ten years after its foundation in 1403. Its history, which has an extraordinary importance in reference to medical science, really begins only in 1582 after it had been again opened at the conclusion of a long period of inactivity. In the 15th century the following universities also were founded at the dates given :† Leipzig (1409), Rostock (1419), Louvain (1426), Greifswald (1456), Freiburg-im-Brisgau (1457), Basel (1460), Treves and Ingolstadt (1472), Tübingen and Mainz (1477), Upsala (1477) and Copenhagen (1479). Medical studies played a modest part at these academies. There were seldom more than one or two teachers to instruct students in medical science and the number of the pupils was generally not much greater.

* J. F. Hautz: Geschichte der Universität Heidelberg, Mannheim 1862, 2 vols.

† *Cf.* Paulsen in Sybel's histor. Zeitschr. 1881, Bd. 45, S. 266 *et seq.*

THE TRAINING OF DOCTORS IN GENERAL.

THE universities of the middle ages were institutions of a different kind to those of the present day. The conceptions which are associated with things change with the lapse of time just as the names do by which we designate them. The academies of that period, moreover, differed considerably among themselves according to the time and place of their origin. Those of Salerno and Montpellier appear to have been, as it were, technical schools of medicine, to which the other faculties were somewhat loosely linked. The academies at Bologna, Padua, and other places in Italy resembled wandering colonies of professors and students, who pitched upon a site wherever the best prospect of freedom and the greatest advantages were offered; many associated themselves with one of the numerous schools of law existing in several towns from a remoter period. The university of Paris and the academies of England and Germany, which were modelled on it, give the impression of philosophical faculties which afforded medicine a place, along with other sciences, within the circle of the studies pursued within their walls; at certain of these universities, such as Paris, Vienna, Prague, Basel and other places, medical teaching stood in close connection with the corporation of doctors, as was also originally the case in the oldest medical schools at Salerno and Montpellier. Just as artisans and artists in their guilds, so also the masters of medicine claimed the right of determining in their general meetings in what manner their art should be taught, and who possessed the requisite knowledge for independently practising it. So, too, in the other academies, the medical faculties had a somewhat different signification to that possessed by them to-day, for at that time they gave no complete technical education, but only the theoretical basis for this which depends upon literature;

and they left the students to acquire at a later period the requisite practical knowledge of the healing art under the guidance of a practising doctor, or in the hospitals. In consequence of this, the centre of gravity of a doctor's training was shifted away from the faculty and at the same time from the university, and this was especially the case in England, while in Germany from a frequent absence of the necessary institutions, and from scarcity and limitation of means, the practical training of doctors was in general neglected.

The course of medical studies, as a rule, was tolerably similar in the different universities, both from custom and in deference to the requirements of the law. The possession of a general preliminary training, including the subjects which were taught at the monastic and cathedral schools, and also at the town schools, was presupposed. If these institutions for the higher teaching existed in towns in which universities were afterwards established, they were incorporated with the latter, as in Paris, Prague, Vienna, and other places. Thus it came about that many students acquired at the university itself that preliminary training necessary for their future technical studies, the philosophical faculties almost taking the place of our gymnasia. This arrangement obtained at the Austrian academies in the form of the two yearly courses of philosophy, which had to be attended before the commencement of medical studies up till the year 1848, and in a modified form it exists at the present day in the universities of England. The Emperor FREDERICK II., we are told, issued an order that a general scientific education should precede the commencement of medical studies, and that three years should be devoted to the same. Gradually it became usual that in most academies the students before beginning medical study should graduate *in artibus*, or, at all events, should attend lectures in the philosophical faculty for a certain number of years. In Paris, after an attendance of two years at such lectures they could obtain

the degree of bachelor, and after three and a half years the license and the degree of master of philosophy.*

The period of studentship in the department of medicine lasted four or five years, but could be shortened by a half or a whole year if the student possessed an academical degree in the faculty of philosophy. This time was divided into two portions, the first comprising the first two or three years and ending with the examination for the degree of bachelor, while the second, forming the two last years of studentship, was concluded with the acquisition of the license to practise.

The medical teaching consisted chiefly of theoretical discourses. The medical writings of the ancients and their Arabian and Italian commentators formed the foundation for these. The teacher added technical explanations and remarks on his own practice to the reading of these books. The various subjects were generally apportioned among the teachers so that each particular theme, as anatomy, fevers, blood-letting, dietetics, materia medica, special pathology, surgery, etc., was treated in an exhaustive way.

The lecture rooms, as they appear in contemporary pictorial representations,† show us the teacher on a raised seat reading out of a bulky volume to his pupils, who are seated on forms or stand near him, and are engaged in copying down his words.

Concerning the subject-matter of medical lectures, a list of the studies of the medical faculty at Leipzig at the end of the 15th century gives us accurate information. It was there laid down as a rule that the first lecture in winter should begin at seven o'clock in the morning, in summer at six, and should deal with theoretical medicine. Three

* L. HAHN: Das Unterrichtswesen in Frankreich, Breslau 1848.

† Cod. Galeni Dresd., No. 92, fol. 20b, 30a, 39a, 296a. No. 93, fol. 587b, 608b.—CH. MEAUX ST. MARC: L'école de Salerne, Paris 1880 (Vignette).—LACROIX: Science et lettres au moyen-age, Paris 1877.—L. GEIGER: Renaissance und Humanismus, Berlin 1882, S. 408 (after a ceiling-painting of LAURENTIUS DE VOLTOLINA).

years were spent upon this subject, and in such a way that for the first year's lectures the first Canon of Avicenna, with the explanations of JACOBUS FOROLIVIENSIS, served as a guide; for the second year the *ars parva* of GALEN, with the commentary of TRUSIANUS; and for the third the Aphorisms of HIPPOKRATES, with GALEN'S remarks upon them. At one o'clock in the afternoon the lectures on practical medicine took place: these also claimed a three years' course. The foundation for the first year's lectures on this subject was the 9th book of the *Liber Medicinalis ad Almansorem* of RHAZES which contained pathology, with the remarks of JOH. ARCULANUS; for the second year the subject of fevers; and for the third general therapeutics, after the Canon of Avicenna, with the explanations of DINO DE GARBO and others.

Along with these regular lectures, delivered by appointed professors, certain doctors belonging to the medical faculty dealt with particular subjects in special lectures; the subjects being chosen by them as they liked, and being of such a nature as, for example, the Prognostics of HIPPOKRATES.

The course of study recommended to the students in 1520 by MARTIN STAINPEIS, professor in the medical faculty at Vienna, was of the same kind.* In his book he enumerates the medical writings which they should read, and arranges them according to their contents in such a way that they appear, if studied in orderly succession, calculated to make students acquainted by degrees with the several parts of medical science. Mention is there made of the most important medical authors of antiquity, and amongst the Arabs, with their expounders, and also of the works of a number of Italian doctors which had at that time obtained a considerable notoriety. STAINPEIS discusses the use of this reading to the future doctor,

* MARTIN STAINPEIS: Liber de modo studendi seu legendi in medicina, Vienn. 1520, f. vii *et seq.*—A. v. ROSAS: Geschichte der Wiener Hochschule u. bes. der med. Facultät, Wien 1843, i, 149 *et seq.*

and gives the advice that numerous students should always study together, in order that they may set one another right on things not clearly understood by any of their number. "Before going to sleep every student must, like an ox, chew the cud of what he has learnt during the day" (fol. xvii). In this way the first three years of medical studentship were passed. During the second half of this period, and consequently after obtaining the degree of Bachelor, the students of medicine occupied themselves with hearing lectures on special subjects, taking part in discussions which occurred every week under the superintendence of the professors, assisting at anatomical dissections, visiting hospitals and learning the practical treatment of diseases.

The discussions, which were usual even in the schools of the Iatrosophists of antiquity, and also were zealously carried on by the Arabs, formed an essential part of medical teaching. They were in conformity with the entire method of education of the scholastic period, which aimed rather at dialectic versatility than at depth of knowledge, more at dead scholarship than at that practical ability which life demands. Looking at their real effect, these discussions served as a useful completion of the theoretical lectures, for they gave the students an opportunity of showing whether they had, or to what extent they had, mastered the contents of the latter. They were also, as it were, examinations which the students subjected themselves to in the presence of their teachers and fellow-students. The learners were thus made acquainted with deficiencies in their knowledge and the teachers with imperfections in their teaching. Unfortunately these discussions frequently degenerated into an empty display of words, which did not advance the matter, but only satisfied personal vanity. "The young people," said JOHN of Salisbury, "pride themselves on their knowledge of HIPPOKRATES and GALEN, make use of unfamiliar expressions and introduce their aphorisms on every occasion." The

bachelors were also bound to teach the young students by translating and expounding extracts from the medical writings of the ancient authors, and by giving lectures on certain parts of medical science. Here, too, usage resulted in the formation of definite rules: thus it was established in Paris that there should be 50 lectures upon the Aphorisms of HIPPOKRATES, 30 upon the book *de regimine*, 38 on acute diseases, and 36 upon the Prognostics.* There is no doubt that this method of teaching had many advantages for the students. The Jesuits, who introduced it afterwards into their schools, have to thank it in great measure for the successful results which they obtained.

TEACHING IN ANATOMY.

MEDICAL teaching in the universities bore thus essentially a theoretical character; only in certain subjects were attempts made to join with it practical demonstrations. For while anatomy was taught chiefly from books, it was likewise illustrated by drawings and sketches, by the examination of the living body, and by the dissection of dead animals and of the human subject. Unfortunately but few anatomical drawings of this period have been preserved. HENRI DE MONDEVILLE, who was first a professor in Montpellier, and afterwards physician in ordinary to PHILIP LE BEL of France (1285-1314) added thirteen illustrations to his Anatomy, as GUIDO DE CAULIACO states.† The royal library at Berlin possesses the college note-book of a student, who in 1304 copied down the lectures delivered there; on the margin are rough pen and ink sketches, for which H. DE MONDEVILLE'S drawings served probably as a copy. A parchment manuscript of the beginning of the 15th century which is preserved in the Royal Library

* SABATIER *op. cit.*

† GUY VON CHAULIAC: Chirurgia, Tract. 1, doctr. 2, c. 1.

at Dresden* contains initials with drawings illustrating incidents in a doctor's life, and also several anatomical demonstrations. It appears evident from this that in teaching, naked persons were brought forward on whom the particular parts of the human body were pointed out and explained. Perhaps the internal organs were indicated by outlines upon the skin. The dissection of animals formed the aid to anatomical teaching in most general use. In Salerno, pigs were used, by preference, for this purpose; in other academies this example was imitated. Again, bears, monkeys, but especially dogs were made use of.† In the pecuniary accounts of the medical departments of this period the purchase of pigs and other animals for anatomical investigation sometimes played a not inconsiderable part. The dissection of the bodies of the lower animals continued to be usual, after that of the human subject had become an established thing, since an opportunity for the latter was but seldom afforded.

Dissection of the human subject was in the first centuries of the middle ages opposed by religious and political ordinances and also by social prejudices. It seems, that the doctors of that time were not entirely without this most important medium of medical education; but the anatomical knowledge of GALEN and his expounders satisfied them, and no desire for independent investigation was manifested by them. Doctors of intelligence certainly never failed to recognize the importance of anatomy to medicine;‡ but not before the 13th and 14th centuries

* Codex Galeni No. 92, 93, with the commentary of NICOL. v. REGGIO, No. 92, fol. 19b, 26b, 34b, 50a, 59a, 83b, 93b, 96b, 109a, 151a, 158a, 164b, 169b, 177a, 304a.—L. CHOULANT: Geschichte und Bibliographie der anatomischen Abbildung, Leipzig 1852, S. 2.

† MONDINO: de anatomia (matricis).—Mag. Richardus in HAESER *op. cit.* 1, S. 736.—J. HYRTL: Vergangenheit und Gegenwart des Museums für menschliche Anatomie an d. Wiener Universität, Wien 1869, p. xii.

‡ Thus TADDEO ALDEROTTI (1223-1303), declared that he could give no accurate information on the nature of pregnancy, since he had unfortunately never had an opportunity of dissecting a pregnant woman.—A. CORRADI:

were the obstacles removed which made its study difficult or impossible.

The Emperor FREDERICK II. exhorted the students of Salerno to give their attention to anatomy, and ordered that no surgeon should be allowed to practise before he had given proofs that he had devoted himself to the study of anatomy for a whole year. On the suggestion of MARTIANUS, Protomedicus of Sicily, he issued an order in 1238 that every five years a corpse should be dissected in the presence of the physicians and surgeons.*

At Bologna dissections of the human subject were probably carried on as early as the 13th century. In 1302, by command of the judge, even a medico-legal dissection was performed there, the suspicion having arisen that a man had been poisoned; two physicians and three surgeons were appointed to make this examination. From the description of this event it is not to be inferred that it was the first case of the kind but on the contrary that people already possessed some experience in such examinations and in the conclusions to be drawn from them.† For a similar reason GULIELMUS DE SALICETO is said to have dissected the corpse of the nephew of the Marchese PALLAVICINI.‡ The Franciscan monk SALIMBENI narrates that, during an epidemic which raged in Italy in 1286, a doctor opened the corpses of many persons who had died from the disease in order to find out its cause. During the great plague of 1348 several doctors made this attempt;§ unfortunately the results obtained were not of much value.

There was also no hesitation in preparing by boiling and maceration the bodies of celebrated persons for transport, when they died far away from their homes. This was done

Dello studio et dell' insegnamento dell' anatomia in Italia nel medio evo in the Rendiconti del R. istit. Lombardo, Milano 1873, ser. ii, vol. vi, p. 634.

* A. BURGGRAEVE: Précis de l'histoire de l'anatomie, Ghent 1840, p. 47.

† MEDICI *op. cit.* p. 5 *et seq.* 10.

‡ PUCCINOTTI: Storia della medicina ii, pars ii, 357.

§ A. CORRADI: Annali delle epidemie in Italia, Bologna pro a. 1286 and 1348.

in the case of the bishops, princes and nobles who in 1167 came with the army of FREDERICK BARBAROSSA to the neighbourhood of Rome and succumbed there to a pestilence,* and in the case too of the Emperor himself when he was drowned near Jerusalem in the river Saleph.† The corpse of LOUIS IX. of France who died in 1270 near Tunis‡ was treated in the same way; as also were the bodies of PHILIP THE BOLD and his Consort.§ Pope BONIFACE VIII. forbade this practice in 1300 ‖ and in so doing robbed anatomical inquiry, precisely when it was starting afresh, of an aid, the loss of which was sensibly felt. MONDINO wrote that certain bones can only be properly recognized, after they have been prepared by boiling but that he did not so prepare them himself as he was fearful of committing a sin.¶ His commentator BERENGER of Carpi, indeed, says of him that he did not always offer resistance to this sin and, in spite of it, sometimes boiled human bones.**

MONDINO, who practised the profession of teaching in Bologna, performed a great number of dissections.†† He himself states, in speaking on a certain occasion of the comparative size of the uterus in the young female during menstruation and in pregnancy, that in 1315 he dissected two female subjects.‡‡ His prosector OTTO AGENIO of Lustrula and a young lady ALASSANDRA GILIANI of Persiceto are said to have assisted him in his work.§§

* G. H. PERTZ: Monum. Welforum ant. in Script. rer. German., Hannov. 1869, p. 41.

† BENEDICTUS PETROBURG: Gesta regni Henrici II. in Script. rer. Brit. med. ævi, London 1867, T. 49, Vol. ii, p. 89.

‡ CORRADI *op. cit.* anno 1270.

§ MURATORI: Rer. script. it. viii, 861.

‖ Decr. de sepulturis.—*Vid.* also CORRADI: Dello studio dell' anatomia *op. cit.* p. 865.

¶ MONDINO: De anatomia auris.

** Comment. Bonon. 1521, f. 510.

†† *Multoties*, as GUY VON CHAULIAC writes in his Surgery (i, 1, 1).

‡‡ MONDINO: de anatom. matricis.

§§ Although AL. MACCHIAVELLI (Effemeridi sacro-civili, Bologna 1736, p. 60 *et seq.*) says of the latter that she knew how to clean the blood-vessels even to

Practical instruction on the dead body was concluded in four lessons, as is stated by GUIDO DE CAULIACO, who had attended those of BERTUCCIO, a pupil of MONDINO. In the first lecture the organs of nutrition that is to say those of the abdomen were described "since these fall into decomposition most rapidly," in the second the *membra spiritualia* namely the thoracic organs, in the third the *membra animata* (the brain) and in the fourth the extremities.* In order to see and to study the ligaments, the cartilages, the joints, the larger nerves, etc., the bodies were dried for a considerable time in the sun, buried in the ground to putrify or placed in running water, sometimes in boiling water. Many anatomists, like the Magister RICARDUS, considered such treatment of the human body to be "horrible" and preferred therefore to teach anatomy on the bodies of the lower animals. Others were induced to adopt a similar course not so much by a religious dread as by the circumstance that opportunities for dissection of human bodies occurred but seldom.

Many doctors provided themselves with bodies, when they could not get them in a legitimate way, by theft. Thus a trial took place at Bologna in 1319 in which a teacher of medicine at that place and four of his pupils were charged with having taken home with them out of the grave the corpse of a man who had been hanged, for the purpose of dissecting it.† Such cases may pretty often have happened at that time. People countenanced this procedure, and while unwilling to give them freely, allowed the corpses to be taken. "The laws against the desecration of graves were silent" as CORRADI‡ says "without being abolished:

their minutest branches without tearing them and that she then filled them with a coloured fluid which after coagulating allowed the form of the vessels to be plainly seen, this statement is not confirmed by any ancient writer. It is certainly improbable that the art of injection was already known at a time when anatomy was but little advanced. *Cf.* M. MEDICI *op. cit.* p. 28 *et seq.*

* GUY V. CHAULIAC: Chirurgia *op. cit.*

† MEDICI *op. cit.* p. 36, 427 *et seq.*

‡ CORRADI *op. cit.* p. 642.

and the authorities interfered only if decided violence had been used or a great scandal raised."

Only quite gradually was legal permission granted for dissection of the human body. The Senate of Venice in 1368 issued an order that a dissection should be performed once a year in order that physicians and surgeons might inform themselves upon the relative position of the different parts of the body.* The university of Montpellier was granted the right in 1375 of dissecting† every year the body of a criminal on whom the death sentence had been carried out, and the university of Lérida was in 1391 granted the same privilege by King JOHN I.‡ He decreed that the town authorities should deliver over for this purpose the corpse of a criminal who had been put to death by forcible submersion in water, in order that the body should be completely uninjured. FERDINAND THE CATHOLIC permitted the physicians and surgeons at Saragossa to open the bodies of persons who died in the hospital there if they considered it would serve any useful purpose,§ and the Pope confirmed this permission in the case of the doctors of the Monastery della Guadelupe in Estremadura.‖ The medical faculty at Tübingen received permission from Pope SIXTUS IV. in 1482 to dissect the bodies of executed criminals.¶ In the statutes of the university of Bologna of the year 1405 it was enjoined "that no doctor or student of medicine, or anyone else, shall appropriate a corpse without permission of the Rector." On a dissection being held under the guidance of a professor, a definite number of students were invited

* CORRADI *op. cit.* p. 635.

† ASTRUC *op. cit.* p. 32.

‡ GERMAIN *op. cit.* iii, 134.—DENIFLE *op. cit.* i, S. 507.

§ A. H. MOREJON: Historia bibliografica de la medicina espagñola, Madrid 1842, i, 252.

‖ MOREJON *op. cit.* ii, 25. Unfortunately he does not say when this occurred.

¶ L. F. FRORIEP: Die anatomischen Anstalten zu Tübingen, Weimar 1811, Beil. i, 14.

to be present at it; no more than 20 might attend at the dissection of a male subject; at that of a female—a rarer event—no more than 30; so that everyone might see distinctly. No student was allowed to attend these demonstrations until he had attended medical lectures for two years. The Rector had to take care that all medical students in turn should have the opportunity of seeing dissections, and that the members of all student-corporations should be equally respected in receiving invitations to be present at them. On this ground a rule was made that no student who had seen the dissection of a male body should be invited a second time in the same year to a similar demonstration. If such took place in the following year of studentship he was generally not again invited to the dissection of a male but only of a female subject, so that under favourable circumstances he might during his studentship assist at the dissection of two male subjects and one female. The students who were present had to bear the expense of getting, removing, preparing and burying the corpse; this, however, was not allowed to exceed 16 Bologna pounds for a male, and 20 for a female body. Of this sum the professor who performed the dissection received 100 solidi. The members of the Teachers' College relieved one another in this function; no teacher was at liberty to decline the demand of the students that he should undertake the dissection of a corpse.*

In 1442 it was ordained by law that the authorities or magistrates of Bologna should deliver over to the university every year two corpses, one male and the other female, or when the latter could not be obtained both male, for anatomical dissection. It was not here prescribed that the bodies should be those of criminals who had been executed, but it was left to the judgment of the magistrates to procure them in whatever way it was possible (*quo modo cumque fieri poterit*); only they were not allowed to make

* Statut. dell' univ. di Bologna v. 1405, Rubr. 96, in CORRADI: Dello studio dell' anat. in Italia *op. cit.* p. 638 *et seq.* 647.

such use of the bodies of persons whose homes had been in Bologna.* The same conditions obtained in Padua, Ferrara, and Pisa.† In general, care was taken to devote to anatomical investigation the bodies of criminals on whom the punishment of death had been carried out. The populace, as in the ages of antiquity, regarded the mutilation and cutting to pieces of the dead body as a desecration, to which one was at liberty to expose only those persons who, by their execrable crimes, had drawn general contempt upon themselves. As the demands of science increased, this method of getting dead bodies did not suffice, and people were obliged to find out how to procure them in other ways. But even then the principle was adhered to of employing for this degrading purpose (as it was thought to be in the opinion of the public) only the bodies of strangers, or, if of natives, then only those of lowly origin. If in Pisa the dead bodies of the burgesses of the town, and of the students and doctors, with the consent of their relatives, were used for this purpose it was an exception, and is probably explained by the democratic spirit which prevailed there at the time.‡

Practical teaching in anatomy was developed in the universities of other countries at a later period, and to a much smaller extent than in the academies of Italy. Not until the 15th century were such demonstrations commenced in Paris. In Prague, anatomical dissections took place from the year 1460, after the medical faculty there had, by a present, come into possession of a house of its own.§ In Vienna, Professor GALEAZZO DI S. SOFIA, who had been called thither from Padua, instituted in 1404 the first anatomical demonstration, a male subject being given up to him for this purpose. It took place in the town hospital, and lasted eight days. At the conclusion the

* Statut. v. 1442, Rubr. 19, in CORRADI *op. cit.* p. 648.

† CORRADI *op. cit.* p. 638.

‡ FABRONI: Hist. Acad. Pisan., Pisa 1792, T. ii, 73.

§ HYRTL: Geschichte der Anatomie in Prag., 1841, S. 9.

professor collected money from the spectators, which was poured into the chest of the faculty.* Twelve years passed before the next public anatomical dissection took place; it was repeated again in 1418. To this demonstration doctors and students of medicine, surgeons, apothecaries and other persons of learning or distinguished position were invited. In 1433 a special lecturer on anatomy was appointed, Dr. JOH. AIGEL, of Nürnberg. The faculty was in 1440 disappointed in its expectation of an anatomical dissection in a singular manner. The body of a criminal, who had been hanged, was for this purpose given over to it; but when they were about to begin dissecting, the man came to life again. As a result of this he was pardoned, and sent away in charge of the beadle of the university to Alt-Ötting, his home, in Bavaria, where he afterwards on account of fresh crimes died on the gallows. In 1452 for the first time in Vienna a female subject was dissected; only physicians and surgeons were allowed to be present. In the 15th century an anatomical demonstration on a corpse took place about once in every eight years. The statutes of the medical faculty at Tübingen of the year 1497 decreed that every three or four years a human body should be publicly dissected; on these occasions a professor had to read the descriptive account from MONDINO'S Anatomy to the spectators. A similar course was adopted in the other German academies.

It is not astonishing that under these conditions the science of anatomy made at that period no visible progress. MONDINO'S anatomical work, the first produced since ancient times the author of which had dissected human bodies, showed, nevertheless, no advance upon the position taken by GALEN. Resting on a teleological foundation, it gives about 80 pages of rather bare description to the position of the different parts of the body, *i.e.*, the organs of the three great cavities of the body and to their presumed uses; of the muscles, those only of the abdominal parietes are thoroughly

* HYRTL: Vergangenheit und Gegenwart *op. cit.* S. viii.

described; numerous notes upon diseases and operations on particular parts of the body, which are scattered about among the descriptions, indicate the purpose the book was intended to serve. At the same time it gained an extraordinary reputation, and formed for more than three hundred years the favourite text-book of anatomy. Neither did anatomical knowledge receive any noteworthy advancement from GUIDO DE CAULIACO, MATTHÆUS DE GRADIBUS, PETRUS DE ARGELATA, and their successors. The rough woodcuts which the Leipzig professor MAGNUS HUNDT added* to his work on anatomy cast a lurid light on the condition of anatomy in the 15th century. The anatomical drawings in the work of JOHANNES DE KETHAM occupy a higher position, proceeding as they do in part from the hands of skilful artists like B. MONTAGNA.

TEACHING IN PHARMACY AND IN MEDICAL PRACTICE.

OPPORTUNITY was afforded for the study of medicinal plants in the gardens adjoining many of the monasteries. Many doctors moreover laid out gardens of this kind, as MATTHÆUS SYLVATICUS at Salerno, and the Magister WALTER in Venice, to whom the Senate assigned† a site for the purpose. But the universities at this period did not yet possess this valuable aid to teaching, and the knowledge of medicinal plants was chiefly communicated by theoretical teaching and by books which were sometimes embellished with botanical drawings. The students learned how to recognize drugs and how to prepare remedies in the dispensaries, which arose in all the larger towns from the 13th century onwards. STAINPEIS recommended students and young practitioners frequently to visit dispensaries with this object. FELIX PLATTER‡ narrates

* CHOULANT *op. cit.* S. 24. † MEYER *op. cit.* iv, 255.

‡ PLATTER *op. cit.* S. 151.

"that in addition to continual studying and attending of lessons in Montpellier he made a frequent practice of observing the preparation of all kinds of medicines at the dispensary," and he collected many herbs which he "neatly" wrapped in paper.

The apothecaries got the greater part of their drugs from abroad, and a stirring trade developed in these articles in the middle ages, travelling from the East through Italy.* In addition to medicaments, the apothecaries' shops contained other articles for sale, as various spices and aromatics, wax candles, paper, sugar, and sweets; in many places, especially in Germany, the apothecaries carried on at the same time the trade of ginger-bread bakers, and were bound to send every year in Lent as a present to the councillors all kinds of dainties.† A contract dating from 1424, in which an apothecary undertook to supply the necessary medicaments for the ducal Court at Este, gives us information concerning the drugs which at that time were kept in store in the dispensaries and were chiefly used.‡ This information is supported and completed by certain statements made upon the contents of a dispensary at Kosel, in Silesia, in 1417,§ and upon the drugs and medicaments which the apothecaries in Frankfort-on-the-Main sold in 1450.‖ Certain drawings in the already mentioned Dresden Codex, and in various early editions of medical works, give a clear picture of the arrangements of the dispensaries of that period.¶

* W. Heyd: Geschichte des Levantehandels, Stuttgart 1879, ii, 550 *et seq.*

† A. Philippe: Geschichte der Apotheker, übers. v. H. Ludwig, Jena 1859, i, S. 87.

‡ A. Corradi: Su i documenti storici spett. alla medicina, chirurgia, farmaceutica, in Annal. univ. di med., Vol. 273, Milano 1885.

§ Henschel in the Janus, Breslau 1847, ii, 152.

‖ J. C. Flückiger: Die Frankfurter Liste, Halle 1873.

¶ Cod. Galeni No. 92, fol. 181b, 182a, 193a, 265a, 266a.—Choulant in Naumann's Arch. f. d. zeichnenden Künste, Leipzig 1855, Bd. i, 2, S. 264.—H. Peters: Mittelalterliche Apotheken im Anzeiger des germ. Nationalmuseums, Nürnberg 1885, Bd. i, H. 1-2.—A. Essenwein in d. Beil. z. Anz. d. germ. Nat., Bd. i, No. 11-12.

The apothecaries in Italy and France as early as the 13th century formed confederacies, which framed their own laws and kept a strict watch to see that their rights were not encroached upon.* In Germany the first apothecaries' shops are said to have been erected at Wetzlar in 1233, at Schweidnitz in 1248, at Würzburg in 1276, at Augsburg in 1285, at Esslingen in 1300, and at Frankfort-on-the-Main in 1343. In the 15th century, not only every considerable town, but many also of the middle-sized and small ones, had apothecaries' shops, as, for example, Znaim, Pressburg, Krems, Budweis, Olmütz, Brünn, and Kuttenberg.† The education of the apothecaries was that of men training for a handicraft.‡ The works of NICOLAUS MYREPSOS, NICOLAUS PRÆPOSITUS, CHRISTOPHOR DE HONESTIS, SALADIN of Asculum, QUIRICUS DE AUGUSTIS, and others served chiefly as the text-books.

Before permission to practise their business was granted to apothecaries they had to undergo an examination in which their masters and some doctors put the questions. Superintendence of the apothecaries' shops and visits of inspection were duties assigned to the doctors, and at a later period were especially performed by the town-physicians.

Instruction of a practical nature in the treatment of the sick was also, like practical treaching in materia medica, a task which the universities did not impose upon themselves. But we must not from this at once draw the conclusion that the students of that time as a general rule received no clinical instruction. Celebrated historians have formed this erroneous opinion because in the accounts which deal with the more ancient history of the academies and medical faculties little or nothing is said on the subject. Practical instruction in the treatment of the sick was inde-

* A. CORRADI: Gli antichi statuti degli speziali in Annali univ. di med., Vol. 277, Milano 1886.

† STAINPEIS *op. cit.* f. 29.

‡ STAINPEIS *op, cit.* f. 29b.

pendent of the universities because the latter were not in connection with hospitals. When the student of medicine had passed his bachelor's examination he endeavoured to educate himself in medical practice under the guidance of the teacher whose theoretical lectures he had attended, or of some other experienced doctor. For this purpose he accompanied him when he visited his patients, and took pains to get an opportunity at the hospitals of seeing how people were relieved in their sufferings, and of learning the art of giving such relief. As soon as he had acquired some knowledge of this subject he was allowed to assist and represent his master, and might begin, under the supervision and on the responsibility of the latter, himself to treat the patients. This method of medical education, which resembles that of to-day, was recommended in the arrangement of medical studies made by the Emperor FREDERICK II.

The young doctors at Salerno were placed, as has been said, at the conclusion of the period of studentship as prescribed by law, under the supervision of an older practitioner for another year, as a necessary preliminary to the independent exercise of their calling.

In the manuscript of GALEN belonging to the 15th century, preserved at Dresden, which has already been mentioned several times, numerous initial miniatures are found which refer to clinical teaching. Thus No. 93 fol. 461b shows a picture of a patient suffering from marasmus, and lying in bed; near him stands a doctor dictating a prescription to his pupils; two nurses are also present. The illustration on fol. 565b represents a doctor demonstrating to his pupils two patients whose legs are covered with ulcers. Fol. 468b shows a surgical operation on the leg which the pupil is performing in presence of his teacher; 500b, the opening of an abscess in the axilla. In Cod. 92 fol. 268b is seen a clinical visit to children, and on fol. 158a and fol. 295b naked pregnant women are represented.*

* *Cf.* also Cod. Galeni No. 92, fol. 7b, 17b, 43a, 75b, 121a, 128a, 208a, 224a. No. 93, fol. 458a, 471b, 475b, 482b, 496a, 504a, 535b, 560b.

In Montpellier, where a hospital existed as early as the year 1198, it was usual for the students of medicine, after obtaining the bachelor's degree, to practise medicine under the guidance of an experienced physician. ASTRUC* brings forward several instances in the biographies of the earlier teachers of medicine at the school of Montpellier, where this system was observed and by no means looks upon them as exceptions but as the general rule. The medical faculty of Paris in 1449 required of the bachelors that they should diligently visit the hospitals or accompany a skilful practitioner in his visits to patients and refused to grant them the license when this rule was not observed.†

In the oldest statutes of the medical faculty of Vienna dating from the 14th century the rule is laid down that bachelors of medicine must practise the healing art within the walls of Vienna only with the knowledge and under the guidance of their teacher or of some other doctor of the faculty of Vienna.‡ STEINPEIS gave the students excellent advice as to how they should act on these occasions.§ Above all things, he says, it is important to find out the cause of the disease; then the ailing part of the body may be carefully inspected and finally the rest of the body submitted to a careful examination.

At the university of Ingolstadt the bachelors of medicine, according to the statutes of 1472, were obliged to take an oath before the Dean that within the city and for six miles round they would visit the sick and practise only if sent as

* ASTRUC *op. cit.* p. 236 (*après son baccalauréat il alla en Provence pour y exercer la médecine, suivant l'usage de ce temps-là*), p. 243 (*après quoi il alla passer le temps, qu'il étoit alors destiné pour s'exercer à la pratique après le baccalauréat*), etc.—*Cf.* PLATTER *op. cit.* S. 154.—In the statutes of 1240 is found: *Item nullus magister presentet aliquem* (for the License) *nisi ille steterit in practica extrà villam Montispessulani per dimidium annum* (in GERMAIN *op. cit.* iii, 424).

† HAZON: Eloge historique de la faculté de médecine de Paris, 1770, p. 20 (*qu'ils suivissent les hôpitaux ou la pratique de quelque maître pendant le cours de la licence, faute de quoi ils n'étoient point admis à ce degré*).

‡ J. ZEISL: Chronol. dipl. universit. Vindob. Vienn. 1755, Statut. p. 80.

§ STAINPEIS *op. cit.* f. 102b *et seq.*

the representatives of their teacher or of some other doctor of the faculty of that place.* They thus performed nearly the same functions as practitioners of our day at the policlinical institutions of many academies.

In the middle ages there was no lack of hospitals in which bachelors of medicine could find opportunities for acquiring practical education in the healing art. The great number of these institutions must excite in us the more astonishment inasmuch as only a certain proportion of them is known to us. The information which has reached us concerning them is incomplete and defective. So much of it as refers to Germany, or as deals with leper-houses has been collected by VIRCHOW.† Besides this, rich material lies scattered in archives and libraries: many sources of knowledge are probably as yet undiscovered. It would be a thankworthy task, to write a history of the foundation and development of hospitals in the middle ages, and would cast many a ray of light upon the history of medicine and the general history of civilization. Christianity had called into existence a number of charitable institutions, as I have explained on a previous page. Wherever its doctrines were made known and found adherents, houses for the poor and infirm of all kinds arose by the side of churches and monasteries. The Christian missionaries, who travelled from Italy and France to the countries of Northern and Eastern Europe were carriers of civilization, preaching humanity and spreading knowledge —at least in so far as it did not come into conflict with their own interests. Christian charity celebrated imperishable triumphs in founding numerous clerical and lay Orders the members of which made the care of the sick the task of their lives. An enthusiasm of philanthropy filled all hearts in a way seen but once in the history of the world. High-born princesses and poor peasants, knights and burghers vied

* C. PRANTL: Geschichte der Ludwig Maximilians-Universität zu Ingolstadt, Landshut, München 1872, i, 50. ii, 43.

† VIRCHOW's Archiv., Bd. 18, S. 138-162, 273-329.—Bd. 19, S. 43-93.—Bd. 20, S. 166-197, 459-512.

with one another in works of mercy. It is quite possible, that many were induced to consecrate their lives to the service of mankind, not so much by ideal love as by hopes of reward in the world to come, and other less noble influences; but is this a reason why their good deeds should have conferred fewer blessings? The longing and striving after ideals, which men, discontented with the present, believed to be realized in the supersensuous world of the future, had an ennobling effect upon character, tempered harshness of manner and threw a charm round many an undertaking which otherwise might have seemed foolish or despicable. This feature of romance was peculiarly impressed on the aspect of the Crusades, in which a wild craving for adventures and low covetousness were associated with piety and simple faith. Even if the particular object of these military expeditions was not, or only temporarily, attained,—the object namely of emancipating from the Muhammedan dominion that land, once the cradle of Christianity,—yet many results advantageous to the development of civilization accrued therefrom; for by means of these wars commercial relations were opened up between the Orient and the Occident, the intellectual horizon of Europe was enlarged, and the feeling of mutual dependence was awakened among the Christians in their intercourse with people professing another faith. This feeling manifested itself in the foundation of hospitals and of Orders and united people differing in creed in a common work for the welfare of the sick.

The large hospital which the Knights of St. John possessed in the 12th century in Jerusalem was able to accommodate 2,000 patients. It consisted of numerous buildings supported by 124 marble columns as we are informed by the Knight Sir JOHN MANDEVILLE. Five physicians and three surgeons, who were appointed to this hospital, took charge of the medical service.* In 1236 the Order possessed 4,000 lodges which were distributed over the different countries

* F. v. RAUMER: Geschichte der Hohenstaufen, Leipzig 1858, vi, 439.

of Christendom; but only a century later Pope CLEMENT VI. complained that the distinguished Knights of the Order took more pleasure in beautiful horses and dogs, in banquets, fine clothes, gold and silver vessels and valuables of all kinds, and generally in the accumulation of riches than in the care of the sick and the giving of alms.*

The German Order also, having erected a large number of hospitals, disregarded, after the 14th century, more and more the care of the sick and preferred gaining political power by conquests in war.

The Order of the Lazarists, which arose in Palestine and undertook the task of attending to the wants of lepers, founded a multitude of leper-houses.† When leprosy, as the result of improvements in hygiene and a more correct diagnosis of the various ailments which people had up to that time included under the name, gradually diminished and become wholly extinct in certain countries as early as the 16th century, the Knights of St. Lazarus felt themselves excused from their duty of nursing the sick.

The civil societies for the care of the sick attached themselves more loyally to this task, even if some of these too degenerated at a later period.

The Order of the Holy Ghost was a creation of Pope INNOCENT III., who had formed it as an instrument for enabling him to bestow upon sick-nursing an organization embracing the whole of Christendom.‡ As VIRCHOW says, it must needs impress us favourably and may help, at the same time, to reconcile us to "this strong man who humbled the Emperor and deposed kings, the unappeasable persecutor of the Albigenses," to note that he "yet looked mercifully upon the poor and the sick, and sought out the helpless and miserable."§ The Order of the Holy Ghost is first

* J. TAAFFE: The history of the holy military sovereign order of St. JOHN of Jerusalem, London 1852, ad ann. 1343.

† F. v. RAUMER *op. cit.* vi, 534.

‡ HURTER: Geschichte des Pabstes Innocenz III., Hamburg 1842.

§ VIRCHOW: Gesammelte Abhandlungen, Berlin 1879, ii, S. 24.

mentioned in a document of the year 1198; already at that time it possessed two hospitals in Rome, one in Montpellier and seven others elsewhere in France. In 1204 the Hospital of the Holy Spirit, built by INNOCENT III., was consecrated at Rome; the site on which it was erected is said to have borne the old Saxon Hospice at so remote a time as the 6th century under Pope SYMMACHUS.* The Order of the Holy Ghost displayed extraordinary activity. Even soon after its origin it erected hospitals at various places, as, for example, at Zürich, Halberstadt, Vienna, Spandau, Breslau, Riga, Lübeck, Bremen, and Hamburg, or undertook the direction of those, which previously existed, as at Memmingen, Freiburg-im-Brisgau, Mainz, and Ulm. VIRCHOW has collected information concerning 154 hospitals of this Order in Germany, which, with a few exceptions, were founded in the 13th and 14th centuries.† There existed, besides, many other hospitals conducted by other societies for nursing the sick.

The foundation of charitable institutions followed the path taken by advancing civilization in Europe. Italy, France, Southern and Western Germany took the lead, and the Northern and Eastern countries of our continent followed them. In order to form an opinion on this movement and its results in particular cases, it is best to fix one's eyes on a limited district. Thüringen, Saxony, Brandenburg, Pomerania, and Silesia,—those countries, in fact, which at that time formed approximately the boundaries of civilization,—were, as early as in the 13th century, richly provided with hospitals and leper-houses;‡ even small places, the names of which are scarcely mentioned in history, possessed institutions of this kind. In Silesia we find them in the following towns at the dates given:—Breslau (1214), Kloster-Trebnitz, Neisse (1226), Neumarkt

* C. L. MORICHINI: Degli istituti di carità, Roma 1870, p. 99.—GREGOROVIUS: Geschichte der Stadt Rom im Mittelalter, Stuttgart 1859, ii, 467.

† VIRCHOW *op. cit.* ii, 45 *et seq.*

‡ VIRCHOW's Archiv, Bd. 18, S. 150 *et seq.*, 275 *et seq.*, 310 *et seq.*

(1234), Bunzlau (1261), Brieg (1273), Glatz (1275), Münsterberg (1276), Liegnitz (1280), Sagan (1283), Steinau (1290), Ratibor (1295), Gr. Glogau (1296), Görlitz (1298), Sprottau and Schweidnitz (1299), Beuthen (1302), Oels (1307), Frankenstein (1319), Freistadt (1320), Löwenberg (1322), Leubus (1330), Strehlen (1347), Goldberg (1348), etc. Certainly the references made to these are incomplete and unprecise, but they give us a picture of the abundant preparation which had been made for the care of the sick. It may be fairly assumed that in countries the civilization of which was older and of more advanced development, and the wealth of which was greater, the arrangements made were certainly not worse, but probably better. Frankfort-on-the-Main possessed in the 13th century three or four hospitals.* The Katharinen-Hospital at Regensburg, erected for the sick and infirm, had 250 patients in the middle of the 13th century. Such a number formed certainly an exception at that time, for most of the hospitals were small, and could take in only a few persons. The directors of the Regensburg institution drew attention to the fact that it was over-crowded, and that as a result the air was polluted and diseases were communicated to the healthy. The extent to which want of cleanliness and unsanitary conditions prevailed in the 15th century at certain hospitals is indicated by the severe remarks which THOMAS PLATTER made concerning his sojourn in the hospital at Breslau.†

As yet, unfortunately, but little investigation has been made to what extent and in what way the hospitals of the middle ages approached the subject of teaching medical students and young doctors. The erection of institutions for the sick in many places was effected before the settlement in such places of scientifically trained doctors. Sick nursing thus generally precedes medical treatment.

* G. L. KRIEGK: Deutsches Bürgerthum im Mittelalter, Frankfurt a. M. 1868, i, S. 76 *et seq.*—W. STRICKER: Geschichte der Heilkunde in Frankfurt a. M. 1847, S. 129.

† PLATTER *op. cit.* S. 22.

MEDICAL EXAMINATIONS.

THE medical examinations, which students of medicine had to pass, before being permitted to practise, had their prototype in the arrangements made by the Emperor FREDERICK II. at Salerno. In course of time however the place of the single examination, occurring at the conclusion of the studies, was taken by examinations for the degree of Bachelor, for the license, and for the degree of Magister or of Doctor. These academical degrees were apparently first introduced at Bologna and Paris. In Salerno and Naples they were instituted by CHARLES of Anjou in 1278 and 1280, as appears from the documents cited by S. DE RENZI.* All candidates for the degree of bachelor of medicine, were obliged to have attended medical lectures for two or three years and then to give proofs in an oral examination held before members of the medical faculty that they had acquired a general theoretical knowledge of the several branches of medical science. By a solemn act, the "determination," in which the candidate discussed a scientific question which had been propounded to him, he was transferred from the class of the scholars into that of the "baccalarii" as they were called in the corrupt Latin of the middle ages. The word is by some commentators, associated with *baculum,* a stick, which is said to have been handed to the bachelors presumably as a token of their new dignity.† It may with greater probability be derived from *bacca lauri:* it recalls the crowning of poets with the laurel-wreath, of which mention is made in the history of the middle ages. After an interval of two or three years, which the candidate made use of to acquire more extensive education in his department of learning and especially practical training, the examinations which preceded the conferring of the license followed the bachelor's

* S. DE RENZI: Storia docum. della scuola med. di Salerno, Doc. No. 287, 291.

† DE RENZI: Storia docum. della scuola med. di Salerno, p. 556.

degree. Before granting this it was required that the bachelor besides having attended lectures should have taken part in discussions, and should have been catechized by the professors on more than one occasion, should have given lectures himself, have assisted at anatomical demonstrations and have thoroughly trained himself in the practical art of healing. The examinations were moreover held by the medical faculty and consisted of the exposition of one of the aphorisms of HIPPOKRATES, the description of certain diseases and the answering of questions connected with these subjects. If the result was favourable, the candidate was presented by two members of the faculty to the Chancellor of the University, who conferred the license upon him in a solemn manner.

As the dignity of Chancellor was always vested in a high ecclesiastic who looked upon himself as the representative of the Pope, the highest patron of teaching, it resulted that this act took place in the Church. It bore therefore somewhat of a religious character, which excluded members of other faiths, as for example Jews, from obtaining the license: but even at a very early period a way out of this difficulty seems to have been found, the granting of the license in such cases being transferred to the faculty.* The doctors, who had in the examinations shown their fitness for medical practice and had received permission to practise, were called Masters or Magistri.

After the title of Doctor had become usual among the jurists at Bologna † and had found entrance into all schools of law, the medical faculties began also to make use of it. The word "Doctor" occurs even in the literature of antiquity ‡ and there indicates a teacher (from *docere*). In this sense the title of Doctor was given also

* DE RENZI *op. cit.* p. 558, 572.

† SAVIGNY *op. cit.* i, 476.—GRUNER's Almanach für Ärzte, Jena 1789, S. 250 *et seq.*

‡ CICERO: de orat. i, 19.—SUETON.: Cæsar c. 42.—Valer. Maxim. ii, 3.—QUINTILIAN: Instit. orat. xi, 3, xii, 2.—ERSCH and GRUBER: Encyklop. sect. 1, Th. 25, S. 237 *et seq.*

by the medical faculty to those who were actively engaged as teachers of medical science. This was the case at most of the academies as early as the 13th century. And as the right to teach was possessed by every medical man who was legally qualified for the practice of his profession, so also was the title of Doctor gradually conferred upon all legally qualified practitioners. When people began to distinguish between the *Doctores legentes et non legentes,* —between those who made a practice of teaching and those who neglected to do so—the custom arose of calling the former Professors.

This expression also draws its origin from ancient times;* it comes from *profiteri* "to practise or teach publicly an art or science." At the German universities the title "Professor" came first into vogue in the 16th century and only those academical teachers were designated by it who were commissioned to hold lectures and for the instruction they imparted in this way drew a salary or remuneration. They were in fact members of the College of Teachers, called, at an earlier time, *Doctores legentes.*

The change in the significance of titles and forms of politeness, which is effected in course of time, has its foundation for the most part in human vanity. At the present time it is the case with the title of Professor as it formerly was with that of Doctor; it is bestowed on members of the medical profession who hold themselves quite aloof from the function of teaching, whereas many academic teachers are already less inclined to bear the title of Professor than such titles as Geheimrath, Hofrath, or Regierungsrath.

Anyone who possessed a qualification to practise medicine could obtain the dignity of Doctor of Medicine. No special examinations were necessary for this; on the other hand it was demanded that the candidate should be

* Celsus: Præf. and ii, 6.—Sueton: Rhetor. 5.—Quintilian: Inst. orat. Prooem, and i, 9. xii, 11.—Savigny *op. cit.* i, 396.—H. Conring: Antiq. acad. i, 25.

of honourable and legitimate descent, of irreproachable character and respectability, at least 26 years old, without bodily defect or deformity. In some universities the age was fixed at 28 years, and a concession in respect of age was only allowed if the candidate did not look too effeminate and young. Persons who were misshapen or repulsively ugly were not allowed to take this degree, and, truly, for a singular reason, namely lest pregnant women seeing them might bear children with marks to correspond.

The act of promotion was associated with a public discussion and various ceremonies which were intended to typify the acceptance of the candidate into the medical corporation, and to bring plainly before his eyes the high significance of his new dignity. The ceremony was performed with the co-operation of the whole faculty, and amid the ringing of bells. It began with a discourse by the candidate for the doctor's degree, the merits of which were reviewed in a speech by the professor, who conducted the proceedings. The candidate then took an oath that he would always fulfil his duties to the faculty and the medical profession generally; hereupon the so-called 'doctor's hat' was placed upon his head, a ring put on his finger as a token of the knightly rank, to which the dignity of doctor was considered equivalent, a golden belt fastened on him, and a book of HIPPOKRATES opened before him. He was then invited to sit down by the side of the President, who, embracing him, conferred a blessing upon him. The ceremony closed with the thanks of the new doctor, and was followed by a banquet in which all members of the faculty took part. The expenses of this, in addition to the fees which were paid and the presents which were given to various persons, made the promotion to the degree of doctor a rather costly affair. In Vienna the candidate was under the obligation of presenting one doctor of the medical faculty with a complete attire; 14 ells of good cloth had to be used for this. For the rest, he was by no

means forbidden to gratify several of his colleagues in this way. Moreover, every doctor of the faculty received a cap and a pair of woven gloves, every licentiate and bachelor a pair of ordinary gloves "in choosing which, however, the reputation and honour of the faculty are to be respected." *

Similar demands were made at other universities. The expenses caused by the promotion to the higher degree in Paris reached the largest amount. Poor candidates for the Doctorate, if distinguished for their learning, were exceptionally excused the high charges and at certain academies this practice was carried out regularly at stated intervals.† Many were repelled by the charges connected with promotion from taking it, and were content to practise medicine as licentiates. The latter enjoyed in respect of medical practice the same rights as the doctors. The only difference between them consisted in this, that the doctors were accredited members of the faculty in the enjoyment of full rights, consulted together upon the business matters connected with it, determined its laws, and shared in certain privileges. It was a characteristic feature of the *Studium generale* that the degree of doctor was of recognized value in all countries of Christendom. It is true, that even in earlier times some limitations were imposed on this privilege; they, however, restricted not so much the right of practising medicine as a calling, in any and every locality, as they did the claim of an alien doctor to be received as a member enjoying full rights in the medical faculty of a university not his own. The faculties saw in promotion an important source of income, which was encroached upon if doctors who had received the higher degree in a foreign academy were without any further ceremony regarded as members of their own. Thus the doctors of Bologna in 1298 refused to receive a colleague—the son of a citizen of that town—into their

* Rosas *op. cit.* i, S. 35.—Hautz *op. cit.* i, 160.

† Coppi *op. cit.* p. 204.

own society, because he had taken the degree of Doctor of Medicine in Salerno and was not yet 30 years old. He answered with some self-importance that he made up for the scarcity of his years by the abundance of his knowledge.* Between Paris and Montpellier continual quarrels of this kind prevailed and such also was the case with other high schools. An end was only put to this state of things when it was arranged that doctors seeking admission into a faculty other than the one at which they had taken their academical degree, should pass certain examinations, which were for the main part mere formalities, and pay the regulated fees. Thus the medical men entitled to practise, who had received their theoretical education at the universities, were divided into doctors and licentiates and were distinguished from one another not by attainments but only by title.

SURGERY AND MIDWIFERY.

IN the practice of their profession doctors were divided into two classes, viz., those who dealt chiefly with internal, and those who preferred to treat, external diseases. The separation of surgery from internal medicine existed, as has been explained on an earlier page, even in ancient times. This separation may therefore have been maintained also during the first centuries of the middle ages, without at the same time any absolute divorce existing between the representatives of the two branches. Being each equal to the other in the knowledge and skill required for practising them, so certainly they may have enjoyed in social life an equal degree of respect. In the curriculum of study arranged by the Emperor FREDERICK II., the interdependence of these two branches of the healing art was prominently set forth and the medical schools of Salerno and Montpellier gave due attention to surgery in their scheme of teaching and educated both categories of doctors. People

* MEINERS: Geschichte der hohen Schulen, Bd. ii, S. 267.

distinguished medical men as *medici physici* and *medici chirurgi* and by this probably wished to indicate that both classes possessed an equivalent technical education. The title *physici* was also used in the place of *medici*. Unfortunately, at a later period, most universities, following the example of Paris, neglected teaching in practical medicine and especially in surgery. Since at the same time the practice of surgery was forbidden to the doctors who belonged to the priestly calling, the need of a class of practitioners, especially devoting their attention to the treatment of wounds, became very manifest. To this was added the fact that the wars and standing feuds between small territorial lords, the Crusades, and especially the great pestilences which devastated countries in the middle ages, afforded the proof that the doctors at hand were neither in numbers nor knowledge equal to the requirements. These circumstances favoured the formation of a surgical profession, which really only in the 13th century assumed a decided shape.* It was composed of doctors and licentiates of medicine, who had strongly pronounced inclinations or gifts for surgery, of practitioners to whom the acquisition of an academical degree was denied on religious or social grounds and of a multitude of empirics who had acquired a remarkable dexterity in the treatment of surgical ailments. Concealed in its ranks were individuals of widely-varying scientific attainments.

The surgeons of Italy and France as a general rule stood on an equal footing with the physicians of their native countries, respectively. They attended for some time the lectures at the university† and acquired a general scientific and practical training, which answered the requirements of the time. Many had at the same time the right of treating internal diseases and distinguished themselves in this branch as much as in surgery. The names of HUGO and THEO-

* A. CHIAPELLI: Studii sull' esercizio della medicina in Italia negli ultimi tre secoli del medio evo, Milano 1885, p. 5.

† COPPI *op. cit.* p. 199.

DORICO BORGOGNONI, BRUNUS LONGOBURGENSIS, GULIELMUS DE SALICETO, LANFRANCHI, HENRI DE MONDEVILLE, GUIDO DE CAULIACO, PETER of Argelata, MARCELLO CUMANO, L. BERTAPAGLIA and others belong to the most distinguished which the surgical literature of that time or the history of medicine in general can show.

The surgeons of Paris as early as about the middle of the 13th century formed a society, organized after the pattern of the medical faculty. It was named St. Côme after ST. COSMAS who was chosen for its patron saint. The members of this society held meetings regularly at which they discussed business connected with the profession and the teaching of it, and imparted to their pupils instruction in their art. The teaching was apparently for the most part of a practical nature, the pupils accompanying their instructors in their visits to the sick, and there learning the technical details of surgery. LANFRANCHI, who taught at the college of St. Côme, performed operations in the presence of his pupils and received their assistance in them. The pupils also assisted in the public and gratuitous relief of the sick which the members of the college presided over, and visited the hospitals where their teachers held appointments. Certain of the pupils probably executed there the duties now performed by our sick-attendants and male-nurses. Besides this, they were admitted to anatomical demonstrations, if an opportunity for such occurred. The students had, at the conclusion of their studies, to undergo an examination, and as early as the year 1254 the surgeons requested that examiners should be appointed for this purpose.

An edict of PHILIP LE BEL of the year 1311 ordained that nobody should engage in the practice of surgery who was not considered competent by the masters, and had received a license permitting him to practise from the king's body-surgeon.* Afterwards the students of surgery were obliged to take the degree of *Magister Artium* at the

* BUCHEZ: De la faculté de méd. de Paris, *op. cit.* 1822.

university, and to attend some lectures of the medical faculty.

In the year 1416 the Collège de St. Côme was incorporated as a separate faculty of the university of Paris. Its pupils thus obtained a scientific education which was in no way inferior to that of the physicians. In spite of this they were not regarded as equal to them in social position. This tendency to place the surgical profession in the background, which was first apparent in Paris, originated partly in the already-mentioned circumstance that the clergy—who laid claim at that time to the highest position in social life—kept themselves aloof from it, partly in the fact that many uneducated people of the lower class were associated with the surgeons, but above all was the result of petty jealousies and quarrels with the medical faculty, which asserted an unwarrantable claim to a superiority in scientific attainments. The struggle between the physicians and surgeons continued until the beginning of the 18th century, and was prosecuted with a bitterness which resulted in deplorable excesses on both sides. The medical faculty of Paris in the year 1350 made it obligatory on its members and students to abstain from the practice of surgery and expelled those who contravened this prohibition.* Finding too little humility and subjection among the surgeons, the faculty in 1372 brought to effect their design of giving barbers the right not only of letting blood but also of practising all so-called minor surgery—of treating ulcers and wounds, so long as they were not dangerous to life. And, indeed, the want may have arisen of a class of assistants to stand at the service of the physicians of that time, for the purpose of performing those minor services of surgery in almost daily request; for the specialists for wounds who had technical training were few in number and consequently much occupied. By these arrangements the boundary between the surgeons and the barbers, at no time, probably, insurmountable, was still further broken down.

* A. F. Théry: Histoire de l'éducation en France, Paris 1858.

The medical faculty of Paris endeavoured to render it easier for the latter to become trained surgeons by inaugurating lectures for them in 1491, which were delivered in the French language, and dealt with the various parts of surgery and the art of operating.* In fact, out of the condition of barbers there arose a great number of surgeons, some of whom by the introduction of improvements have rendered imperishable services to the healing art.

In the other countries of Christian Europe surgery was in a more debased condition than in Italy and France. If the Netherlander, JEHAN YPERMAN, in the 13th, and the Englishman, JOHN ARDERN, in the 14th century, far excelled in knowledge their colleagues in their respective countries, they owed this entirely to the circumstance that they had received their technical education in France. In Spain only do more favourable conditions appear to have prevailed for some time. In Saragossa the doctors were examined in surgery, and received the title of Medico-Surgeons; an arrangement which was not abolished until 1585.†

What kind of practitioners practised surgery in Germany, certain facts which are reported as having occurred at the end of the 12th century sufficiently indicate. When the Margrave DEDO VON ROCHLITZ UND GROIX had to accompany the Emperor HENRY VI., in 1190, to Italy, he feared the hot climate and the fatigues of the journey on account of his corpulence; he summoned a doctor who straightway laid open his body in order to extract the fat. It is not surprising that the Margrave sank under this singular operation.‡ In 1195 LEOPOLD V., Duke of Austria, broke his leg through a fall from his horse, and in such a way that the broken ends of the bone protruded through the skin. His doctors treated him with plasters and medicines until mortification set in. They refused to submit the limb to amputation, although

* HAZON: *op. cit.*

† V. DE LA FUENTE: *op. cit.* ii., p. 479.

‡ Chron. mont. seren, ed. ECKSTEIN in the Progr. d. latein. Hauptschule zu Halle, Halle 1844, p. 53.

the patient desired it. One of his servants at last performed the operation, but the result, as might have been expected, was unfavourable. The duke died on the following day.* Temerity and cowardice, the offspring of ignorance, were the peculiarities which distinguished the great majority of the German surgeons of that time. Even the Bündth-Erzney of the German knight, HEINRICH VON PFOLSPRUNDT, the most prominent surgeon produced by the Fatherland in the 15th century, cannot be compared with the surgical works of the Italians and French; for it was really nothing more than an introduction to bandaging and to the treatment of wounds and external injuries.

In no country was surgery during the middle ages able to rise to the height it attained in ancient times. We certainly find in the writings of certain surgeons remarks which display a correct knowledge of the tasks of surgery, an excellent gift of observation and a rich experience, but the keynote of these works was that intellectual feebleness which characterized the whole age. T. BORGOGNONI recommended a treatment of as simple a kind as possible and referred to healing *per primam* (by first intention).† Among the methods of arresting hæmorrhage, ligature was mentioned by LANFRANCHI and others. LANFRANCHI endeavoured to advance the diagnosis of fractures of the skull and confined the operation of trephining to those cases in which the brain was implicated in consequence of depressed fragments.‡ GUIDO DE CAULIACO (Gui de Chauliac) wrote that the wounded man on holding a metal rod between his teeth and touching it feels a pain in the skull at the situation of the fracture. He also gave the precise indications for trephining and described the operation.§ He avoided amputation: if mortification invaded an extremity,

* WILLIAM OF NEWBURGH: Hist. rer. Angl. lib. v., c. 8, in Rer. brit. med. ævi script., Vol. 82, Pt. 2, p. 432 *et seq.*, London 1885.

† Chirurg. ii, c. 27.

‡ LANFRANCHI: Chir. parva, c. 7.

§ G. DE CAULIAC: Ars chirurg. tr. iii, doctr. 2, cap. 1, Venet. 1546.

he waited until a line of demarcation was formed at the next joint and the mortified part separated itself from the limb of its own accord.* In the treatment of fracture of the thigh he employed long-continued extension of the limb which he sought to effect by means of a weight suspended to a cord which ran over rollers.† The bandages which were used to apply to broken extremities were smeared with white of egg which after coagulating gave fixation—of a kind—to the limb.‡ The œsophagus-tube was known and was used for artificial feeding.§ Fistulæ were enlarged by gentian root or converted by the knife into open wounds.‖ In the operation for rectal fistula JOHN ARDERN enjoyed a great reputation.¶ Ruptures were treated by long-continued lying on the back or by trusses.** Herniology underwent essential improvement at the hands of GUIDO DE CAULIACO who distinguished the various forms of hernia according to the outlet involved, and separated varicocele, hydrocele and sarcocele from hernia of every kind.†† Endeavours were made to effect the radical cure by cauterizing the outlets after the replacement of the prolapsed intestine. The removal of the testis which was resorted to in scrotal hernia was only undertaken by the wandering empirics. Even lithotomy, which was performed after the method of CELSUS, lay in the hands of specialists of this kind. In strictures of the urethra bougies of wax, tin or silver were employed. In diseases of the bladder and in gonorrhœa JOHN ARDERN ordered injections. Certain descriptions of ulcers and gangrenous destruction of

* *Id. op. cit.* tr. vi, d. 1, c. 8.

† *Id. op. cit.* tr. v, d. 1, c. 7 (*ad pedem ligo pondus plumbo transeundo chordam super parvam polegeam; itaque tenebit tibiam in sua longitudine.*)

‡ *Id. op. cit.* tr. v, d. 1, c. 1.

§ M. C. BROEKX: La Chirurgie de M. J. YPERMAN in the Annal. de l'acad. d'archéol. de Belgique, Anvers 1863, p. 128-326.

‖ G. DE CAULIAC *op. cit.* tract. iv, d. 1, c. 5.

¶ A. GORE in the Dublin Journal of Medical Science, 1883, p. 269 *et seq.*

** BROEKX: YPERMAN *op. cit.*, p. 178.

†† G. DE CAULIAC *op. cit.* tr. vi, d. 2, c. 6, 7.—E. ALBERT: Die Herniologie d. Alten, S. 161 *et seq.*

the sexual organs refer most probably to syphilis and venereal affections. The story that YPERMAN healed numerous "leprous" persons with a mercurial ointment throws a strong light on the more ancient history of syphilis, as to which it was erroneously assumed for a long time that it came into general prevalence only at the end of the 15th century.* Indeed this remedy was then generally used for ulcers and skin diseases.† GUIDO DE CAULIACO advised that intractable ulcers should be treated by laying on them a plate of lead on which mercury had been rubbed. In carcinoma he recommended the actual cautery and sublimated arsenic.‡

Surgery gained an important advantage by the revival of plastic operations which, as has been stated previously, were known in ancient times. At Norcia and Preci in Calabria the members of several families gave constant attention to the performance of particular surgical operations for instance herniotomy, lithotomy, the operations for cataract, etc. Here arose the first knowledge of the rhinoplastic operation. The surgeon BRANCA, who practised at Catania in Sicily at the commencement of the 15th century, excited a legitimate astonishment by the art with which he replaced lost noses and lips by adaptation of neighbouring parts of the skin of the face.§ His son ANTONIO, also, possessed considerable skill in the same art; but, afterwards, instead of the skin of the face a suitable portion of the skin of the arm was used to replace the loss of substance. This procedure came by degrees to be known among surgeons and even reached Germany, as is clear from PFOLSPRUNDT'S book.

Mention must not be omitted of the fact that already at

* BROEKX: YPERMAN *op. cit.* p. 145.

† Annals of Waverley in ALF. CORRADI: Nuovi documenti per la storia delle malattie veneree in Ann. univ. di med. Milano 1884, vol. 269, p. 289.

‡ G. DE CAULIAC.: *op. cit.* tr. iv, doctr. 2, c. 6.

BARTH. FACIUS: De viris illustr. Florent. 1745, p. 38.—E. ZEIS: Geschichte der plast. Chirurgie, Leipzig 1863, S. 188 *et seq.*

this time anæsthetic inhalations were made use of in great surgical operations. They are mentioned first in the Antidotarium of NICOLAUS PRÆPOSITUS; for this purpose a new sponge was used, which having been saturated with solutions of narcotic substances, for instance, opium, hyoscyamus, etc., was dried in the sun and before use was placed in hot water; it was then held to the nose of the patient when the rising vapours reduced him to a condition of stupefaction and unconsciousness of pain.*

The treatment of diseases of the eyes lay for the most part in the hands of empirics who attempted by ointments and medicaments to effect their cure. The best ophthalmic surgeons belonged, as A. BENEDETTI says, to the East;† from thence BENVENUTUS GRAPHEUS and others came to Europe and by their art achieved great success. The operation for cataract was carried out by depression of the affected lens as in ancient times: GUIDO DE CAULIACO says that, in order to prevent it rising again the lens should be held down during the recital of three *paternosters* or one *miserere*.‡

In the middle ages it fared even worse with midwifery than it did with ophthalmic practice. The doctors who belonged to the priesthood, did not venture to engage in it, that they might be preserved from undue familiarity with women, and other practitioners did not concern themselves with it. Ignorance, idleness, and other causes prevented the doctors from practising midwifery. They were called to parturient women only when it was a question of removing a dead fœtus from the uterus or of extracting a retained placenta. Medical interference was as a general rule limited to these two tasks, in this province. GUIDO DE CAULIACO says in his work upon surgery that he is unwilling to dwell at length upon midwifery, seeing that as

* G. DE CAULIAC.: Chirurg., tr. i, doct. 1, c. 8.—A. CORRADI: Escursioni d'un medico nel Decamerone, in Atti dell' istituto Lombardo, 1878, p. 127 *et seq.*

† A. HIRSCH: Geschichte der Augenheilkunde *op. cit.* S. 295.

‡ G. DE CAULIAC. *op. cit.* tr. vi, doctr. 2, c. 2.

a rule it is practised by women. It is true that in the work on natural science by THOMAS CANTIMPRATENSIS and in the Breviarium attributed, perhaps incorrectly, to ARNALDUS DE VILLANOVA, allusion is made to turning by the head and feet,* and GUY also speaks of the conversion of an abnormal presentation into a normal one; but it is impossible to decide how far these remarks rest upon literary reminiscences or how far they are the result of private experience. If the mother died before delivery Cæsarean section was performed in order if possible to save the life of the child. In certain cases the operation was even performed during the mother's life. The bishop PAUL of Merida, celebrated for his medical skill, who lived as early as in the 6th century, removed a dead child by an incision in the abdomen in a case of extra-uterine fœtation.† In 1350 a pregnant woman of Medingen in Swabia was condemned to death for having, as was supposed, stolen three consecrated hosts to sell to the Jews; Cæsarean section was performed on her before she was burnt.‡ As a rule, midwives undertook the duties of midwifery and the manual interference required during the birth of a child. They probably learned their art as a handicraft. Their medical knowledge differed much in different countries. In Italy and France some among them elevated themselves into becoming female doctors, and extended their knowledge over the whole field of medical science; in Germany they were seldom more than well-practised nurses, who had amassed some experience in midwifery. At first it was not demanded of them that they should submit to examinations. Public opinion, in this case represented by the most respectable women of the place, pronounced judgment upon their ability. These also exercised a certain control over the midwives. Afterwards, the mid-

* ARNALD DE VILLANOVA: Breviarium, lib. iii, c. 4.

† C. F. HEUSINGER in the Janus i, 764 *et seq.*

‡ G. LAMMERT: Volksmedicin u. medicin. Aberglaube in Bayern, Würzburg 1868, S. 12.

wives were put under the superintendence of the town-doctors, who examined them on their technical knowledge. About the middle of the 15th century certain towns in Germany began to appoint regular midwives. Their pay was, indeed, by no means large: thus the chief town-midwife of Frankfort-on-the-Main received four gulden a year, and each of the others two.*

THE MEDICAL PROFESSION AND MEDICAL LITERATURE OF THIS PERIOD.

BESIDES doctors for internal diseases, surgeons, and oculists, there were dentists and specialists for various internal and external affections.† The barbers and bath-men were also privileged to perform some medical functions. In the first centuries of the middle ages these functionaries were distinguished from one another, and only at a later period became associated into one corporation. Bathmen were more numerous at that time than they are at the present day and the custom of bathing more widely spread. Every town, nay, even many villages had public baths. Frankfort-on-the-Main in 1387 possessed at least 15,‡ and numbered among its citizens 29 bathmen. Mainz in the 14th century had four public baths, Würzburg in the 15th century eight, Ulm 11, Nürnberg 13, Augsburg 17, and Vienna 29.§ To these persons more or less permitted by law to exercise the medical art, was added another class of people who ventured to rely on custom as their only title and license to practise. To this class belonged in the first place, the executioner, and not, indeed, only in the sense

* KRIEGK *op. cit.* i, 14.

† CHIAPELLI *op. cit.* p. 7 *et seq.*—S. DE RENZI: Storia docum. della scuola med. di Salerno, p. 559.

‡ KRIEGK *op. cit.* ii, 15 *et seq.*

§ G. ZAPPERT: Über das Badewesen mittelalterlicher und späterer Zeit im Archiv für Kunde österr. Geschichtsquellen, Wien 1858, Bd. 21.—R. HOFFMANN: Die Augsburger Bäder und das Handwerk der Bader in d. Zeitschr. d. histor. Vereins f. Schwaben, 1886, Jahrg. 12.

that in the exercise of his calling he puts an end in a summary manner to all the afflictions a man has to bear, but as a matter of fact the hangman performed medical services, in dressing the wounds inflicted by the rack, reducing the joints which had suffered dislocation, etc. In most countries, certainly, medical practice was only permitted in the case of those who had given proof of their ability by successfully passing examinations. Quackery was forbidden in Paris as early as in the year 1220. Infringements of this law were severely dealt with as the reports of a trial, in the year 1311, which originated in circumstances of this nature, sufficiently indicate.* It was a matter of excommunication. In Vienna also, people of this kind were excluded from participation in the sacraments.† At the same there was no lack of charlatans of either sex. And, indeed, it occurred not unfrequently that empirics who had received no systematic medical education received testimonials and diplomas from high lords and magistrates, if they attained to success in practice, and a scarcity of doctors prevailed.

A probable estimate may be formed of the value of medical fees if we take note of the payments sanctioned by law which were prevalent in certain localities. Thus in the 14th and 15th centuries at Venice, for each professional visit in ordinary cases of sickness 10 soldi were paid; in Milan the doctor might demand for every day of treatment 12-20 soldi, for a night visit one ducat, and if called outside the city, for each day 4-6 lire.‡ JOHN ARDERN demanded for the operation for rectal fistula a fee of at least 100 gold sols. Rich and distinguished patients presented their doctors with large sums and estates, while the poor sought to pay their debt by a pair of fowls, eggs, or fruit.§ The salaries which the physicians in ordinary and the medical officers of towns received, show what a high value was placed upon medical services at that time. The

* HAZON *op. cit.*

† ROSAS *op. cit.* i, 124 *et seq.*

‡ CHIAPELLI *op. cit.* p. 29.

§ CHIAPELLI *op. cit.* p. 28.

dukes of Savoy, who, as is well known, cannot be classed amongst rich princes, gave their physicians in ordinary a yearly stipend of from 40 to 60 gulden; at the court of Naples they received, on the other hand, from 100 to 300 ducats. In Prague the usufruct of several estates was assigned to the royal physicians in ordinary.

The institution of the *Archiatri populares*, the paid medical officers of towns, was probably kept up in many towns of Italy without interruption from ancient times through the entire period of the middle ages. The Ostrogoths and Lombards received it from the Romans and most likely handed it on unchanged to their successors in the dominion of Italy. In Rome, as also in Denmark and Sweden, the name of archiater was used as a title for a high medical official even up to the most recent times.

The duties of the town medical officers were these: to attend gratis the officials of the town and the poor of the town, to provide medical service for the town hospitals, to assist the magistrates as experts, and to accompany the citizens into the field in time of war; they also exercised control over the apothecaries' shops and licensed houses, and conducted the public sanitary service. At a later period in many places they also undertook the teaching of the lower class of attendants on the sick and examined them. In Venice there were 12 physicians and 12 surgeons appointed by the town; the former receiving from 15 to 100 ducats annual pay and the latter from 10 to 130. Even smaller places devoted a regular sum to this purpose in their budget of expenditure. Treviso paid its three public medical officers 728 lire a year, Conegliano 350 lire to physicians, 250 to surgeons, and Palermo granted to its two town doctors 50 ounces of gold a year.* In Germany public medical officers were first appointed in the 14th century. In an order of the Emperor SIGISMUND, of the year 1426, it is said: "In every imperial town there is to be a chief-doctor; he is to be paid 100 gulden.

* CHIAPELLI *op. cit.* pp. 22, 31.

A church must provide him with them. He is to physic when necessary each and everyone gratis and he must earn his pay by true and faithful service."* Frankfort-on-the-Main had in 1348 a town doctor who received clothing and 30 curnocks of corn;† there were afterwards three, their pay ranging between 10 and 100 gulden. Doctors were also appointed for the troops, the hospitals, the monasteries, and particular prisons, and received regular pay.

Doctors, especially medical officers of towns, enjoyed in many places freedom from taxation and other privileges. Some received, free of charge, the freedom of the city they had settled in. In social position they ranked with the nobility. The members of the medical profession belonged for the most part to the wealthy classes; among them we find names representative of the most distinguished families of Italy. On the other hand the surgeons, especially in Germany, as a rule had a tendency to issue from the poorer classes.

Among doctors the Jews were very numerously represented. While, during the first centuries of the middle ages medical study languished in the Christian States of the West, it was the privilege of the Jews to derive instruction from their contact with Arabian civilization and from the investigation of learned Rabbis. It was not therefore surprising if they excelled their Christian colleagues in knowledge and skill. And thus it came about that especially in countries in which, as in Germany, medicine was very much neglected, the Jews were in the greatest request as doctors. Not only princes and ruling lords but even bishops and popes had Jewish physicians in ordinary; at most monasteries Jews were appointed as doctors, as ARNALDUS DE VILLANOVA declares.‡

* MOEHSEN: Geschichte der Wissenschaften in Brandenburg, Berlin 1783, S. 564.—P. FRANK: System der medicin. Polizei, Wien 1817, vi, 1, S. 174.

† KRIEGK *op. cit.* S. 8.

‡ GÜDEMANN: Geschichte des Enziehungswesens der Juden, Wien, i, S. 155.

In Prague in the 12th century nearly all medical practice was in the hands of Jewish doctors; and the same appears to have been the case at Avignon.* In Frankfort-on-the-Main ADAM LONICERUS was the only Christian doctor; all his colleagues at that place belonging to the faith of Israel.† This is partly explained by the fact that most of the other learned careers were closed to the Jews. It is true, that at several Church Councils it was decreed that Christians should not seek advice from Jewish doctors; the priests however did not regard themselves as included in this prohibition, which, for the rest, had but little effect, if there was an absence or scarcity of doctors belonging to the Christian faith at any particular place. When the waves of religious passion rose higher and the persecutions of the Jews began, the results became remarkable even in this walk of life. In the statutes of the medical faculty at Ingolstadt of the year 1472 the Christian doctors were forbidden to hold consultations with their Jewish colleagues,‡ and in the regulations for midwives issued at Regensburg in 1451 it was set forth that they might go to any woman in need of their assistance "except to a Jewess to whom they must not go."§

The clergy were more and more deterred from medical practice both by the laws of the Church and by the increasing professional competition which confronted them after the foundation of the universities. At the Councils of Rheims (1131), Montpellier (1162), Tours (1163), Paris (1212), at those of the Lateran (1139 and 1215) and also by the decretals of the Popes ALEXANDER III. (1180) and HONORIUS III. (1219) medical practice and especially surgery were forbidden to priests. This prohibition was probably not obeyed, as it had so often to be repeated, or

* J. v. HASNER in the Prager Vierteljahrsschrift 1866, Bd. 90.—G. BAYLE *op. cit.* p. 68.

† W. STRICKER: Geschichte der Heilkunde in Frankfurt-a-M., 1847, S. 68.

‡ PRANTL. *op. cit.* ii, 47.

§ G. LAMMERT: Geschichte des bürgerlichen Lebens, Regensburg 1880, S. 289.

in any case it was frequently eluded, stipends, dispensations * and many other arrangements offering even a direct invitation to ignore it. All the same, this much was accomplished, that priests at least held themselves aloof from performing surgical operations and treating women. On the other hand medical teaching was still at many academies left for some time in their hands. The reason being that sometimes benefices were associated with the position of teacher, and the tenure of these benefices presupposed the priestly character of the incumbent. Thus for example H. LURCZ, professor of medicine at the University of Vienna, was at the same time minister of Hohlfeld in Bavaria; he kept a substitute there and gave lectures himself in Vienna.† As a result of such conditions at many universities celibacy was demanded of the teachers of medicine. When in 1479 the Elector PHILIP wished to install a layman as Professor of medical science in Heidelberg, the Academy protested because he was not a clergyman. This matter was only carried through after the Pope in 1482 had given permission that laymen, even when married, might be created Professors of Medicine.‡ In Paris, where so much importance was attached to celibacy that JEAN DE POIS was deprived of his license in 1395 because he had married, these rules were abolished in 1452 by Cardinal D'ESTOUTEVILLE. In many cases the matter was passed over in silence and the benefices given to candidates who could not satisfy all the provisions of the canonical law.§

Clericalism made its predominating influence felt in every walk of public and private life. It triumphantly associated itself with all the intellectual efforts, which so numerously manifested themselves during the period of scholasticism. It dominated even the literature of natural

* A. CORRADI in Rend. d. R. ist. Lomb. 1873, Ser. ii, v. vi, p. 863.

† ASCHBACH *op. cit.* i, S. 410.

‡ J. F. HAUTZ *op. cit.*

§ PAULSEN in SYBEL's histor. Zeitschr. Bd. 45, S. 310, 434.—HEFELE: Conciliengeschichte vii, 355.

science and of medicine. One purpose alone did this literature serve—that namely of making science the foundation and support of theological dogma. The works on natural science of the 13th century bore an encyclopædic character. The most prominent authors were ALBERTUS MAGNUS, Dominican monk and afterwards Bishop of Regensburg, the Minorite BARTHOLOMÆUS ANGLICUS, the Frenchmen THOMAS DE CANTIMPRÉ and VINCENT DE BEAUVAIS, the Italians BRUNETTO LATINI, the teacher of DANTE, and RISTORIO D'AREZZO, and the German KUNRAT VON MEGENBERG. The Natural Philosophy composed by the monks of the Mainau Monastery belongs to this period. Medical literature in the strict sense was chiefly composed of writings explanatory of the works of the ancients and of the Arabian authors known by their Latin translations. Of this nature were the works of the following: TADDEO ALDEROTTI called FLORENTINUS, DINO and TOMMASO DI GARBO, BARTOLOMEO VARIGNANA, TORRIGIANO, GIACOMO DELLA TORRE, GIOVANNI and MARSILIO DI S. SOFIA, GIACOMO DE DONDI, FRANCESCO DI PIEDIMONTE and JACQUES DESPARS of Tournay. Short extracts from the comprehensive therapeutic works of the Arabs arranged for the instruction of students and the use of doctors, and comparative tables, in a concise form, of the drugs in most frequent use, answered the requirements of the day. To this period belong the *Clavis Sanationis* of SIMON of Genoa, the medical Pandects of MATTHÆUS SYLVATICUS, the *Aggregator Brixianus* of GUGLIELMO CORVI, the Medical Compendiums of GILBERTUS ANGLICUS and of the Scotchman GORDON and the writings of JOHANNES DE TORNAMIRA, of the Portuguese VALESCUS DE TARANTA, of NICCOLO FALCUCCI, the Florentine, of MICHELE SAVONAROLA, ANTONIO GUARNERI and others. PETRUS DE ABANO, celebrated for his knowledge in natural science, took up a more independent position and in his *Conciliator differentiarum* delivered a severe and, in some places, most destructive criticism upon the prevalent theories of medical science.

About the same time the Englishman ROGER BACON and the Catalonian ARNALDUS DE VILLANOVA asserted the claims of freedom in investigation and declared that the natural sciences and medicine had no assured foundation except in observation and experience. They opened thus a more independent and direct path for medical science, which became manifest in the writings of their disciples, especially at the schools of Montpellier and Prague and was shown in the numerous collections of clinical cases, which were composed in the 14th and 15th centuries. While holding fast to the prevailing doctrines they yet brought forward many a valuable observation of their own which served to enrich the science of medicine. Thus HUGO BENCIO described cases of periodical insanity, of spermatorrhœa, and of syphilis. MATTEO FERRARI DE GRADIBUS treated a student who suffered from writer's cramp, and observed paralysis of the facial nerve associated with distortion of the face, hallucinations of the sight and obstinate salivation. BAVARIUS reported upon a paralysis of the upper extremities combined with disturbance of speech and weakness of memory which was said to have followed a violent inflammation of the throat.* HENRI DE MONDEVILLE and GUIDO DE CAULIACO saw cases of wounds of the brain with loss of its substance, without permanent disturbance of the intellectual faculties resulting.†

Corresponding with the revival of an independent observation of clinical cases, there ensued a more energetic study of anatomy and more successful enterprise in surgery, as has been explained on a previous page. Other branches of medical science also underwent improvement. A remarkably rich balneological literature arose, which treated of most of the baths known at that time. Germany was dealt with among other countries. HANNS FOLZ, the barber and minstrel of Nürnberg, in 1400

* CH. DAREMBERG *op. cit.* i, p. 338 *et seq.*

† G. DE CAULIAC. *op. cit.* tract. iii, doctr. 1, c. 1.

composed a "little book of all the baths which are naturally hot." Many popular medical writings appeared at the same time, especially in Germany; such were the collections of recipes intended for household use or the directions and rules for diet which were worked up after the pattern of the *Regimen Salernitanum*, as the Dispensatory of ORTOLF of Bavaria, the Garden of Health, which issued from Mainz, etc.

The middle ages were, therefore, by no means so destitute and devoid of intellectual equipment as they are represented to have been by many authors. A stirring life prevailed in all provinces of mental activity. If the results gained did not correspond to the pains and labour bestowed, the reason lay in the fact that the efforts to advance were made in a wrong direction or encountered obstacles they could not surmount. The yoke of scholasticism weighed heavily upon science, and the authority of the Church pointed out to it goals which lay remote from its essential aims and which were not to be reached.

END OF PART II.

III. MEDICAL TEACHING IN RECENT TIMES.

THE CHARACTER OF THE SIXTEENTH CENTURY.

In proportion to the increase of knowledge and its more extensive prevalence, the conviction gained ground that thought must be freed from the fetters which held it in check. What in the 13th century had been felt by only a few select spirits and proclaimed by them with dauntless courage, at the end of the 15th century filled the hearts of all cultivated men. The impulse towards freedom and independence exerted an influence on all provinces of intellectual life and formed the fundamental note which resounded in art as well as in science, in religion no less than in politics.

In the history of civilization movements of mighty import like those of the 16th century, do not arise suddenly but are the outcome of a long preceding activity. They exist long before they appear, they escape superficial observation and are recognizable only by the eye of knowledge. Like the seeds of plants which crowd the soil, they germinate in obscurity and shoot up only when their time has come. The origin of the efforts for reform of the 16th century dates far back in the middle ages. The history of this struggle tells us of unsuccessful attempts, of fruitless toil, of hopes trampled under foot, and of sacrifices sealed by blood. Even in the earlier centuries enthusiastic and devoted men fought for freedom of thought: but the combatants were isolated and were overpowered by their opponents. LUTHER and MELANCHTHON had their forerunners who suffered death for their convictions.

The suppression of robber bands and attacks on the feudal system were prepared for and favoured by the development of an independent and well-to-do burgher-class. Art and science were recalled to the investigation of antiquity and the observation of Nature by the study of humane learning cultivated in Italy since the time of PETRARCH. The artists freed themselves from the traditions of the middle ages and gave to the forms they portrayed a freer expression, which having been learnt in Nature's own school, was true and warmed men's hearts by sympathy.

What the early times of the Renaissance did for art, was accomplished for science by the study of the original works of the Greeks and Romans and the commencement of an independent investigation of nature. In the schools of the middle ages the writings of the Roman classic authors had seldom been studied in the original texts; those of the Greek, never. The Latin which was spoken in teaching and in the daily intercourse between teachers and pupils was very different from the language of CICERO or QUINTILIAN. The Greek language was nowhere brought into the domain of teaching and the knowledge of it was so rare that PETRARCH in 1360 was able to name scarcely ten men of learning in Italy who were acquainted with it.* In other countries there was at least no improvement upon this state of things. The literary works of antiquity were made accessible to the middle ages chiefly by Latin translations, commentaries, and abridgements which were generally prepared not from the originals but from renderings of these into Arabic. People attached little importance here to form and expression of speech; for these were not looked upon as means for education of the mind but were esteemed to be nothing but the worthless shell containing the rich treasure—the real object of pursuit. Even this however was not maintained pure and unadulterated; for

* G. VOIGHT: Die Wiederbelebung des classischen Alterthums, Berlin 1881, ii, 107.

it underwent such alterations as were in the age of scholasticism considered indispensable for preserving the sanction of the Church and the spiritual welfare of the faithful. When people recognized that in this manner they did not attain to the full, unrestricted possession of the rich legacies of knowledge which ancient times had left behind them, they began once more to study the writings of antiquity in the form in which they were originally transmitted to posterity. The classical authors of ancient heathendom awoke to new life and in words of flame made known the greatness and the glory of the past. This occurred first in Italy where numerous remains of buildings, statues, and inscriptions reminded men of the civilization of the Romans. In that land a knowledge of true Latinity was again acquired, and from thence spread to other countries, in the 15th century.

At the German academies professorial chairs for Latin eloquence and rhetoric were founded, the incumbents of which excited by their successful efforts in prose and verse the astonishment and envy of their contemporaries. At the same time the knowledge of the Greek language obtained a general prevalence in the circles of the learned. For this thanks are to a large extent due to the Greek refugees, who, after the conquest of their native country by the Turks, came to Italy and founded there a new home. CHRYSOLARAS, GEORGIOS of Trebezond, THEODOROS GAZA, BESSARION, CONSTANTINE LASKARIS, and others brought many valuable Greek manuscripts with them, and collected round them a circle of select pupils. At the courts of the Medici, those princes of Italy so pre-eminently susceptible to the attractions of art and science, a worship of Hellenism became developed which gathered around it the most prominent men of the state. Learned societies which were called Platonic Academies* made the cultivation of Greek literature the task of their lives. The bright forms of

P. VILLARI: Nicolo Macchiavelli und seine Zeit, Deutsche Übers., Rudolstadt 1882, i, 147 *et seq.*

Greek life caused magical pictures to pass before their minds' eyes of the serene felicity of man, and drew them away from the contemplation of the mournful seriousness of Christian renunciation which hated and condemned pleasure. They elevated themselves to the ideals of freedom and of ancient heroic greatness, even if in regarding the wretched political circumstances of the present they were pressed again to the earth. The writings of the wise men of antiquity afforded them abundant inspiration and instruction; it was in these they discovered the foundations of philosophy, law, mathematics, astronomy, geography, and physics, of the natural sciences and of medicine. With the restoration of Greek and Roman literature there was disclosed a world of ideas and of endeavours which seemed fitted to step into the place of the now defunct forms of life of the middle ages. The spirit of the age struggling towards a modern development of civilization thought to find in it a serviceable weapon for the great struggle with the Church and with scholasticism,—and was not deceived. Certainly, humane learning was limited to a small circle; but this circle comprised the intellectual *élite* of the nations.

The ideas of humane learning soon seized upon the minds of men with such force that no one could escape from them, not even those, who like the representatives of the Church and of ecclesiasticism, must have discerned in them their natural enemies. They found a friendly reception even at the Papal Court. NICHOLAS V. was their well-wishing friend and patron, though probably more from personal vanity than from inward conviction. PIUS II., before ascending the Throne, and while still bearing the name of ÆNEAS SYLVIUS, had worked zealously in favour of their extension in Germany, and remained at all times their true disciple and their advocate both with tongue and pen. To be sure, their influence was manifested less in religion than it was in art and in science. The Humanists, as a rule, avoided direct assaults upon the dogmas of the Church. And there was no fear that the jovial and sometimes even

rather frivolous gods of Greece would supplant the objects of Christian worship as had perhaps been the wish of many representatives of humane learning, like PETER LUDER, BUSCHIUS, or ULRICH VON HUTTEN. The influence exerted by humane letters upon the Christian religion consisted chiefly in the fact that they provoked a comparison with the supernatural and ethical conceptions of antiquity, and thus rendered possible a more unbiassed judgment of the Christian doctrines.

Art owed to antiquity a rich inspiration. The strictly limited circle of ideas belonging to the Jewish-Christian legend, which up to this time had almost exclusively formed material for artists, and which, by its continual repetition, gradually became monotonous, now received a welcome enrichment in the mythology of the Greeks and in the heroic history of Rome. The treatment of form now showed an unconstrained and bold character contrasting agreeably with the stiffness and clumsiness of the earlier periods. The figures—even those borrowed from the transcendental worlds of religious mysticism—now appeared in nearer sympathy with the feelings of mankind. Reflecting glory from ideal conceptions of the good, the beautiful, and the true, they no longer appeared to the eye as powers darkly threatening and of supernatural strength, but as beings spreading happiness and distributing blessings. Who is not acquainted with that splendid three-starred constellation of Florence LEONARDO DA VINCI, RAFAEL SANZIO, and MICHEL-ANGELO BUONAROTTI? A century which saw three such artists together may well have compared itself with the much-praised age of PERIKLES. All three embraced art as a whole; all three were painters, sculptors, architects at once, and accomplished in each of these great things worthy of immortality. LEONARDO, however, was not only an artist, but a mathematician, an engineer, a physicist, and a physiologist, and equally in the history of science has gained for himself an honourable place.

The art of Italy at its prime exercised a stimulating

influence on other countries, especially upon Germany and the Netherlands as the names of ALBRECHT DÜRER, HANS HOLBEIN and LUCAS CRANACH testify. At Nürnberg the arts of the wood carver and the goldsmith reached high perfection. The free towns of Germany produced a race of citizens manifesting taste and intelligence in art and combining a more cheerful enjoyment of life with moral seriousness. Among them artistic and scientific efforts found zealous disciples and representatives. In the field of science humane learning was cultivated chiefly by the learned societies which arose on all sides after the pattern of the so-called Platonic Academies. The Rhenish Society was the best known of them, among its members being such men as the learned Abbot TRITHEMIUS and WILLIBALD PIRKHEIMER the patrician of Nürnberg, besides RUDOLF AGRICOLA, the poet CONRAD CELTES, JOH. REUCHLIN, ERASMUS of Rotterdam and others.

The first result of the growing interest taken in Greek and Roman Literature was, that the manuscripts which had been handed down from former times were compared, and a text was furnished resting upon considerations of grammar and of sense, which seems to have answered all requirements. This formed the commencement of the scientific treatment of philology which exerted such a very far-reaching influence upon the development of the culture of the following periods. Philology played the part of the magician who set free the Dormant Beauty of science, locked in a sleep of a thousand years, and afterwards remained to her a fatherly protector watching her first steps with anxious care. The sciences, and by no means least of all the natural sciences, have to thank philology that they hit upon the right method of investigation: for they learnt from it painful accuracy in sifting scientific material and severe criticism of results won.

To medicine also in its new form philology afforded essential service. Editions of most of the medical authors of antiquity were prepared. The doctors who devoted

themselves to this branch of literary activity, prepared themselves for it by a sound philological training; not a few of them were teachers of the ancient languages before they attached themselves to medicine. The knowledge of Greek passed in those days as a necessary piece of intellectual equipment for anyone laying claim to be called an educated doctor; just as to-day such an one is expected to understand the use of the microscope.

If the literary activity of the doctors, kindled by the study of humane letters, developed in an unexpected manner and contributed to the extension of medical knowledge, thanks are in a large measure due to the art of printing books which was invented in the 15th century. This art came suddenly into existence, but not without a history of derivation from antecedent sources: for it was prepared for by the arts of wood-carving and copper-engraving and by the somewhat imperfect method of impression from fixed types perhaps introduced into Europe from China, and by other things. Nevertheless it was an extraordinary advance, when moveable type was first brought into use about the year 1440. By this the impression of extensive works and trade on a large scale were first rendered possible. To be sure printing had at first to contend with many drawbacks. It was a very tedious process and consequently very costly. Thus for example the impression of the Bible—the first great work which proceeded from the Mainz press founded by GUTTENBERG and afterwards belonging to FUST-SCHÖFFER—took 11 years and cost 4,000 gulden before the 12th sheet was completed. Printing gradually attained to a wider prevalence in proportion to the improvements introduced into the art. DAREMBERG estimates the number of medical writings printed up to the year 1500 as about 800.*

The new discovery exerted a mighty influence upon the intellectual movements of the 16th century. The pulpit, which up to this time had been the only place from which

* CH. DAREMBERG: Histoire des sciences médicales, T. i, 313.

the people were addressed, now found a rival, ready to become, on occasion, an adversary. Liberal ideas here found an ally, and the struggle against the hitherto dominant authorities was carried on with serviceable weapons. But the fullest significance of printing was in aiding the development of science; for the acquisitions of the intellect could now be made easily accessible and become the common property of all. The study of the treasures of knowledge handed down from ancient times incited to a critical examination of their real foundation, and the special investigation required led to the correction of old errors and the discovery of new facts.

The reformation of science thus effected forms, with the corresponding change in religious and political life, the most remarkable phenomenon of an age characterized by the emancipation of individual opinion. These aims received unexpected furtherance by the discovery of America which at the end of the 15th century excited the wonder and astonishment of mankind. A population was there discovered like the inhabitants of Europe in bodily form and in spiritual nature, together with a civilization which bore many points of resemblance to the manners and customs of the old world. Neither the Church nor Antiquity had possessed any knowledge of these things, any more than of the fauna and flora of the new continent. Disappointed in the two highest authorities known at that time, thinkers and philosophers became suddenly independent and compelled to trust to their own observations. Some decades after the discovery of America the first circumnavigation of the earth was made and with it incontestable proof was furnished that the earth was round. The Greek philosophers had already conjectured that its shape was spherical and ARISTOTLE considered it as certain; but LACTANTIUS and other Fathers of the Church * had contested this view and declared it absurd. Their authority sustained with this a serious defeat. The prestige of the

* O. PESCHEL *op. cit.* S. 96 *et seq.*—W. WHEWELL *op. cit.* i, 226 *et seq.*

Church was still more shaken when the heliocentric theory —said already to have been put forward by PYTHAGORAS— was established by COPERNICUS and KEPLER.* The theologians combated this theory, knowing right well that with its acceptance the earth would appear as nothing more than one of the countless luminaries which crowd the firmament and that man—its inhabitant—would lose the dominant position claimed for him under the mode of regarding the universe professed by the Christians. The rivalry between the heliocentric and geocentric doctrines was also decided against the Church. It can be easily understood how by these events the belief in the inadequacy of the human understanding—a doctrine preached by scholasticism and supported by the authority of the Church—was undermined. Protestantism went farthest, by extending the right of man to form an opinion even in matters of theological dogma. On no department of intellectual work did the independence of mind thus acquired cause a deeper or more lasting impression than on the natural sciences and medicine.

Mineralogy received scientific consideration for the first time. The doctor GEORGIUS AGRICOLA made an attempt to classify minerals into different groups on the basis of their external characteristics. Botany began to rise out of the dependent relations in which it stood with regard to materia medica and dietetics, and to assume the form of a science worthy of cultivation for its own sake. It was enriched by a multitude of descriptions of plants, and the flora of Europe, as well as that of the newly-discovered trans-oceanic countries, underwent close examination. Certain botanists undertook to separate plants into different departments according to definite points of resemblance, in order to facilitate the study of them. CONRAD GESSNER and A. CESALPINI made use of the flowers and

* WHEWELL *op. cit.* i, 381 *et seq.*—J. W. DRAPER : Geschichte der geistigen Entwickelung Europas, Leipzig 1871, S. 521 *et seq.* ('History of the intellectual development of Europe.')

fruit for this purpose, and were in consequence the precursors of LINNÆUS. A new period also began in the history of zoology, inaugurated by the great work of the learned GESSNER. This not only contained all the facts which had been ascertained in this department of science during the preceding periods, but also a number of fresh observations. Other investigators chose certain classes of the animal kingdom as the objects of their study, as, for example, B. BELON in the case of birds, and RONDELET in that of fishes, and some again occupied themselves with the fauna of foreign countries. So, too, in physics and chemistry energetic activity prevailed. NICOLAS CUSANUS, the free-thinking Bishop of Brixen, and the great artist LEONARDO DA VINCI had already worked at physics with success.* While mathematical science under HIERONYMUS CARDANUS, TARTAGLIA—who discovered how to solve cubic equations—and others was improved, optics had made also material progress, for which thanks are due chiefly to GIAMBATTISTA PORTA, the discoverer of the *camera obscura*, and to JOHANN KEPLER. Physics and chemistry, however, first achieved really important successes in the 17th century; then first did they become invested with great significance in relation to medicine.

EMANCIPATION FROM THE BELIEF IN AUTHORITIES IN THE SPHERE OF MEDICINE, AND THE PROGRESS OF SCIENCE.

MEDICAL science underwent the same process of development as the other arts and sciences, as civilization advanced. It shook off the yoke of authority which rested only on tradition, and became independent. This fact appears natural and conceivable only in connection with the efforts which were then crowding the history of the time; apart from these it may, indeed, be impressed on the memory, but not on the understanding. The movements in the

* POGGENDORF, *op. cit.* S. 113 *et seq.*

direction of freedom were manifest in all branches of medicine, and in some subjects, especially in anatomy, materia medica, surgery, and midwifery, obtained even in the 16th century remarkable results.

In anatomy, men ceased to rely upon the infallibility of GALEN, and began to make independent investigations on the dead body. GABRIELE ZERBI, in his anatomical description of the human body, already treated separately of bones, muscles, and vessels. He made mention of the oblique and circular muscular fibres of the stomach, and alluded to the *puncta lachrymalia*, the *ligamenta uteri*, etc.* AL. ACHILLINI noticed the *ductus choledochus* opening into the duodenum, and also the ileocæcal valves.† BERENGAR, of Carpi, corrected several mistakes of MONDINO, and is looked upon as the discoverer of the foramina of the sphenoid bone, and of the vermiform appendix; moreover he referred to the fact that the thorax in men and the pelvis in women are in each case proportionately wider than in the other sex.‡ CANANI furnished an excellent description of the muscles, and was the first to observe the valves of veins in the *vena azygos*.§

All these investigators were surpassed in richness of discovery by ANDREAS VESALIUS, who may be called the reformer of anatomy. He was descended from a German family which originally bore the name of WITING, and transferred its home from Wesel to Brussels. The investigations of VESALIUS embraced all parts of anatomy, and formed the basis for a new system of anatomical teaching.|| He explained the nutrition of the bones by means of the vessels of the periosteum and the *vasa nutrientia*, and was the first to point out that nerves penetrate muscles. In the vascular coats he distinguished two layers, of which the inner one was of firmer

* MEDICI, *op. cit.* p. 43.

† BURGGRÆVE *op. cit.* p. 55.—MEDICI *op. cit.* p. 51.

‡ CARPI: Commentaria cum ampl. addition. super Anat. Mundini, Bonon. 1521.

§ AMATUS LUSITANUS: Curat. med. cent., Basil 1556, p. 84.

|| BURGGRÆVE *op. cit.* p. 72 *et seq.*

consistence than the outer, and composed of muscular fasciculi. He described the heart fairly accurately, its position, movements, and changes of form, and also the apparatus of the valves; yet he was never able completely to get rid of the old mistake that the blood passes through the septum of the heart. But whereas in the first issue of his chief anatomical work in 1543 he expressed as yet no doubt whatever on the subject, in the second edition of 1555 he declared, being perhaps influenced by SERVET, that he could not understand how it was possible for the blood, even in very small quantity, to transude from the right to the left side of the heart through the thick, firm substance of the septum.* Important progress is shown in his description of the abdominal walls and of the stomach, the liver, and the male and female sexual organs. He was acquainted with the *corpora cavernosa* and the seminal ducts, refers to the *vesiculæ seminales*, and discussed the changes which the uterus undergoes in pregnancy. He devoted great care to the examination of the brain, drew attention to the distinction between the gray and white substance, and noticed the *corpus callosum*, the *septum lucidum*, the pineal gland, and the *corpora quadrigemina*.

The discoveries of VESALIUS aroused an unprecedented amount of attention. Not only in medical circles was astonishment felt at the boldness with which he pointed out the erroneousness of what people had hitherto considered to be true. Those who revered the ancients, and pinned their faith upon received authority, persecuted him in the most violent manner, headed by his former teacher SYLVIUS, who, making a poor enough joke upon his name, called him VESANUS,—a madman, who was contaminating Europe with his poisonous blasts.† The discoveries of VESALIUS were improved upon and extended in many directions by his contemporaries EUSTACHIUS and FALOPPIUS. The

* H. TOLLIN in the Biolog. Centralblatt 1885, Bd. 5, S. 474 *et seq.*

† JACOB. SYLVIUS: Vesani cujusdam calumniarum in Hipp. et Galen depulsio, Paris 1551.

former occupied himself with the structure of the kidneys, and made mention of the excretory tubes (ducts of BELLINI).* On the other hand, the discovery of the valve named after him at the opening of the *vena cava inferior* into the auricle is wrongly ascribed to him, for it was known at an earlier period. But he improved the knowledge of the organ of hearing, observed the tympanic muscles, the spiral form of the cochlea, and the trumpet-shaped tube which bears his name to the present day; he also left an excellent description of the base of the brain.

FALOPPIUS, the gifted pupil of VESALIUS checked with scrupulous care the discoveries of his teacher, correcting and completing them by a multitude of new facts. With VESALIUS he was the greatest contributor to the reformation of anatomy. He furnished valuable information upon the development of the bones and teeth, described the petrous bone more accurately, enriched myology by admirable descriptions of the muscles of the external ear, of the face, of the palate, and of the tongue, made explicit statements upon the anastomotic connections of certain blood-vessels, for instance of the carotid and vertebral arteries, and discovered the *nervus trochlearis*. We owe to him some advance in the anatomy of the organs of sense. He instituted accurate investigations upon particular parts of the organ of hearing and of the eye, by which he was able to give fuller information upon the *ligamentum ciliare,* the *tunica hyaloidea,* the lens, and other anatomical points. So too in the case of the female sexual organs; the oviduct (known in anthropotomy as the Fallopian tube) has immortalized his name in anatomical terminology.

Of the remaining anatomists of this period the following rendered services to the development of their science: INGRASSIAS, by his labours in osteology especially by his discovery of the *stapes* and of the inferior turbinated bone, ARANZIO, who made researches into the anatomy of the fœtus, VAROLIO, of whom the *pons* reminds us, by his

* BURGGRÆVE *op. cit.* p. 201 *et seq.*

examinations of the brain and nervous system, VOLCHER KOYTER by his contributions to the history of development and to pathological anatomy, FABRIZIO AB AQUAPENDENTE by the first complete description of the valves of the veins, CASSERIO by his labours upon the organs of voice and of hearing, ADRIAN VAN DEN SPIGEL who gave his attention chiefly to the liver, a lobulus of which still bears his name, SALOMON ALBERTI by his description of the lachrymal apparatus, and PETER PAAW who was the first to draw attention to the racial varieties of the skull.*

The progress made by physiology at this period was not so great: which was but natural; for the existing facts of anatomy had to be firmly grasped before men could venture to ask the meaning of them. But at least, the fruitlessness of mere speculation was recognized and recourse was again had to the method of inductive investigation, already pointed out by ARISTOTLE. Thus EUSTACHIUS injected water into the renal arteries, with the object of studying the formation of urine.†

Highly indicative of the complete change effected in the way of thinking among medical investigators are the words of REALDO COLOMBO, that a man learns more in one day by the dissection of a dog than by continually feeling the pulse and studying GALEN'S writings for many months together.‡ MICHAEL SERVET and REALDO COLOMBO, the prosector and of VESALIUS his successor in the professorship of Padua, were the first to correct the old mistake that the blood passes through the septum of the heart from the right side to the left, and hinted at the passage through the lungs. To which of the two the priority of this discovery belongs cannot be decided with certainty, although innumerable probabilities point to SERVET.§ For the rest, neither the

* K. SPRENGEL: Versuch einer pragmat. Geschichte der Arzneikunde, Halle 1827, iii, 64 *et seq.*

† BARTH. EUSTACHIUS: De renum structura, Venet. 1564, c. 37, 46.

‡ REALDO COLOMBO: De re anatomica, Venet. 1559, lib. xiv, p. 258.

§ H. TOLLIN in the Deutschen Archiv f. Gesch. d. Med., Bd. vii, 1884, S. 171 *et seq.*, and in VIRCHOW'S Archiv, Bd. 91, S. 39 *et seq.*

one nor the other stated clearly and unequivocally *how* the passage of the blood is effected from the pulmonary artery to the pulmonary veins. The triumphs of physiology did not begin until the 17th century, when experimental investigation was crowned with success by the discovery of the circulation of the blood.

The progress made in anatomy was bound to exert a stimulating and helpful influence upon surgery, as being the branch of medicine chiefly concerned with the structure of the human body. The methods of operating employed by the surgeons of antiquity were partly forgotten, or only practised by a few who preserved the knowledge of them as a secret which they transmitted to the narrowest circle of their friends. It was thus necessary that they should be discovered afresh, which task was accomplished by certain gifted practitioners who were led to this work by the need of improvement in the methods hitherto used. The revival of the study of ancient writings had but a limited effect in this direction, for the unlearned wound-doctors were, as a general rule, not at all in touch with literature, and the educated doctors frequently lacked the practical knowledge necessary to form an opinion upon the experiences bequeathed by the ancients.

The introduction of fire-arms into warfare was of extraordinary importance in its effect on the development of surgery. While up to this time the wounds to be treated were chiefly cuts or stabs, now gunshot wounds stepped into the foreground. Symptoms hitherto entirely unknown resulted from wounds produced in this way. The writings of the ancients naturally gave no information upon these matters. Surgeons were, therefore, obliged to make observations for themselves, and to accumulate experience; to form opinions of the nature of gunshot wounds and of the way to treat them. This had a most powerful influence in promoting their emancipation from traditional authority and their intellectual independence. The excessive amount of disturbance induced by gunshot wounds and many complications and

sequelæ which were observed to attend them, aroused the suspicion that other circumstances, besides the mechanical wound, were operative in these cases. So the surgeons came to form the conjecture that the serious results of gunshot wounds were produced by burning and poisoning, and they explained this by the nature of the materials, namely powder and lead, which were the immediate agents in causing the wounds. In order to render the supposed influence innocuous they treated gunshot wounds with stimulating and caustic applications. This method of cure obtained general acceptance until a lucky accident smoothed the way for more correct knowledge. After a battle there happened to be a scarcity of hot oil for cauterizing the wounded. The famous French surgeon AMBROISE PARÉ who has described the fact in a very clear manner,* used instead of it merely a dressing of simple soothing ointment and awaited with anxiety the result which should follow this procedure. Who can describe his astonishment when on the next morning he found the wounds he had treated in this way present a good appearance, being neither painful nor inflamed nor swollen, whereas other wounds, which had been cauterized in the old way, had become so? Repeated trials confirmed this experience and the successes which were obtained by this simple method of treatment led to cauterization—inconvenient alike to the patient and the doctor—being gradually laid aside. PARÉ and MAGGI also made the statement that gunshot wounds are not attended with burning since musket balls can be fired on to sacks filled with gunpowder without causing its ignition.†

In any case, however, the kind of wounds caused by the new method of carrying on war was essentially changed. The missiles produced great destruction of the bones which

* Œuvres D'AMBROISE PARÉ ed. par J. F. MALGAIGNE, Paris 1840, T. ii, p. 127 *et seq.*—LE PAULMIER: Ambroise Paré d'après de nouveaux documents, Paris 1885.

† Œuvres D'AMBR. PARÉ *op. cit.* T. ii, 134.

were seldom if ever implicated in wounds caused by the weapons in use at an earlier period. Amputation, but seldom practised before, was now frequently required. With increased experience the surgeons acquired great certainty in performing these operations and began to improve upon the methods till then in use. The chief mistakes made were that surgeons had a tendency to postpone them too long, to perform them when the soft parts were unhealthy or gangrenous and to cauterize the stump with the hot iron or with hot oil in order to arrest the bleeding, and to remove the necrotic tissue. Important steps in advance were therefore made, when BOTALLO demanded the prompt performance of amputation, as soon as signs of threatening gangrene presented themselves, and again when surgeons once more began to make the separation in the healthy parts, and finally when HANS VON GERSDORF, who was able to boast that he had performed about 200 amputations, covered the stump with moistened bladders and applied cooling dressings, in this way securing for the stump a sufficient covering of skin and soft parts which by the employment of the hot iron used to be too extensively destroyed. To prevent the danger of profuse hæmorrhage during the operation, the limb was constricted with bandages above the line of incision. By the pressure on the blood-vessels and nerves caused by the bandages, it was hoped, as A. PARÉ states,* not only to prevent hæmorrhage, but also to diminish the pain and to bring about a local anæsthesia. Ligature of the arteries which was again recommended by A. PARÉ† afforded the greatest security against the threatening hæmorrhage.

This method, as has been said, was already known to the surgeons of ancient times; in the middle ages also it was occasionally employed by certain distinguished operators.

* Œuvres D'AMBR. PARÉ *op. cit.* T. ii, p. 222.

† Œuvres D'AMBR. PARÉ *op. cit.* T. ii, 226 *et seq.* – ADAMKIEWICZ: Die mechanischen Blutstillungsmittel bei verletzten Arterien von Paré bis auf die neueste Zeit, Würzburg 1872.

PARÉ states that he was led to the attempt to ligature vessels by the study of GALEN: he reintroduced this procedure for the first time in an amputation in the lower part of the thigh, in the year 1552. He afterwards adopted ligature *en masse* in place of that of isolated arteries, tying the nerves along with the vessels. The belief was that in this way the discharge of the "nervous spirit" was prevented. For secondary hæmorrhage the arterial trunks were compressed by the external application of the fingers; mention is also made of a method which, in the somewhat obscure description of it by A. PARÉ, appears to answer to ligature in continuity.

Among the diseases liable to occur as the result of wounds erysipelas, hospital gangrene, diphtheria, pyæmia, trismus, and tetanus were noticed.*

The technical procedure in lithotomy underwent a marked improvement in the 16th century. The method in use up to that time, described by CELSUS and simplified by PAULUS AEGINETA, was amended by passing into the urethra, before the operation, a curved hollow sound shaped like a catheter, the convexity of which abutted on the perineum. As the incision in the *pars membranacea* was made on the groove of this sound, the hand of the operator took a more certain direction—a matter of great importance for the result. This procedure was called the operation with the large instrument, and BERNARDO DI RAPALLO was looked upon as its discoverer. It became more generally known through MARIANO SANTO. The disadvantages which sometimes accompanied perineal lithotomy, namely, suppuration of the prostate and of the ejaculatory ducts with the impotence arising therefrom, but above all things the impossibility of removing by the perineal wound either very large or encysted stones, suggested the idea of

* F. WÜRTZ: Practica der Wundartzney, Basel 1642, S. 271, 538, 645 *et seq.*—TH. BILLROTH: Historische Studien über die Beurtheilung und Behandlung der Schusswunden, Berlin 1859, S. 15 *et seq.*—WOLZENDORFF im Deutschen Archiv f. Gesch. d. Medicin, Bd. ii, S. 23 *et seq.*; Leipzig 1879.

going in search of the stone from above by an incision over the pubic symphysis.* PIERRE FRANCO performed high lithotomy for the first time in 1560 with success on a child aged two years after having made a vain attempt to remove the stone, which was the size of a hen's egg, by the old method. He felt himself especially induced to operate in this way as the bladder protruded forwards with some firmness. ROUSSET gave afterwards the very reasonable advice, that the bladder should be filled with water before proceeding to the operation. The high operation had also many dangers attached to it, which rendered its success questionable. PIERRE FRANCO recognized this fact and in consequence practised perineal lithotomy again, introducing a new method. In this the incision upon the curved staff introduced into the bladder was carried sideways from the raphe and prolonged through the prostate. Lateral lithotomy, as this procedure was called, had at least the advantage that by it stones of considerable size could be removed. P. FRANCO made the remark, that calculi in the female sex are frequently removed by simple dilatation of the urethra. Lithotrity had nearly fallen into oblivion. A. BENEDETTI stated that some surgeons crushed the calculus with iron instruments without making any incision, but he did not treat of this procedure at any length.† PROSPER ALPINI ‡ described a particular method which he had learnt in Egypt. It consisted of squeezing the stone by pressure from outside into the urethra, which had been dilated.

Surgeons sought to effect the cure of hernia by long continued lying on the back or by trusses: and not unfrequently the operation for radical cure was decided upon. For this, in inguinal hernia the sides of the opening were,

* C. B. GÜNTHER: Der hohe Steinschnitt seit seinem Ursprunge, Leipzig 1851.

† AL. BENEDICTUS: Omnium à vertice ad calcem morborum signa, causæ etc., Basil. 1508, lib. xxii, C. 48.

‡ De medicina Ægyptorum iii, C. 14.

after returning the prolapsed bowel, sewn together with gold or lead wire or thread. Great credit is due to AMBROISE PARÉ in that he limited as far as possible operative interference to cases of strangulated hernia. Only in such cases did he perform regular herniotomy. It is true that other surgeons, as P FRANCO and ROUSSET, did the same operation before him; but the procedure was laid upon a scientific foundation first by A. PARÉ and a prospect was, in consequence, held out to patients with this affection of being cured, whereas at an earlier time they were generally left to their fate.* The operative relief of urethral stricture by forcible division with a knife, known at an earlier period to surgeons of the time of the Roman Empire, was rescued from oblivion by A. PARÉ. Bougies, also, were made use of in these affections, and were smeared with appropriate medicaments; these were especially recommended by LAGUNA.

The knowledge of plastic operations had in the 16th century long ceased to be a secret of the empirics of Norcia and Preci. Several able surgeons devoted themselves to them, and acquired great skill in performing them. GASPARE TAGLIACOZZI, Professor at Bologna, obtained the greatest success in this branch of surgery and has left a thorough description of the procedure.† To replace the loss of substance he employed the skin of the upper part of the arm, like A. BRANCA before him. From all parts of Europe patients came to him to be operated on. The story that he had at one time in his hospital 12 German Counts, 19 French Marquises, 100 Spanish Grandees and one English Esquire, who had all lost their noses through dissolute living and desired fresh ones from him,‡ if only a witty anecdote yet shows how widely spread his fame as an operator was. TAGLIACOZZI earned but small thanks for

* E. ALBERT: Die Herniologie der Alten, S. 180 *et seq.*—A. GYERGYAI in the Deutschen Arch. f. Gesch. d. Medicin, Leipzig 1880, Bd. iii, S. 326 *et seq.*

† De chirurgia curtorum per insitionem, Ed. TROSCHEL, Berol. 1831.

‡ J. BICKERSTAFF: The Tattler, London 1723, iv, No. 260.

his philanthropic actions. A narrow fanaticism saw in his attempts to restore the loss of nose or lips a presumptuous interference with the rights of the Creator. After his death, the pious sisters of the monastery, in which his earthly remains had been laid, heard during several weeks a voice crying "TAGLIACOZZI is damned!" At the instance of the clergy of Bologna his corpse was taken from the grave and reinterred in unconsecrated ground.* Silliness in matters of faith such as that manifested in the 16th century finds an excuse in the low state of civilization of the period. We of the 19th century however are not at liberty to treat such displays with laughter and contempt; for when, about 40 years ago, the employment of ether was suggested in difficult labours to produce anæsthesia the English zealots rose angrily to oppose it, appealing to the words of the Bible in reference to woman, "In sorrow shalt thou bring forth children!"

Besides TAGLIACOZZI, other surgeons like GRIFFON of Lausanne and CORTESI of Bologna made themselves known by their successful rhinoplastic operations. The loss of the nose was not only the result of disease, generally syphilis, but sometimes was consequent upon an order of the magistrates. This punishment was by an edict of the Emperor FREDERICK III. imposed upon adulteresses and mothers who prostituted their daughters. The Municipal law of Augsburg of the year 1276 decreed that "vagrant girls or 'Hübschlerinnen,'" as they were called, should have their noses cut off if they roamed about the streets during Lent or on Saturday night, except when distinguished foreigners were present in the town.†

Ophthalmic surgery did not take any remarkable share in the progress made by other branches of surgery at this period. It lay almost entirely in the hands of itinerant

* A. CORRADI: Dell' antica autoplastica italiana, Sep.-Abdr. 1874.

† HUILLARD-BRÉHOLLES: Hist. dipl. Fried. II, *op. cit.* iv, p. 168, 170, lib. iii, tit. 74, 80.—LAMMERT: Zur Geschichte des bürgerlichen Lebens *op. cit.* S. 76.

quacks who often undertook with audacious boldness the most serious operations without possessing any knowledge of the structure of the eye or of the nature of the diseases they were treating. When one of these gentry, who shortly before had been a serving man, was asked how he could be so confident as to operate on cataract, he replied that the patient had nothing to lose for if the operation miscarried he only remained blind as he was before.

Midwifery also was during the first half of the 16th century completely neglected. How small the knowledge of doctors on this subject was at that time is shown by the text-book for midwives published by EUCHARIUS RÖSLIN in 1512 under the title "The Pregnant Woman's Rosegarden." This contains incredible mistakes and representations of various positions of the *fœtus in utero* which can only have been fabricated by a fertile fancy, and never actually observed. His imitators, WALTHER REIFF and JACOB RUEFF, citizens and engravers of Zürich, known too as authors of religious dramas, were in much the same position. Even more insignificant was the work of L. BONACCIUOLI, professor at Ferrara, which was dedicated to LUCREZIA BORGIA and in which among other things it is stated that sometimes 70 or more fœtuses escape at the same time from pregnant women; the author appears to have confounded them with intestinal worms.* With the improvement of anatomy and surgery a prospect was opened up of midwifery also being for the first time placed on a scientific foundation. Here again it was AMBROISE PARÉ who initiated more correct views and better methods of treatment. He settled what should be considered indications for turning—a procedure known in ancient times though hitherto but little used—and gave directions for its performance.† It was owing to him that from henceforth it secured for itself a permanent position in operative midwifery. His doctrines received a wider development and

* E. C. J. v. SIEBOLD *op. cit.* ii, 17.

† Œuvres D'AMBROISE PARÉ, ed. MALGAIGNE, T. ii, 628 *et seq.*

a firmer foundation at the hands of PIERRE FRANCO and JAQUES GUILLEMEAU. The former recommended for extracting the child, that a speculum having three branches should be introduced into the vagina: into this he endeavoured to guide the head or the feet of the child. He thus came near to the discovery of the midwifery forceps.* GUILLEMEAU was acquainted with *placenta previa* without however understanding how it arose and he performed an *accouchement forcé* on the daughter of A. PARÉ. Cæsarean section was undertaken on the living; but it appears in several cases, of which mention is made, to have been a question merely of abdominal section in extra-uterine fœtation. Thus BAUHIN relates that JACOB NUFER, a Swiss gelder, in the year 1500 opened the abdomen of his wife who was pregnant "in the manner in which he was accustomed to do it in the case of swine"—and this after 13 midwives and numerous surgeons had attempted in vain to deliver her in the natural way.† In this case he is said to have given exit to a living child after the first incision. But on the other hand some cases must be referred to Cæsarean section proper.‡ Recourse seems to have been had to this operation even more frequently than was necessary; A. PARÉ cautioned surgeons against this and referred to the dangers of the operation. But people were not sufficiently advanced in knowledge to be able to define the conditions under which it is proper to undertake Cæsarean section although the works of ARANZIO on contraction of the pelvis perhaps afforded to doctors some suggestions upon the subject.

The spirit of criticism was aroused also in other departments of medicine and shook men's faith in doctrines and processes which relied for their support upon prevailing authorities. PIERRE BRISSOT pronounced it to be wrong, in

* SIEBOLD *op. cit.* ii, 83.

† SIEBOLD *op. cit.* ii, 94 *et seq.*

‡ SIEBOLD *op. cit.* ii, 106 *et seq.*—O. WACHS: Der Wittenberger Kaiserschnitt von 1610, Leipzig 1868.

inflammatory diseases, to bleed at a point remote from the affected part, as was customary at that time, and on the contrary performed the operation in its vicinity. His opponents, holding fast to the old opinions, attacked him vehemently on this account and affirmed that his innovation was as dangerous for the body as the religious belief of LUTHER was for the soul.* More important than all these disputes about the method of bleeding was the fact that in consequence of them doubts arose whether bleeding itself was always requisite in particular cases. About the same time MICHAEL SERVET combated the erroneous doctrines concerning the concoction of the juices. Moreover the exaggerated importance which men attached to the pulse and to the character of the urine, experienced a reasonable and necessary limitation. Unprincipled adventurers and ignorant empirics made such things the means of intolerable abuses. The urine-glass formed, as it were, the token of the doctor as may be seen in the pictures of the Dutch school and was said to give information upon the most secret and wonderful things. It was only likely that honourable doctors and men of intelligence not in the profession, like the Bishop DUDITH of Horekowicz, should turn from these practices and strive to obtain a scientific treatment of the subject of the urine. But in truth any such treatment could only be undertaken with success when chemistry had attained to a higher development.

No one effected more in this direction during the 16th century, than THEOPHRASTUS BOMBASTUS PARACELSUS, of Hohenheim. This man, who forms one of the most remarkable figures in the history of civilization, by some unduly honoured and by others overwhelmed with scorn and hatred, has but seldom been judged correctly and without prejudice. He was of a nature like FAUST'S: while fastening his eyes on the highest and noblest objects, he suffered shipwreck in consequence of his bold, ambitious

* K. SPRENGEL: Geschichte der Arzneikunde iii, 176 after MOREAU: De miss. sanguin. in pleurit., Paris 1630, p. 102.

plans and, in the strife with the conditions which surrounded him, lost all; lost even himself. But these sad facts cannot rob him of the credit of having rendered a great service to medicine in combating the theory of juices as held by the ancients, and in being the first to give expression to the thought that the processes of life are of a chemical nature, and that chemical changes form the conditions of health and disease. He recognized the falsity of the doctrine derived from ancient times that the heart is the source of heat, and said that every part of the body contains its own source of heat.* He referred to the analogy between gout and calculous diseases, saying that both are characterised by the deposit of solid material, and he recommended the use of alkaline waters in these cases. The internal employment of various chemical, and especially mineral, substances was first attempted by him. To this category belong mercury in different forms, several combinations of lead, antimonial medicines, precipitated sulphur, sulphate of copper, ferric oxide, and other preparations of iron. PARACELSUS declared that the task of chemistry was not the fabrication of gold, but the production of medicines. He devoted diligent study to that science,† and was the first to avail himself of tincture of galls for determining the presence of iron in mineral waters. The evil results entailed by the too long continued use of certain minerals—as, for instance, mercury—did not escape his notice. He had learnt to recognize them among the workmen in the mines of Idria. In the same way he described the effects of arsenic, and the diseases to which miners are exposed in smelting many metals. In taking chemistry out of the hands of the alchemists, and in making it useful to medical science, he gave an incentive to the treatment of it in a scientific manner, and to the foundation of a medical chemistry.

The effects of these circumstances were seen in pharma-

* PARACELSUS: Paramirum, Lib. i.

† KOPP: Gesch. der Chemie *op. cit.* i., 96.

cology. Numerous remedies which had been almost or completely forgotten were once more called to mind, and new ones were discovered. At the same time the pharmacopœia was much enriched by the addition of drugs introduced from America. The Emperor CHARLES V., by the advice of VESALIUS, made use of a decoction of china root (*smilax china*) when he lay ill with the gout. Guaiacum enjoyed a great reputation as a specific remedy for syphilis. ULRICH VON HUTTEN, who himself suffered for many years from this disease, has given a complete description of the effects of guaiacum.*

In the domain of internal medicine, the spirit of independence awakened by the struggle against the faith in authority brought forward a number of observations which contributed largely to the knowledge of diseases. Syphilis, which at this period was of unwonted virulence, and spread like an epidemic—on this account being considered a new disease which had reached Europe from the newly discovered countries across the ocean—had a startling light thrown upon its real nature by the establishment of genetic relations between the primary local affection on the one hand, and the ensuing secondary and tertiary symptoms on the other. Numerous treatises dealt with the course, symptoms, and treatment of this affection, and took into consideration every aspect presented by the disease.

The first contributions upon scurvy date from the same period. VASCO DE GAMA in his expedition of 1498 lost no less than 55 of his ship's company, who succumbed to this disease.† The appearance of it was also observed in the maritime countries bordering on the North Sea and Baltic and in certain other districts.

So too, at the end of the 16th century the earliest

* U. v. HUTTEN: De Guajaci medicina, Mogunt. 1519.—F. F. A. POTTON: Livre du chevalier allemand Ulrich de Hutten sur la maladie française, Lyon, 1865.

† A. HIRSCH: Handbuch der historisch-geographischen Pathologie, Stuttgart 1883, ii, 358 *et seq.*

accounts are given of spasmodic ergotism—*Ergotismus convulsivus*—which was distinguished both by its symptoms and by its geographical distribution from the gangrenous form of the same toxic affection and which in earlier times was commonly designated *Ignis sacer*.

In consequence of the careful study of the symptoms of disease and the progress of medical science it gradually became possible to separate the multifarious nosological conceptions commonly formed of leprosy and plague and to apportion them to the various diseases from which they had been taken. As a result of this, along with various affections characterized by eruptions on the skin, the typhus and typhoid fevers gained an independent place in scientific pathology. FRESCATORIUS, the most distinguished epidemiologist of the 16th century, published the first description of exanthematic typhus. BAILLOU left the first unmistakable account of whooping-cough and croup. Besides these works of fundamental importance, the literature dealing with individual cases deserves to be mentioned, being of great significance in the development of medical science. Particular observations are even now full of interest, such as those upon gallstones by A. BENEDETTI; the description, illustrated by a drawing, of the renal calculi of the DUKE ALBERT V. of Bavaria to which popular superstition assigned the form of Jesuits' heads;* the case narrated by F. VALLERIOLA, in which a pistol-ball, which had penetrated the abdomen, was after a certain period passed *per anum* without producing any further complications;† the report of a case by DODONÆUS, who at the post-mortem examination of a French prince, for long a sufferer from urethral discharge and pain in the region of the kidneys, found suppuration of the ureters and induration of the kidneys;‡ the experiences of FELIX PLATTER in the treatment of mental diseases and his outspoken expressions against

* CREDÉ and DISTEL in VIRCHOW's Archiv, Bd. 96, S. 501 *et seq.*

† Observat. medicin. lib., iv, c. 9. Lugd. 1605.

‡ Medic. observat. exempla rara, Harderwyk 1521, p. 72, c. 41.

coercive measures and the confinement of the insane in prisons; and many others.

It has been possible here only to glance at the rich acquisitions made by medical science in the 16th century: for a complete description of particular lines of progress would carry us too far and is not the task of the writer of this work. The examples adduced are sufficient to indicate how the spirit of the age was reflected in the development of medicine.

THE UNIVERSITIES IN THE SIXTEENTH CENTURY.

THE intellectual life, thus developing itself with unexpected energy, resulted in the foundation of numerous universities. In Spain and Portugal, which countries in consequence of the discoveries across the ocean were pressed into the foreground among places of public interest, academies were founded at Toledo (1520), Baeza (1533), Compostella (1534), Granada (1540), Ossuna and Gandia (1549), Almagro (1552), Orchuela (1555), Tarragona (1572), and Oviedo (1580); universities arose even in the new world, at Lima (1551) and Mexico (1553). But in the evolution of science the importance of these was but small. They quickly sank into oblivion when Spain, destined by fate to play the part of the leading maritime power, had, through the short-sighted ecclesiastical policy of her rulers and the narrow-minded priest-ridden character of her people, fallen precipitately from the political height which she had attained. England and the Netherlands, stepping into the place of Spain, soon came to rule the trade and intercourse with the countries across the ocean, and knew better how to make use of the advantages of their position. Their prosperity grew apace, and they became the wealthiest countries of the world. They united in their possession the riches of America and the treasures of Asia; for even the Oriental trade, which had hitherto found its way across Italy, now

adopted another route and reached the coasts of Great Britain, Holland, and North Germany by sea. These facts afford the explanation of the remarkable phenomenon that the last mentioned countries from this time forth played an important part also in the scenes of intellectual life, in art and science, while, on the other hand, they throw light upon the decline of Italy, which began at this period, and became clearly evident at the conclusion of the 17th century. Italy contained in the 16th century only two academies, those of Macerata (1540) and Messina (1548).

In France universities were founded at Rheims (1558), Douai (1561), Besançon (1564), and Pont-à-Mousson (1572).* To these, the universities of Lausanne (1536) and Geneva (1569), situated in French Switzerland, were added. Moreover, King FRANCIS I. founded the Collège de France, where lectures were delivered gratis, which everyone was free to attend. Among the twelve richly-endowed professorships one was devoted to medicine.

In the British islands Edinburgh (1583) and Dublin (1591) possessed each a university. Similar institutions arose in the Netherlands at Leyden (1575) and Franecker (1585). On the eastern boundaries of civilization Wilna (1597) was made the seat of an academy. The number of German universities was also considerably increased. As early as at the Diet of Worms in 1495 the Emperor MAXIMILIAN I. issued an order to the Electors that each should found an academy in his own country. What the Electors effected, that also the other territorial lords desired to achieve if it was in any way possible. And in this manner a number of universities were created, many of which were scarcely in possession of the barest necessaries for their existence. In 1502 the Elector FREDERICK THE WISE of Saxony founded, with the Emperor's permission, the academy at Wittenberg, which in the following decades formed

* TOURDES: Origine de l'enseignement méd. au Lorraine. La faculté de méd. de Pont-à-Mousson, Paris, 1876.—LEGRAND: L'université de Douai, Douai 1888.

the centre of the movements connected with religious reform. The foundation of the university at Frankfort-on-the-Oder for the Margraviate of Brandenburg followed in 1506. The first academy which came into existence after the Reformation, and bore a decidedly Protestant character, was that of Marburg, in Hessen, which was founded in 1527, but which only in 1541 received the sanction of the Emperor. And like the Marburg university there arose that of Königsberg, in Prussia (1544), under the influence of MELANCHTHON, whose son-in-law, SABINUS, was its first Rector.* In 1549, O. VON TRUCHSESS, Bishop of Augsburg, founded at Dillingen an educational establishment for the clergy, which in 1554 was invested by the Pope with the rights of a university. Afterwards it was conducted by the Jesuits, and was abolished in 1804.† The university of Jena (1558) arose from the circumstance that the Elector JOHN FREDERICK of Saxony desired to have a university in the neighbourhood of his residence, when, after the unfortunate battle of Mühlberg he was compelled to exchange his country for that of his cousin MORITZ. His example was followed by the Duke JULIUS of Brunswick, who in 1576 created the university of Helmstädt, which existed up to the year 1809. The medical faculty of this university bore on its coat of arms a crowned ox under a star.‡

Academies in the dominions of the Hapsburg dynasty were founded at Olmütz (1573) and Graz (1585), and bore the stamp of Catholicism; they were, however, not provided with all the faculties. The university of Würzburg, reopened in 1582 by the Prince Bishop JULIUS ECHTER, alone possessed a richer equipment for the advancement of medical studies. For the rest, the other newly-arisen universities had seldom more than one medical professor. Theology always as yet occupied the

* M. TÖPPEN: Die Gründung der Universität zu Königsberg, 1844.

† PAULSEN: Geschichte des gelehrten Unterrichts *op. cit.* S. 268.

‡ Geschichte der ehemaligen Hochschule zu Helmstädt, Helmstädt 1876.

foreground. The Protestant academies fought no less zealously for the new faith than did the Catholic universities, under the guidance of Jesuits, defend the authority of the Pope. No one who did not adhere to the Lutheran belief was tolerated at the academy of Helmstädt. The Duke of Brunswick, in 1584, declared to the General Consistory that it was better that such people should "go straightway to the devil than that they should sully and contaminate his churches and schools."* However, it was already a great advance in the direction of tolerance that he only *wished* those of another faith, in the world to come, and did not use force to help them on the road thither. Unfortunately this occurred only too often even under the rule of Protestantism, as, not to mention the cruel and bloody persecutions of which England and the countries subject to her were the scene, the example of the unfortunate MICHAEL SERVET testifies, who, on the prosecution of CALVIN, came to the stake at Geneva owing to his failure to comprehend the doctrine of the Trinity in Unity of the Godhead.†

The effect of the split in the Church upon the universities, which attached themselves to the movements of religious reform, manifested itself first by the act of shaking off the yoke of Rome and by a removal of direct papal interference. But ecclesiastical influence was not thus abolished; Protestant theologians merely stepped into the place of their Catholic predecessors, making their rule oppressively felt in many countries—for example, in England—and extending their control in an unjustifiable manner over all possible paths of intellectual life. A freer spirit animated the Protestant academies of Germany. The priesthood of the new Church here won less power and developed gradually into an organ of the State Govern-

* PAULSEN *op. cit.* S. 178 following E. L. T. HENKE: Georg Calixtus und seine Zeit, Halle 1853.

† W. E. H. LECKY: History of the Rise and Influence of the Spirit of Rationalism in Europe.

ment, which, on grounds of political expediency, was obliged to avoid brutal outbreaks of religious intolerance. In France the control of the universities and generally of the whole system of education by the State was gradually introduced by the energy of the governments, just as in the Protestant countries of Germany it came about under the influence of the Reformation.

In the Catholic countries of Germany this process was only accomplished in the 18th century, and in other States, as in Italy, only in the 19th. It resulted in the introduction of many changes in the organization of the universities. The dignity of Chancellor, if not entirely abolished, was conferred upon high officials or trusted friends of the Government, and the charter was no longer conferred by the Church but by the State. The cosmopolitan character of the universities ceased to exist at the same time; henceforth they were no more than the highest educational establishments of the State, and their academical degrees were no longer, as formerly, of value in all countries of Christendom, but only in a narrowly-defined political district. The unlimited freedom which the learned professions enjoyed in the middle ages was done away with, and a system of tests gradually became developed which recognized knowledge only when it had been acquired in particular training grounds. The financial condition of the universities of Germany and of several other countries which attached themselves to Protestantism sustained as a general rule a great revolution. The Professors lost the prospect of an increase of their incomes by the acquisition of fat benefices. The slight rise in their stipends which resulted from the secularization of the Church property afforded but a poor compensation. Everywhere it was felt that the secure support afforded heretofore by the rich pecuniary possessions of the Church now no longer existed. How insignificant was the amount demanded at that time for the support of a university is shown by the annual budget of the academy of Tübingen for 1541-42. The

income reached 5,176 florins, the expenditure 4,853 florins; in the latter were included the stipends of three professors of theology, six of law, two of medicine, and ten of the liberal arts, the amounts varying from 40fl. to 200fl., in all 2,394fl.*

The requirements of a small university of that period were not great, as is seen by the example of Greifswald where the whole extent of the university was included in a single house. It consisted of three lecture-rooms, the senate-chamber, a stall for the trade in academical books, the library, the chamber for the records, dwelling rooms for two professors, several apartments where students lived, and the prison in the basement.† The Catholic academies were in a more favourable position in this respect. Pope JULIUS III., in the year 1553 promulgated a bull by which it was made legal to grant spiritual benefices to secular professors,—a practice, indeed, which had long been sanctioned by usage and passed over in silence. The celibacy of university teachers became, in consequence of this, objectless, and gradually ceased to be observed even in Catholic countries. In Protestant academies it was naturally done away with; yet custom had such a powerful effect that in Tübingen, for example, the usage was still adhered to, and celibacy was demanded even of the professor of medicine, long after the university had become Protestant. The salaries of the professors differed in different countries and in the various faculties; those of the professors of medicine, as a rule, were on a lower scale than in the case of the theologians and jurists. In Paris each professor of medicine received in 1505 twelve livres a year.‡ In Königsberg, in the year 1544, salaries of 200 and of 150 florins were given to the two teachers of medicine.§

* F. PAULSEN in SYBEL's histor. Zeitschr. 1881, Bd. 45, S. 278 *et seq.*

† F. PAULSEN *op. cit.* S. 304, 407.

‡ HAZON *op. cit.*

§ D. H. ARNOLDT: Historie der Königsbergischen Universität, Königsberg 1746.

In Heidelberg before the Reformation the three professors of medicine drew the yearly stipends of 180, 160 and 140 florins. In 1588 these were raised to 270, 180 and 170 fl., and in addition, each professor received free lodging, a tun of wine and twelve measures of corn a year.* The Duke WILLIAM of Bavaria in 1537 established in Ingolstadt a teacher of law with the stipend of 300 fl. This was the highest salary paid at that time at a German university.†

The students, as a body, were in like manner powerfully influenced by the great events of the time. The struggle against authority opened up along all lines of attack, the study of humane learning seeing its ideals in the unconstrained life of the ancient world, but above all the division in the Church, engendered a spirit of freedom and liberty which sometimes rose in revolt against every interference with complete independence. The records of the Senate of the university of Tübingen contain remarkable notes for the history of manners among the students of the 16th century. Thus in a letter of the year 1564 addressed to the Senate the nuns of Silchen complained that they were molested by the frequent and importunate visits of the students. Many students in Tübingen were married and fathers of families. In 1575 the young students were forbidden to marry without the consent of their parents. In 1589 the Senate was informed that a widow misconducted herself with the students; as a punishment for this she was "chained up in a little room."‡ Similar excesses occurred at Wittenburg.§ Among the students also of Catholic universities, as we learn from information to hand concern

* HAUTZ *op cit.*

† MEINERS: Geschichte der Entstehung der hohen Schulen, Göttingen 180

‡ R. v. MOHL: Nachweisungen über die Sitten und das Betragen der Tübinger Studierenden während des 16 Jahrhunderts, Tübingen 1871.—JOH. HUBER Deutches Studentenleben in Kleine Schriften, Leipzig 1871, S. 364 *et seq.*—GEBHARDT in the Zeitschr f. allgem. Gesch. edited by ZWIEDINECK-SÜDHORST, Bd. iv, 1887, S. 962.

§ J. F. A. GILLET: Crato von Crafftheim, Frankfurt-a-M. 1860, i, 101.

ing that of Ingolstadt, a rough, violent tone prevailed.* The students lived partly in "Bursen" or boarding-houses, as they existed in the middle ages, partly at the houses of private people or professors. The latter found a sometimes highly desirable source of income in housing and attending to students. The son of MARTIN LUTHER kept a boarding-house for students in Wittenberg which was much frequented.† In Heidelberg it not unfrequently occurred that the professors caused the wine which formed a portion of their pay, to be publicly retailed: they might safely calculate upon their pupils devoting themselves to it with at least as much assiduity as to their lectures. Poor students were exposed to the bitterest want. THOMAS PLATTER has given a touching picture of their miserable existence in his autobiography. Cold and hungry, clothed in rags and begging for alms, he, with his companions, traversed Switzerland and Germany. The travelling students formed a vagabond class which put credulity and ignorance under contribution and in many places became a serious annoyance to the country. A deep social gap divided these beggar-students from the rich and distinguished young men to whom, at most universities where they studied, a privileged position was assigned. These frequently sought to cut a figure by costly feasts and banquets, by an appearance of prodigality and by excessive luxury in dress. The pantaloons, for example, of some students used to cost above 100 fl.: a sum, the value of which we begin to grasp when we consider that the midday meal of the Tübingen students of that period, consisting of three courses and a quart of wine, was paid for at the rate of 38 florins a year. Laws, sermons and books inveighed against the prodigality of the students but, as it seems, without result. Professor MUSCULUS, of Frankfort-on-the-Oder, criticized severely the fashion of pantaloons in a tractate bearing the title: "An Exhortation and Admonition against the decoy-

* B. GEBHARDT *op. cit.* S. 957.

† PAULSEN: Gesch. d. gel. Unterrichts S. 161.

ing, manners- and honour-compromising, pantalooning Trousers-devil" (Frankfort-on-the-Oder, 1556). A resolution of the Senate of the Tübingen Academy of the year 1554 cautioned "the noblemen, so lately arrived here, in respect of their unrefined and indelicate trousers" and called upon them "to lay aside such an objectionable and soldiering garment."

MEDICAL TEACHING.

THE changes, brought about in medical science, exercised an influence upon medical teaching inasmuch as the quantity of subject matter as well as the number of professorships and the means of instruction were augmented: the method, also, of medical education, in response to the importance acquired by anatomy and surgery, took by degrees a somewhat more practical direction. Events which had occurred in the history of civilization, discoveries and inventions of many kinds, likewise exercised a powerful influence upon the system of education.

Before the discovery of the art of printing, libraries were the rarest and costliest things. The medical faculty of Paris possessed in 1395 no more than nine works, among which the *Continens* of RHAZES was the most highly prized. When King LOUIS XI. in 1471 wished to borrow this work, in order to have it copied, long consultations were held by the faculty upon the subject and they only granted permission after the King had deposited as caution-money 12 marks in silver and had granted a loan of 100 thalers in gold.* Private persons could make collections of books only by the expenditure of large sums of money. Even so prominent and wealthy a doctor as TADDEO ALDEROTTI, left at his death only four books; in the property bequeathed by the doctor FREIDANK we find no

* J. C. SABATIER *op. cit.*—KOSEGARTEN (Geschichte der Universität Greifswald, Greifswald 1857, ii, 232) gives a catalogue of the books which in 1482 were in the possession of the medical faculty of Griefswald.

more than three.* The preparation of a copy of a work claimed years of strenuous application and demanded attainments at that time by no means common. With the discovery of printing a revolution was effected in this respect, similar to that which in the most recent times has been brought about by the substitution of machine- for hand-work in the preparation of goods. The foundation and improvement of academical libraries were by this facilitated or, properly speaking, for the first time made possible. The universities in this way gained an aid to teaching which promoted the development, at once, of the intellect and of the character. They recognized its importance thoroughly, and took pains to procure the money necessary for the acquisition of books and to regulate the use of these collections by judicious arrangements and instructions.† The rules of the medical faculty of Montpellier in 1534 provided, that the library should be opened at 6 a.m. in summer and at 8 a.m. in winter, and should be closed at 4 p.m. The students were held responsible for any injury occurring either by loss or disfigurement of the books.‡

In the 16th century the practice was also commenced of providing the universities with botanical gardens. The republic of Venice set a good example, in this respect, to all other states by causing a botanical garden to be laid out at Padua in 1545.§ Then arose those at Pisa (1547) and Bologna (1568) where afterwards A. CESALPINI "the greatest botanist of his century" taught and worked. In 1577 LEYDEN acquired a botanical garden; Montpellier in 1593. In the German academies the earliest were founded at Leipzig (1580), Breslau (1587), Basel (1588) and Heidel-

* KRIEGK *op. cit.* i, 17.

† PRANTL *op. cit.* i, 215.

‡ DUBOUCHET in the Gaz. hebd. des scienc. méd. de Montpellier 1887, No. 11, p. 124. Compare also the very detailed Rules for the Library of the École de Médecine of Paris for the year 1395 in SABATIER *op. cit.*

§ MEYER *op. cit.* iv, 256 *et seq.*

berg (1593).* At first they only served to promote the study of medicinal plants. The teaching of botany was combined with demonstrations on the plants, a procedure which facilitated the comprehension of the lectures in an extraordinary degree. Moreover, herbaria or collections of dried plants, probably introduced since the middle of the 16th century,† were applied to the same purpose, as also were drawings of plants. Even in ancient times care was taken to embellish botanical works with drawings. Those of the manuscripts of DIOSKORIDES, which are now possessed by the Imperial Court Library at Vienna, date from the 5th century. From later times, also, especially from the 15th century, numerous drawings of plants have been preserved.‡ By the invention of wood- and copper-engraving it became possible to multiply the drawings at pleasure. Distinguished artists, nay, even the master-hand of a GUIDO RENI, made drawings for the engraver. Botanical literature was in the 15th and 16th centuries enriched with a great number of illustrated works of this kind.

Anatomy owed still more to the art of painting. The most celebrated painters of this period devoted diligent study to the anatomy of the human body. LEONARDO DA VINCI received instruction from his friend, the anatomist MARC ANTONIO DELLA TORRE, upon the course and form of the muscles and upon the position of particular parts of the human body. He supplied the latter with drawings for an anatomical work, which he desired to publish, but which never appeared. These came afterwards for the most part into the possession of the Biblioteca Ambrosiana at Milan and then reached Paris; certain of them became the property of the English Royal Family and were published by means of engraving in the case of some of the drawings, in the case of others by photography.§ MICHELANGELO, too, occupied

* HAUTZ *op. cit.*

† MEYER *op. cit.* iv, 266 *et seq.* ‡ MEYER *op. cit.* iv, 273 *et seq.*

VASARI: Leben der ausgezeichneten Maler, Bildhauer und Baumeister. Deutsche Übersetzung, Stuttgart, 1843, Bd. iii, S. 26.—R. KNOX: Great Artists

himself for many years with anatomical studies, and during his sojourn in Rome was assisted in these by the anatomist REALDO COLOMBO who provided him with the body of a wonderfully handsome young negro to study.* He made observations upon the structure of man in the vaults of S. Spirito at Florence, and followed with great attention the dissections at which he had the opportunity of assisting. The report even went abroad that he made use of a living man as model when he had to represent the Saviour upon the Cross exactly as in ancient times a similar tale, as is well known, was told of PARRHASIOS when he painted PROMETHEUS torn by the vulture.† Among the anatomical drawings of MICHELANGELO mention may be made of the sketch of a dissection, and of the picture of a human body the muscles of which are shown after removal of the skin: the latter is characterized by close accuracy in its proportions. The skeleton studies of RAFAEL also are drawn strictly after nature; they produce a powerful effect by their essential truth and by their fidelity of expression. ROSSO DE ROSSI, a pupil of ANDREA DEL SARTO, produced some excellent representations of the muscles and of the human skeleton, which were multiplied by means of copper-engravings.‡

Sculpture was influenced also by studies in this direction as is clear from the statue of ST. BARTHOLOMEW preserved in Milan Cathedral in which the muscles are shown laid bare: this was the work of MARCO AGRATE. The anatomical plates of VESALIUS and the drawings accompanying his two larger works came from the school of TITIAN and were probably chiefly the work of JAN VAN

and Great Anatomists, London 1852.—CHOULANT *op. cit.* p. 6 *et seq.*—K. F. H. MARX: Über Marc Antonio della Torre und Lionardo da Vinci in Abhdlgn. der Göttinger Soc. d. Wissensch., Bd. iv, 177 *et seq.*—C. LANGER in the Sitzungsber. d. k. k. Akad. d. Wiss. Math.-Naturwiss. Kl., Wien 1867, Bd. 55, i, 637.

* A. CORRADI in Rendic. del R. Ist. Lomb. di sc. e lett., Vol. vi, ser. ii, p. 643.

† HAESER *op. cit.* ii, 27.—CHOULANT *op. cit.* p. 10 *et seq.*—ANN. SENECA: Controvers., lib. x, c. 5 (No. 34).

‡ CHOULANT *op. cit.* S. 16 *et seq.*

CALCKER, certain sheets and certain improvements in other sheets being perhaps by TITIAN himself. It is quite possible that, in addition to the two well-known figures of a man and woman, he had a hand also in the title page where VESALIUS appears performing the dissection of a corpse in the anatomical theatre in the presence of a large concourse of spectators. The anatomical plates of the pre-Vesalian period have a lower value, as, for example that of B. PASSAROTTI—a representation of blood-letting—which, it would appear, served for the instruction of surgeons and barbers.* ALBRECHT DÜRER and LEONARDO DA VINCI published works on the proportions of the human body † which were translated into foreign languages and exercised a great influence as is evident from the productions of several Spanish artists. Certain anatomists, also, produced valuable anatomical drawings. The picture which VAROLIUS made of the base of the brain displays contours, correct indeed if also rather coarse, and was obviously intended for teaching.‡ BERENGER of Carpi was, according to the testimony of BENVENUTO CELLINI, not only an experienced physician and anatomist, but also a skilful draughtsman. He embellished his anatomical works with woodcuts, which kept in view the interests of the artists as much as those of the doctors. So, too, the myology of CANNANI and the anatomical writings of CHARLES ESTIENNE (STEPHANUS), EUSTACHIUS and VOLCHER KOYTER, who himself made many anatomical drawings, of the Spaniard VALVERDE DE HAMUSCO, and again of GUIDI (VIDIUS), JACQUES GUILLEMEAU, FELIX PLATTER, SALOMON ALBERTI, GIULIO CASSERIO, and ADRIAN VAN DEN SPIGEL were all provided with illustrations.

Besides the anatomical drawings, which doubtless were

* CHOULANT *op. cit.* S. 39 *et seq.*

† A. W. BECKER: Kunst und Künstler des 16 Jahrhunderts, Leipzig 1863, Bd. i, 341, iv, 163.

‡ CHOULANT, *op. cit.* S. 69.

of great value in the education of doctors, and besides the theoretical lectures, the means of teaching most resorted to consisted of practical demonstrations for which opportunity was afforded by the dissection of corpses. These demonstrations were, in the course of the 16th century, introduced at all universities with which medical faculties were associated. At first they were performed in this manner:—the professor delivered from the chair descriptions and explanations of the various parts of the body, while the dissection itself was being made by a surgeon or a barber. The learned doctors were frequently of opinion that their dignity would be lowered if they meddled personally with dissection of corpses. When VESALIUS was studying at Paris anatomical teaching was, at that place, entirely in the hands "of ignorant beard-shavers," as he says,* "who confined themselves to showing the muscles of abdomen in a torn and shamefully mangled state, but did not demonstrate any other muscles or any bones; still less did they review, in any regular manner, the arteries, veins, or nerves." GUINTER of Andernach,† who taught anatomy in Paris, held aloof from practical work. VESALIUS says of him that he never used the knife for any other purpose than that of cutting up roast meat.

The Italian anatomists adopted a more correct method, in performing the dissections themselves. It was no doubt chiefly owing to this circumstance that nearly all the great anatomical discoveries of that period proceeded from Italy. The anatomical schools of that country were the best in the world. All the prominent anatomists of the 16th century received their education at them; among their professors are found the most glorious names in the history of science. In electing teachers there was no condition imposed as to their being natives of Italy; but the ablest

* VESALIUS: Epist. dedicat. to De corp. hum. fabrica.

† Concerning this teacher see E. TURNER in the Gaz. hebdom. de Méd., Paris 1881, No. 27, 28, 32.

teaching power was accepted from any and every country. Many Dutchmen and Germans were teachers of anatomy in Italian academies. At the suggestion of A. BENEDETTI an anatomical theatre was founded at Bologna in the year 1490. Similar institutions on the same plan arose also later in Padua (1548), Amsterdam (1555) and at other academies.* A great drawback to the development of anatomical teaching was occasioned by the scarcity of subjects, a state of things which was only very gradually improved. Even VESALIUS declared that he had so seldom had an opportunity of dissecting the uterus of a pregnant woman that he was really quite ignorant of the differences existing between it and the same organ in a similar condition in the canine race.† As a student in Paris and afterwards at Louvain he, with his companions, visited the churchyards by night in order to dig up and collect human bones; once he is said on such an expedition to have mounted the gallows and to have taken down the skeleton of the criminal who had been hanged there.‡ It was the same in other places as well. FELIX PLATTER narrates how he when a student at Montpellier, along with friends, among whom was a "daring monk of the Augustine Monastery," dug up bodies by night in the churchyard "after having had a good deep drink," and clandestinely conveyed the bones into the town.§ Not only the students, however, but the professors also, complained of the scarcity of subjects. RONDELET of Montpellier is said for this reason to have even dissected the body of his own son who had died. It is further said of him that when his colleague FONTANO was lying very ill he begged to be allowed, after his death, to devote his body to anatomical purposes.‖ Certainly in the statutes of the

* CERVETTO: Di alcuni illustri anatomici, Verona 1842, p. 150 *et seq.*

† VESALIUS: Epist. radic. chyn. decoct. rat. pertractans in A. CORRADI *op. cit.* p. 634.

‡ H. TOLLIN in the Biolog. Centralblatt 1885, Bd. v, 276 *et seq.*

§ FELIX PLATTER: Selbstbiographie, *op. cit.* S. 152.

‖ CORRADI *op. cit.* p. 643.—PORTAL: Hist. de l'anatomie i, 522.

medical faculties rules were laid down that every year one or more anatomical demonstrations should take place, and that the authorities should provide the bodies required. But the authorities were not always equal to their duties in this respect and, even when this was the case, the material used for study was scarcely sufficient for teaching purposes, and still less did it supply the wants of anatomical investigators in the pursuit of their researches.

It was therefore not unnatural that, baffled in obtaining material in a legal way, anatomists sought to provide it in another. Purchase and theft of bodies became consequently a not uncommon practice and one regarded by the magistrates with a certain toleration, when the objects in view were connected with science. But it seems to have been sometimes carried on too openly and also to have led to abuses with which it was necessary to interfere. In 1550 the people of Padua demanded that the laws against the desecration of graves and the stealing of bodies should be more strictly administered.* Religious now took the place of social prejudices in opposing the practice of dissection. Only through the good will of intelligent magistrates and the powerful support of the distinguished lords who interested themselves in anatomy, was it possible for investigators to find the material necessary for their studies. FALLOPIUS had the opportunity, in a single year, of dissecting seven human bodies; REALDO COLOMBO brought the number up to 14.† FELIX PLATTER states that in the course of thirty years' work he dissected more than 50 bodies;‡ a number unusually large for that time. VESALIUS during his successful activity in the academies of Padua, Pisa and Bologna had as many subjects as he wished; they were delivered to him from the scaffolds and from the hospitals. The judges had the kindness to

* CORRADI *op. cit.* p. 642.

† R. COLOMBO *op. cit.* xv, p. 262.

‡ F. PLATERUS: De corp. hum. structura et usu, Basil. 1583, in the dedication after the title-page.

choose a mode of death for the condemned, proposed by VESALIUS, with the object of preserving the bodies uninjured, or they put off the executions at his desire till such time as a scarcity of bodies prevailed. This obliging disposition was carried so far that when VESALIUS, wishing to solve the, at that time, undecided problem * as to the existence of the *hymen virginitatis*, was in a state of embarrassment as to where he could get a suitable female subject, COSMO DE MEDICI placed at his disposal the corpse of a pious nun who had died a short time before. As a result of this, as HYRTL remarks, it was possible to give its due weight to this important attribute of virginity, which it had hitherto been impossible to do, since the bodies of the maidens brought from the gallows as a rule were no longer in possession of this structure.

Practical teaching in anatomy consisted chiefly in the demonstration of parts of the body; the students only exceptionally had the opportunity of taking part in dissections themselves. It can be seen however from the statutes of the medical faculties that the number of dissections made every year for the purpose of educating the doctors gradually increased. In 1519 the rule was made that every year a body should be publicly dissected, since without anatomical dissection a knowledge of the human body and its diseases was unattainable.† A similar order is found in the statutes which the Duke ULRICH promulgated for Tübingen.

In Prague not only were anatomical studies in a very low condition, but the whole university had sunk into disrepute. The Priest JACOB in 1517 called it at the Teynkirche a "rusty ornament."‡ Medicine had almost ceased to be taught there in the 15th and 16th centuries. Anatomical demonstrations were first introduced at this university by JOHANN JESENSKY (JESSENIUS) who at the conclusion of

* H. TOLLIN in the Biolog. Centralbl. v, 347.

† ZARNCKE: Statutenbücher der Universität Leipzig, 1861, S. 39.

‡ W. TOMEK: Geschichte der Prager Universität, 1849.

the 16th century undertook there a professorship of medicine.*

Things were not much better in Vienna during the first half of the 16th century. Only after AICHHOLTZ assumed the teaching of anatomy were public dissections held there at least once in every winter. But these were afterwards discontinued. Then in 1567 the medical students requested that a dissection should once again be made, since this had not been done for many years. Their petition was, however, refused; they therefore repeated it the following year, but with the same result; only in 1571 was their wish gratified.†

About 1542 VESALIUS performed the first dissection of a human subject in Basel. The skeleton of it is still preserved, along with that prepared by FELIX PLATTER, in the anatomical museum of that university.‡ The latter undertook in the years 1559, 1563, and 1571 public dissections in the presence of the doctors, surgeons, and other spectators. Regular anatomical demonstrations were, however, only introduced after C. BAUHIN had been made professor of anatomy and botany.

In Edinburgh the Corporation of Surgeons obtained permission in the year 1505 to dissect the body of an executed criminal once a year.

The statutes of the medical faculty of Montpellier of the year 1534 contain detailed information as to how the students were to proceed in dissecting, and how much they were to pay for the privilege. In 1598 an anatomical theatre was founded there and a prosector appointed with a stipend of 100 thalers.§ In Paris the post of prosector was instituted as early as 1576: it was filled by a surgeon who carried out the practical arrangements, while a bache-

* J. HYRTL: Geschichte der Anatomie in Prag, Prag 1841, p. 11.

† ROSAS *op. cit.* ii, 85, 89, 104.

‡ His in the Correspond.-Blatt der Schweizer Arzte, 1879, S. 121 *et seq.*

§ DUBOUCHET in the Gaz. hebd. d. scienc. méd. de Montpellier, 1887, No. 11 and 17.—ASTRUC *op. cit.* p. 66 *et seq.*

lor of medicine who was distinguished for his anatomical knowledge, had to compile from literature, and deliver orally, the theoretical explanations. The latter bore the title of Archidiaconus. The prosector had a very dependent position. He was under the supervision of the professor of anatomy who, as was said in the statutes of 1598, must take care that the prosector does not idle about, but occupies himself diligently with anatomical dissections and demonstrations (*non sinat dissectorem divagari, sed contineat in officio dissecandi et demonstrandi*). It was further resolved, that every year at least two public dissections should take place. At the same time, the authorities were directed never to hand over a body for anatomical purposes without the cognizance of the dean of the medical faculty, and in delivering bodies up to have regard first to the requirements of the professors and doctors of medicine and, only in the event of these resigning all claims to them, to let the surgeons have them.* The expenses connected with the anatomical demonstrations were in all cases borne by the spectators,† that is to say by the students, whereas the theoretical lectures of the professors since the beginning of the 16th century were given gratis.

Practical teaching in materia medica and the treatment of diseases was adopted by the universities long after that in anatomical dissection. The students learnt the properties of drugs and the methods of compounding them in the apothecaries' shops. In 1536 it was ordained by law in Paris "that the bachelors of medicine should accompany the doctors in their visits to the apothecaries' shops, in order that they might be able to inform themselves concerning drugs."‡ Already at that time

* D. Puylon: Statuts de la faculté de médecine en l'université de Paris 1672, Art. 56 and supplement Art 5.—A. Pinet: Lois, décrets. reglements et circulaires conc. les facultés et les écoles préparatoires de médecine, Paris 1880, i, Art. 56, supplement Art. 8.

† *Cf.* Cervetto *op. cit.* p. 139.

‡ Philippe *op. cit.* S. 153.

there were apothecaries' shops in nearly all towns. They were furnished with distilling apparatus, fire places and furnaces for chemical and pharmaceutical operations, druggists' wares and various surgical utensils, which were there stored for sale.* By an edict of LOUIS XII. of the year 1514 the apothecaries of Paris were liberated from association with the grocers, with whom they had hitherto been joined in a guild. Whoever devoted himself to the business of an apothecary was obliged, in accordance with the statutes issued by FRANCIS I., to have received a good school-education and to have learnt as much as would enable him to understand the text-books written in the Latin tongue and the pharmacopœias; and then to have gone through a four-years' training in an apothecary's shop. In Paris an arrangement was made that during the space of a year students of pharmacy should attend two lectures in every week upon the apothecary's art which should be given by a specially competent and respectable member of the medical faculty. The examination was held before a commission composed of doctors and apothecaries and consisted of a theoretical and a practical part; in the latter the candidate was obliged to show knowledge and experience on the subject of medicinal plants and, as a final test of his ability, to make up five prescriptions.†

Clinical instruction also lay outside the scheme of university teaching. The students of medicine betook themselves, for this, to their teacher or to some other doctor busily engaged in practice who was able to give them opportunities either amongst his private patients or at a hospital at which he was employed, of observing the sick and of learning how to treat them. At some academies the professors were required by law to give their pupils the necessary introduction. At Vienna, Heidelberg, Würzburg, Ingolstadt and other places they were charged to take their

* H. PETERS: Aus pharmaceutischer Vorzeit, Berlin 1886, S. 25 *et seq.*, 111 *et seq.*

† PHILIPPE *op. cit.* S. 165 *et seq.*

pupils occasionally to the bedsides of their patients provided that the latter were not annoyed by such a proceeding. In Basel, the medical officer of the town, who also held the appointment of teacher of practical medicine and was head of the town hospital, was bound to afford the students of medicine access to this hospital and to demonstrate to them the patients who were being treated there.* In Paris the bachelors of medicine were allowed to engage in practice under the supervision and as the representatives of the members of the faculty.†

But there was no systematic introduction to the treatment of the sick; this want could not be supplied by occasional observations and casual experiences. Not only the doctors, as for example, the Swedish court-physician W. LEMNIUS,‡ saw this, but intelligent laymen as well. The philosopher P. RAMUS in 1562 in a letter to CHARLES IX. of France, in which he proposed various reforms in the system of education, asked that institutions should be arranged for clinical teaching.§ This idea had already at that time been carried into effect, namely in Padua. GIAMBATTISTA DA MONTE (MONTANUS), who taught there at the same time as VESALIUS, is said to have employed the clinical method of teaching as early as the year 1543.‖ But after his death in 1551 this arrangement ceased and was only renewed in 1578. About this time the professors ALBERTINO BOTTONI and MARCO ODDO—of whom one conducted the division for men and the other that for women in the hospital of St. Franciscus—began to give

* O. BECKER: Zur Geschichte der medicin. Facultät in Heidelberg, 1876.—A. v. KÖLLIKER: Zur Geschichte der medicin. Facultät in Würzburg, 1871.—F. MIESCHER: Die medicin. Facultät in Basel, 1860, S. 32 *et seq.*—W. VISCHER: Gesch. d. Univ. Basel, Basel 1860.

† PINET *op. cit.* and PUYTON *op. cit.* Art. 59.

‡ P. FRANK *op cit.* vi, 2, S. 189.

§ CH. JOURDAIN: Histoire de l'université de Paris au 17 et au 18 siècle, Paris 1862-66, T. i, p. 3.

‖ G. CERVETTO: Di Giambattista da Monte e della medicina italiana nel secolo xvi, Verona 1839, p. 51.

clinical instruction at the request of the German students; moreover the corpses of the patients who died in the hospital were opened, if the time of year was suitable, in order that the students should have pointed out to them the sites and causes of disease (*sed cum in fine Octobris cœli constitutio frigidior esset, professores cadavera aperiunt et loca affecta auditoribus demonstrant*). Unfortunately, the necropsies were forbidden after a short time, since improprieties had occurred and parts of bodies had been secretly conveyed away from the institution.* With the deaths of BOTTONI and ODDO the zeal of teachers and pupils relaxed and instruction was at last chiefly confined to investigation of the pulse and urine. The attempts to place teaching in medicine upon a practical basis had, however, to yield, in the curricula of the medical faculties, to the theoretical lectures which claimed the place of chief importance. According to the statutes of the medical faculty of Würzburg of the year 1587, there were there three professorial chairs of medicine. The incumbent of the first, the Professor of the Theory of Medicine, had to read publicly in the first year the *primam primi libri Avicennæ et libros Galeni de morborum differentiis, causis et symptomatibus;* in the second year, the *Galeni artem medicinalem cum Hippocratis prognosticis;* in the third year, to lecture *de pulsibus et urinis* according to ACTUARIUS, *de victûs ratione in morbis acutis* after HIPPOKRATES, *Galeni de alimentorum facultatibus* and to read *Avicennæ tertiam primi;* the Professor of the Practice of Medicine had in the first year to comment upon general therapeutics, and to discuss blood-letting and purging and the nature of fever according to AVICENNA; in the second and third years the subjects of his lectures were special pathology and thera-

* A. COMPARETTI: Saggio della scuola clinica nello spedale di Padova 1793, p. 6 *et seq.*—C. NEUBERT in d. Beiträgen zur prakt. Heilkunde, her. v. Clarus u. Radius, Leipzig 1836, ii, 148 *et seq.*—On the other hand, P. A. O. MAHON (Histoire de la médecine clinique, Paris 1804) brings forward nothing upon clinical teaching.

peutics of individual diseases. The Professor of Surgery had in the first year to speak *de tumoribus* according to GALEN, in the second, on ulcers and wounds after GALEN, HIPPOKRATES, and the Arabs, and in the third, on fractures and dislocations according to GALEN and HIPPOKRATES. Besides this, in summer he had to treat the subject of materia medica and to demonstrate the officinal plants, and in winter to teach anatomy and physiology. The list of lectures was more accurately settled by the professors in the midsummer holidays so that it could be committed to paper and published in the catalogue with the arrangement of lectures of the other faculties.* In an official report, which was drawn up in 1569 upon the lectures delivered by the professors of medicine at Heidelberg, it is said: 1. Professor CURIO is reading *de generibus morborum ex Galeno*, is explaining *Hippocratis de morborum signis*, and has an audience of three or four. 2. Professor ERASTUS gives no lectures, as he is attending the fair at Frankfort-on-the-Main. 3. Professor SIEGMUND MELANCHTHON is lecturing upon the art of medicine according to GALEN, and has some five pupils.† This report casts a light also upon the numbers belonging to the medical faculties at that time. They appear very small compared with to-day. Medicine was seldom represented at Leipzig by more than from four to six persons. The academy at Basel numbered, in 1556, two professors and two students of medicine.‡ At Erfurt, between the years 1392 and 1520, only five doctors of medicine were created, as against 120 of theology and 40 of law. Many Germans frequented universities abroad, especially those of Paris, Bologna, Padua, and Montpellier. In Padua there were, in the year 1564, about 200 Germans studying law.§ Medical students sought out by preference

* A. v. KÖLLIKER *op. cit.* S. 58. F. v. WEGELE: Geschichte der Universität Würzburg, 1885, ii, 191-199.

† J. F. HAUTZ *op. cit.*

‡ PLATTER *op. cit.* S. 169.

§ MEINERS: Geschichte der Entstehung u. Entwickelung der hohen Schulen, Göttingen 1802.

Montpellier and Padua, as is apparent from numerous biographies of celebrated physicians of the 16th century.* A doctor of Göttingen, in 1420, left a legacy of 600 florins on the interest of which a poor student of medicine was to be maintained for four years at Montpellier.† FELIX PLATTER also betook himself thither from Basel to complete his medical studies.

THE MEDICAL PROFESSION AND ITS ATTITUDE TOWARDS THE MOVEMENTS OF THE SIXTEENTH CENTURY.

THE medical examinations were of the same pattern as before. But the academical degrees sank much in value, in consequence of the easy terms upon which they were granted at many academies. As early as the year 1502 complaints were made that "horse-dealers, traders in cattle, and other common people, who have not the slightest acquaintance with ARISTOTLE and are ignorant of even the first elements of grammar" obtained the title of Magister in the philosophical faculty of Paris.‡ At some French universities the degree of Doctor of Medicine was even sold for money. King FRANCIS I. on this account felt himself obliged to extend his recognition to the medical diplomas of Paris and Montpellier only.§ In Padua the singular custom arose of the candidates bringing with them assistants to the examination who whispered to them the answers to the questions which were put. The convenience of the candidates was still further consulted if, as AUGUSTIN LEYSER states, the questions with the answers annexed

* MELCHIOR ADAM: Vitæ Germanorum Medicorum, Heidelberg 1620.—A. BUDINSZKY: Die Universität Paris und die Fremden an derselben im Mittelalter, Berlin 1876, S. 115 *et seq.*

† SCHMIDT: Göttinger Urkundenbuch ii, 20.

‡ BULÆUS: Hist. Universitat. Paris 1673, T. vi, p. 11.

§ H. TOLLIN in VIRCHOW's Archiv 1880, Bd. 80, S. 66, and in the Biol. Centralblatt, Bd. v, S. 341.

were previously written out and supplied to them.* Then, too, it must be remembered that the title of doctor was conferred not only by the universities but also by the Pope and the Emperor. In the 14th century even the Counts Palatine obtained the right to grant the title of doctor just as they were also competent, as is well known, to legitimate bastards. To such a state of affairs the caustic description which PETRARCH has left of the ceremony of taking the doctor's degree might sometimes fitly apply. "Now the young man appears, puts on an air of importance and mutters some unintelligible stuff while the people stare at him with astonishment, and his friends congratulate and applaud him. The bells are rung, trumpets sounded, rings and kisses exchanged, and the round cap of the Master is placed on his head. Whereupon he, who had mounted the ceremonial chair a blockhead, descends from it a wise man. This is a metamorphosis of which OVID knew nothing."† Many students refused to take the degree of doctor at all on account of the expense and of the small estimation in which it was held. In this, perhaps, lies the explanation of the failure to trace the diplomas of several celebrated doctors such as J. SYLVIUS, VESALIUS, M. SERVET, J. THIBAULT and others.

The surgeons were as a rule excluded from the privilege of obtaining the degree of doctor of medicine. In Italy only, where the separation of surgery from the rest of medicine was at no time so complete as in other countries, an exception was made to this rule. In France also the surgeons received a scientific education. The Collège de St. Côme, in 1545, obtained the right to grant academical degrees. Its students had to study for four years and attend lectures not only on surgery but also on anatomy,

* C. MEINERS: Über die Verfassung und Verwaltung deutscher Universitäten, Göttingen 1801, i, 328 *et seq.*; and C. MEINERS: Geschichte der Entstehung u. Entwickelung der hohen Schulen, i, 188.

† PETRARCA: De vera sapienta, Dial. i. (Op. ed. Basil. 1554, p. 365).

materia medica, and many other subjects. Unfortunately, at this period also, petty jealousies and quarrels continued to exist between the surgical faculty, as the Collège de St. Côme may be called, and the medical faculty, to the injury of science in general. The doctors gave themselves pains to provide the surgeons with opponents endowed with privileges equal to their own, in the so-called barber-surgeons: they, with this object, took care that the latter should acquire a larger amount of general and technical knowledge. Although this led to many unsatisfactory occurrences between the two classes of practitioners it had yet this good effect that the possibility was afforded to highly-gifted members of the inferior class of surgeons of becoming operating surgeons in our sense of the words. The example of an AMBROISE PARÉ shows how much surgery and with it medicine in general owes to this circumstance. It is only fair to say that the members of the faculty of medicine in their procedure had not this laudable end in view but wished rather to lower the credit of surgery and make its representatives their humble servants, willing to recognize their own intellectual superiority. This way of looking at the subject is clearly indicated by the words of M. SERVIN who wrote in 1607, "*que la science n'est pour ceux qui n'ont que la main, qu'ils doivent laisser à juger aux médecins.*"* When one of the professors, ROBERT LE SECQ, in an examination of surgeons in the year 1606, alluded to physiology and entered upon the subject of the action of the muscles, the mechanism of respiration and many other matters, the faculty of medicine entered a protest, on the ground that these things were points of controversy in science.† In Germany and other countries surgery seldom raised itself above a handicraft. It was only taught at some universities. At Vienna, a Professor of Surgery was appointed with the annual stipend of 52 florins.‡ The German

* D. PUYLON : Statuts de la faculté de médecine, Paris 1672.

† HAZON *op. cit.*

‡ ROSAS *op. cit.* ii, 51.

surgeons arose almost exclusively from the position of barbers or bagnio-keepers. They learnt from a master the treatment of wounds and ulcers, of fractures and dislocations, and obtained afterwards some further training in hospitals and in military medical service. Some, such as HIERONYMUS BRUNSCHWYG, HANNS VON GERSDORF and FELIX WÜRTZ acquired considerable operative ability. The scarcity of educated doctors, which prevailed in Germany, and the numerous wars and pestilences which that country had to endure in the 16th century, caused surgeons to be looked upon as indispensable; it must also be remembered that besides the treatment of external ailments that also of diseases affecting the sexual organs fell into their hands. Since they frequently surpassed the physicians in practical dexterity and experience, were in a position of nearer social relationship with the people, and demanded smaller sums of money for their services, much favour was shown them. Many were employed as private medical attendants at the courts of princes, in the public service, or in prominent positions in the medical service of the army.

The doctors took a lively share in the intellectual movements of the 16th century. Then, as always, the great majority of them embraced the cause of freedom. It was but natural that PARACELSUS, inclining as he did to radicalism, should follow with enthusiasm all currents of thought which were opposed to existing authorities, and that he should long to see them increase into a devastating flood. But men of reflection and cool judgment were also led by their convictions into the camp of the Reformation, and this because they saw that its limits did not exceed the boundaries marked out by a process of natural development. The captains of Protestantism bestowed upon medicine a lively interest. MARTIN LUTHER caused his son PAUL to study medical science; the latter afterwards was employed as a physician-in-ordinary at Gotha, Berlin, and Dresden, and also became known as

a medical author. The son-in-law of MELANCHTHON, CASPAR PEUCER, was Professor of Medicine at Wittenberg; his nephew SIEGMUND, at Heidelberg. ADAM VON BODENSTEIN the son of the theologian KARLSTADT, practised medicine at Basel. CRATO VON CRAFFTHEIM by the advice of MARTIN LUTHER exchanged the study of theology, which he had begun under LUTHER'S guidance, for that of medical science; in this he gained great success and performed distinguished services at Vienna as doctor-in-ordinary to three emperors. He was the chief figure of Protestantism at Breslau and afterwards its most zealous representative at the court of Vienna.* His colleague, also, DIOMEDES CORNARUS (HAGENBUTT) doctor-in-ordinary to the Emperor MAXIMILIAN II. probably belonged to this faith. At Vienna in 1584 three doctors shortly before dying declared themselves to be opposed to the confessional, and a fourth forbade the tolling of bells at his funeral, and demanded that his corpse should be interred in unconsecrated ground. CASPAR PIRCHPACH, doctor of medicine, when in 1268 he filled the post of Rector of the university of Vienna, was instrumental in getting the requirement of the statutes that the academical teachers should subscribe to the Roman Catholic Faith set aside, and the word *Catholicæ* replaced by *Christianæ (fidei)*. It was at the same time decided that those who subscribed to the Augsburg Confession might be admitted to the degree of Doctor.† Even in Ingolstadt, the head-quarters of the reaction in favour of the Church, several professors of the medical faculty embraced a freer opinion in religious matters: they were on this account through the influence of the Jesuits, who soon after came into considerable power there, deposed from their offices.‡ At the conclusion of the 16th century the intellectual movements

* J. F. A. GILLET: Crato von Crafftheim u. seine Freunde, Frankfurt-a-M. 1860, ii, 14.

† PAULSEN: Geschichte des gelehrten Unterrichts, S. 272.

‡ PRANTL *op. cit.* i, 319.

with which it commenced, had nearly everywhere achieved victory. In so far as they bore a revolutionary character they were certainly unsuccessful; but they attained their goal while confining their activity within the bounds of reasonable reform. Their chief success lay in the fact that even those opposed to them were compelled to recognize their propriety, inasmuch as they abandoned the paths they had trodden hitherto and found new roads to advance in. Nowhere indeed had the ploughshare of intellectual work traced deeper furrows than on the soil of the natural sciences and of medicine. Yet the significance of this activity must be sought for not so much in what was achieved, as in what the future of scientific inquiry promised.

Enlightened spirits, like FRANCIS BACON Lord VERULAM, began to recognize what an important part was assigned to the natural sciences in the development of civilization. This distinguished English statesman and philosopher, who, as it were, represented in himself the total of the intellectual efforts of the 16th century, declared that induction from experience and experiment could alone give a solution to the questions which scientific investigators were striving to understand. Though himself not in a position to enrich science by new discoveries, he nevertheless pointed out to her the paths which led to them. He certainly foresaw correctly the inter-dependence of many phenomena, the clear comprehension of which was reserved for later centuries. Thus he already gave plain utterance to the conjecture that the atmosphere subserves the nutrition of plants, that colour is a modification of light, and heat a form of motion, and that some day it would be possible to produce mineral waters artificially.* He referred to the value of vivisection, to the importance of pathological anatomy, and of statistics of the results of the treatment of disease. But his most meritorious services lay in

* H. v. BAMBERGER: Über BACON VON VERULAM, Würzburg 1865, S 15, 21 *et seq.*

the domain of theoretical knowledge: he brought the method of investigation to such a clear and complete development as, before his time, had never been accomplished. BACON was neither the shallow vain prattler, without any originality of thought, that he has been represented by some, nor the creative genius out of whose head science sprang in complete beauty, that others have depicted him. He was, as it were, a hand on the face of a clock pointing out to us the progress made by time.

THE EXPERIMENTAL DIRECTION TAKEN BY THE NATURAL SCIENCES, PHYSICS, AND CHEMISTRY DURING THE SEVENTEENTH CENTURY.

THE expectations raised by the startling progress of the natural sciences in the 16th, were most abundantly fulfilled in the following, century. If men had hitherto confined themselves to observing facts in nature and to taking a firm mental grasp of the existence of things, they now began to investigate their causes and to fathom their reciprocal relations. They desired to become acquainted with the processes of organic life in their development and with this object they instituted experiments by which they might imitate the workings of nature by artificial means.

Experiment advanced into the foreground and gave a characteristic colouring to the mode of thought of the 17th century. No path of intellectual activity was more influenced by this than that of the natural sciences and medicine. They have to thank this bias in favour of experiment for the stimulus which led to new investigations and by it they attained to that certainty of doctrine which is of the essence of science. Physics, chemistry and physiology—those subjects, in fine, which are principally founded on experiment—were at this period enriched with a great number of discoveries. A new period of their history began. Mineralogy, botany, zoology and anatomy also

made important progress. Crystallography was advanced by the observations of NICHOLAS STENO and GULIELMINI upon the markings and construction of crystals and the immutability of their angles. ROBERT BOYLE noticed the crystallization of bismuth out of the molten flux of the furnace, and the Danish doctor ERASMUS BARTHOLINUS discovered double refraction in Icelandic calcspar (1670), a subject more closely investigated by HUYGENS and which had an important bearing upon the undulatory theory of light.*

At the same time botany was experiencing important changes. While the knowledge of the different species of plants was increased by numerous works upon the floras of particular regions and countries, the various attempts to classify plants according to the similarity of their organs into families and groups contributed to the more accurate study of their structure. But the foundation of phytotomy by MALPIGHI and GREW, their excellent investigations into the minuter structure of plants, and especially their labours upon the blossoms, fruits, and seeds of plants, together with the experimental demonstration of sexuality in the vegetable kingdom by R. J. CAMERARIUS, first rendered it possible to formulate a system corresponding to the demands of science. LINNÆUS, who accomplished this task, gave a definite and complete form to botany by the methodical arrangement and characterization of his genera and species combined with his persistent use of the binary nomenclature: the discovery of a natural system being reserved to satisfy the just requirements of future times.†

With the application of the magnifying-glass and microscope to scientific investigations, a new world of life was opened to zoology of the existence of which none had hitherto entertained a presentiment. LEEUWENHOEK discovered infusoria, described certain rotifera, observed

* F. v. KOBELL: Geschichte der Mineralogie, München 1864, S. 8 *et seq.*

† J. SACHS: Geschichte der Botanik. München 1875, S. 84 *et seq.*, 246 *et seq.*, 417 *et seq.*

the faceted eyes of insects, and studied the origin and development of several of the lower forms of animal life. MALPIGHI imparted valuable information upon the structure and composition of the organs of the animal body and, even thus early, gave utterance to the thought that the complicated structure of the more highly developed organisms is analogous to the more simple structure of the lower forms of life, and by such is to be explained. He even came tolerably near the discovery of the animal cell, while ROBERT HOOKE drew attention to the cellular structure of plants. The zootomical labours of SWAMMERDAM, whose accuracy is evidenced by his investigations on numerous mollusca, on the uro-genital organs of the frog, on the anatomy of the bee, etc., served naturally to throw much light on the views of men of science, as did also the observations of F. REDI upon generation, as a result of which he made the statement that in decomposing meat no maggots develop if flies are kept away. Supported by these results, JOHN RAY, J. T. KLEIN, LINNÆUS and others were able to facilitate the study of animals by classifying them systematically, and to represent zoological science in a comprehensive way.*

Physics and chemistry however experienced at this period transformations of the highest significance. When chemistry, by the influence of PARACELSUS and his disciples, was diverted from alchemy and turned into the direction of materia medica, it started afresh with a vigour which promised to be full of benefit to itself and to medicine alike. A large number of new medicines were discovered, and the technical methods of preparing them were improved in manifold ways. Perhaps no less important was the effect which chemical views and knowledge exerted on physiology and pathology. A certain number of doctors saw in every occurrence in the organism processes of fermentation and decomposition, and were willing to explain most phenomena of the body in health and disease by

* V. CARUS: Geschichte der Zoologie, München 1872, S. 386 *et seq.*

means of chemical reactions. This intro-chemical bent was sometimes carried too far, for under its influence men imposed upon themselves problems, the solutions of which were not discoverable, owing to the slight development reached by chemistry at that time. But these views had this great merit, that they accustomed doctors to the thought that they might expect but little from speculation, much however, if not everything, from an examination of facts. Chemistry owed to the perception of this circumstance many discoveries and an important enlargement of its subject matter.

The doctor LIBAVIUS invented the method of preparing sulphuric acid from sulphur and saltpetre, and recognized that the product was identical with that formed from metallic sulphates or alum. He first produced the bichloride of tin by the distillation of bichloride of mercury (corrosive sublimate) with tin, and was acquainted with the process of colouring the glassy flux by the addition of gold. TURQUET DE MAYERNE taught the preparation of benzoic acid crystals by sublimation. J. B. VAN HELMONT, also, enriched chemistry by a multitude of new facts. He stated the proposition that only such metals are separated from a solution as were previously contained in it, giving thus the deathblow to the goldmaker's art. He discovered carbonic acid gas, and introduced into chemistry the conception of gases as being of the nature of air, but not identical with atmospheric air. The attempt which he made to study the parts played by soil, water, and air in the nutrition of plants affords clear proof of the experimental method of his inquiry. In the writings of GLAUBER, who furnished more accurate information upon sulphate of soda and numerous other salts, we already find a crude, but promising, appreciation of chemical affinity.*

A deeper foundation was here laid by ROBERT BOYLE, who, by his corpuscular theory, sought to explain the separation of chemical combinations into their constituent parts

* KOPP *op. cit.* i, 111, 114, 120 *et seq.*, 130.

and the union of these parts with those of other combinations by the attractions and repulsions which they exerted upon one another. With BOYLE commenced the time of the study of chemistry for its own sake, when it was no longer looked upon as mere means of finding the philosopher's stone, as was the case with the Alchemists, or of furnishing new medicines as was the case with the Iatrochemists. He discovered phosphoric acid, chloride of copper, fuming sulphide of ammonium, and was the first to observe the opposite reactions of acids and alkalies respectively with certain vegetable colours. From him is derived the practice of impregnating strips of paper with vegetable colouring matter and using them as reagents. BOYLE rendered great services by founding analytical chemistry, and by applying chemistry to the purposes of the arts.*

Among those who took an important part in building up the structure of scientific chemistry we find the following :— KUNKEL, BECHER, W. HOMBERG, LEMERY, STAHL, F. HOFFMANN, the last of whom gave his chief attention to the chemical investigation of mineral springs and found sulphate of magnesia in the mineral water of Seidlitz; MARGGRAF, who founded the beetroot sugar industry; DU HAMEL, who drew attention to the difference between soda and potash, taught how to prepare soda and referred to its existence in the ashes of plants growing on the sea coast; H. CAVENDISH, whose researches on hydrogen (which he unfortunately took for the much-sought-for, but non-existent, phlogiston), and on the properties, specific gravity, and the absorbability in water, oil, and alcohol respectively of carbonic acid gas deserve mention here; BERGMANN, who worked at the doctrine of chemical affinity; and, finally, SCHEELE, who did good work in organic chemistry, discovered lactic and uric acids, besides various vegetable acids, and also advanced inorganic chemistry by the discovery of several new elements, such as chlorine and manganese. Many of these were also doctors, and conse-

* KOPP *op. cit.* i, 165 *et seq.*

quently devoted special attention to the relations of chemistry to medicine.

Unfortunately the progress of chemistry was hampered by erroneous opinions which had been preconceived, and which had developed into dogmas generally accepted. Thus people assumed that the process of combustion is dependent upon the presence of a material called phlogiston, and the greater or less combustibility of a body, upon the quantity of this burning-material contained in it. The phlogistic theory—according to the analogy of which the origin of the acids was ascribed to an acid material, the so-called primitive acid, and that of the caustic alkalies to a caustic material—was paramount in men's minds for nearly a century, and was only exploded by LAVOISIER.

A luckier star presided over the destiny of physics,* for philosophers were here not influenced in their judgment by untenable and baseless hypotheses, but used all their intellectual powers in collecting material which could be employed in building up a firm structure of doctrine. GALILEO whose achievements in astronomy, and whose martyrdom for his convictions are better known than his service to physics, discovered the laws of falling bodies and of the pendulum. He recognized the importance of the proposition of the parallelogram of forces and sought by its help to determine the course of projectiles. Concurrently with STEVINUS he worked also at hydrostatics and hydrodynamics. "If any single person can lay claim to the honour of founding such a many-branched science as that of physics," says POGGENDORFF (*op. cit.* p. 268), "that honour is, without hesitation, GALILEO'S; for he laid the foundation of scientific mechanics, which runs like a nerve through almost every part of physics." As early as 1597 GALILEO constructed a thermometer, with the production of which instrument R. FLUDD, SANCTORIUS, and C. DREBBEL also occupied themselves. GALILEO'S highly gifted pupil TORRICELLI determined the laws of the outflow of liquids

* J. C. POGGENDORFF, Geschichte der Physik, Leipzig 1879, S. 204 *et seq.*

through tubes, invented the barometer (1643) and explained that the rise and fall of the mercury are due to changes of atmospheric pressure. PASCAL made some irrefutable statements on this subject and pointed out that with the help of the barometer the difference in height between two places can be determined. MARIOTTE, J. PECQUET, and SINCLAIR rendered these ideas more complete and brought the practical application of them nearer. PASCAL constructed a wine-barometer, while BERTI and O. V. GUERICKE enclosed water instead of mercury in the tube. OTTO VON GUERICKE, burgomaster of Magdeburg and formerly engineer of the fortress of Erfurt, devised the air-pump and considerably astonished the princes assembled in the imperial diet at Regensburg in 1654, by the experiments he performed with it. He made excellent observations on the weight of air and constructed the first manometer for measuring the density and weight of the atmosphere. He also referred to the fact that in spaces from which the air has been removed no sound can be produced and no combustion take place. His observations were completed by BOYLE, who studied more closely the elasticity of air and discovered the law, erroneously named after MARIOTTE, that the volumes of equal weights of air stand in inverse ratio to the pressures to which they are subjected. About the same time attempts were made to determine the velocity of sound. GASSENDI asserted that it travels 1,473 feet in a second. MERSENNE came somewhat nearer the truth in estimating the number of feet at 1,380. Even if the results they arrived at were incorrect, they nevertheless hit upon the right method of investigation and this was already an extraordinary advance. Even a NEWTON was unable to avoid every source of error; he calculated the velocity of sound at 906 Paris feet in a second, not making a sufficient allowance, as LAPLACE has pointed out, for the influence of temperature.

The most important advances were made in optics, favoured, and, to some extent indeed, rendered for the first

time possible, by the invention of various instruments which took place at that time. The telescope enabled the eye to see into the distance: the microscope opened out into view the world of small things. By these two optical aids the power of human vision was strengthened in an unexpected manner and paths were opened to investigation, which had before been beyond the boundaries of human knowledge. The seat of these inventions was Holland. It is doubtful to whom priority belongs in these discoveries: but it appears that the brothers JANSSEN, who in the beginning of the 17th century lived in Middelburg as glass cutters, have the best claims, at least in respect of the compound microscope.

It is not my business to go more closely in this place into the history of this discovery and it is also unnecessary since it has already been discussed by HARTING in a fairly exhaustive manner.* The extraordinary importance of the microscope in the study of natural sciences cannot be described in words.

The instruments were gradually improved and rendered more complete in numberless ways. The discovery of the reflecting telescope by JAMES GREGORY, that of the micrometer (crossed threads) by ROBERT HOOKE, the construction for the first time by M. HALL of achromatic lenses by a combination of crown and flint glass, etc., were added afterwards.

Even then men ventured to attack the difficult problems of light and colour. The great philosopher DESCARTES (CARTESIUS), to whom mathematics owes the recognition of the meaning of the negative roots of equations and the foundation of analytical geometry, sought for an explanation of the rainbow and in this way worked out the law of incident and reflected rays, and the angles formed by them.

SNELL established the relations between different media and the refraction of light in them, and GRIMALDI dis-

* P. HARTING: Das Mikroskop, ins deutsche übers. v. THEILE, iii. Theil, Braunschweig 1866.

covered diffraction or inflection of light as well as its dispersion or splitting up into its constituent colours. The last-mentioned, and HOOKE in even greater degree, when he published his observations on the colours of thin films, had suspicions of the undulatory movement of light which HUYGENS, supported by the phenomenon of double refraction, raised by his undulatory theory into one of the facts of science. It is true that it had to wait more than a century before receiving general recognition; for NEWTON had asserted that light consists of concrete particles which are emitted from luminous bodies with great velocity, and his authority was so powerful that all attempts which were at variance with it were unavailing, for a time, to make truth victorious. Not till 1815 did success crown the persevering efforts of FRESNEL and ARAGO to secure a general acceptance for the undulatory theory.

The first contributions, also, upon the phenomena of polarization — observed indeed by NEWTON but which he was unable to explain intelligibly — date from the end of the 17th century. On the other hand, in his experiments upon the dispersion of sunlight, undertaken by him after the method already adopted by GRIMALDI and, before GRIMALDI, by the Prague doctor MARCUS MARCI of Kronland, NEWTON arrived at the important result that white light is composed of an infinite number of coloured rays of different refrangibility and that to each degree of refrangibility a particular colour corresponds. NEWTON'S views upon the origin and essence of colours were not correct; it appears that L. EULER in 1746 was the first who had correct coherent notions on this subject. Many more discoveries in physics belong to the 17th century,—discoveries which have advanced civilization very greatly in many directions. HOOKE improved the watch by inventing the spiral spring, and HUYGENS was the first to construct a pendulum-clock.

The Marquess of WORCESTER, Captain SAVERY, MORELAND, PAPIN and others studied the power of steam very

carefully and contrived machines for making a practical test of its value; an operation which had at first to contend with many inconveniences. Thus the opening and shutting of the stopcocks of the injecting-pipe and steam-pipe had to be done by hand. But one day a clever fellow, to whom this duty was entrusted, remarked that the turning of the cocks tallied with the movement of the beam. He thereupon bound them together with string and saw that the machine forthwith worked by itself. PAPIN even proposed to make use of steam power for driving ships.

So also the first observations of electrical phenomena date from this period.* The Englishman GILBERT, who discovered telluric magnetism, found that electricity is produced by friction, but cannot be generated in all bodies and is distinct from magnetism. O. v. GUERICKE, by the help of an apparatus constructed by himself and which led up directly to the electrical machine, observed besides the already known electrical attraction, other phenomena of which nothing was previously known, namely electrical repulsion, and light and crackling sounds produced by electrical means. Then the English philosopher WALL in 1698 described the real electric spark and compared it and the crackling sounds, arising under electrification, with lightning and thunder.

STEPHEN GRAY in 1729 established by experiment the distinction between conductors and non-conductors of electricity; he pointed out that electricity may be communicated from one body to another and that, for this, direct contact is not always required, but that approximation is sufficient; he moreover referred to the fact that in the electrification of bodies it is not a question of their mass but of the extent of surface presented by them; he was also the first to electrify water and the human body and for this purpose even made use of the insulating stool. Soon after this DUFAY made the important discovery that there

* E. HOPPE: Geschichte der Elektricität, Leipzig 1884.

are two distinct kinds of electricity one of which clings to glass and the other to resin. Upon this followed improvements of the apparatus for generating electricity brought about by BOSE, J. H. WINKLER and others and which led to the construction of the electrical machine; the discovery of the Leyden Jar made almost simultaneously by MUSSCHENBROEK at Leyden and Baron KLEIST in Pomerania; the discovery of atmospheric electricity by LE MONNIER; the invention of the lightning conductor by BENJAMIN FRANKLIN; and the construction of the first electrometer by JOHN CANTON.

Finally, certain other advances in physics must be mentioned here, which belong to the same period. The thermometer was improved at the instigation of FERDINAND II. of the Medici family. Already the differential thermometer was invented. AMONTONS, who devised the hygroscope and studied the influence of heat on the barometer, constructed the first effective air-thermometer. By graduating and adding a scale to the thermometer, for which FAHRENHEIT of Danzig deserves special credit, its practical applicability was largely extended. At Florence, the first observations on specific heat were made; it was called heat-capacity. ALF. BORELLI threw more light upon the phenomena of capillarity, a subject known to LEONARDO DA VINCI.

But all these things yielded in importance to ISAAC NEWTON'S discovery of general gravitation,* by which the infinitely complicated movements of the heavenly bodies were explained through the all-binding laws of mathematics and physics and the proof was given that such laws hold good for the entire universe. This conception exerted the greatest influence in the emancipation of man's intellect from the dominion of mystic transcendental powers, giving it a grasp which seemed to reach beyond the boundaries of this world. Even if NEWTON had rendered no other ser-

* W. WHEWELL: History of the Inductive Sciences (Germ. trans.), Stuttgart 1840, ii, 158 *et seq.*

vices to physics, the theory of gravitation was enough to place his name among the first in the history of this science. He was one of the greatest mathematicians and physicists that ever lived. If we wish to indicate in one word the intellectual tendency of that time, fruitful as it was, to an uncommon degree, in results and discoveries bearing upon physics, we need only recall the name of NEWTON—its most prominent representative.

What a mighty revolution in thought had been effected in the interval of time between GALILEO and NEWTON! The natural sciences, which still in the 16th century were oppressed and controlled by the ruling authorities, regarded with indifference or disdain by the public, cherished and actively advanced only by a few, stood now in the focus of intellectual interest and were permitted fearlessly to draw within the range of their investigations the highest problems of man's existence.

Natural philosophy proceeded to its tasks with the fiery zeal of youth and the successes achieved, rapid as they were and exceeding all expectations as they did, seemed to justify the hope that no limit was fixed to its progress. When this hope was not fulfilled and insurmountable obstacles opposed themselves to human knowledge, industry slackened and work began to stop. Men turned again to other efforts which promised greater results than the pursuit of the natural sciences. To the victorious advances made by the natural sciences in the 16th and 17th centuries there succeeded in the 18th century a retreat or at least a halt. This period contributed no essential increase to the sum of knowledge, but, under the influence of a tendency in men's minds towards encyclopædic literature, led to a collecting and sifting of such results as had been gained—a proceeding useful and necessary for their further development.

MICROSCOPICAL INVESTIGATION IN ANATOMY AND EXPERIMENT IN PHYSIOLOGY.

THE 16th century witnessed the splendid triumphs of anatomists, who investigated the structure of the human body; physiological experiment, which created a science founded on facts, impressed its mark upon the 17th century. Anatomy was an established science already in the 16th century, in its essential outlines at least, and so far as was possible by investigation with the unaided eye. The following periods had the tasks assigned to them of testing the scientific results already won, of correcting and of completing them by examination of details, and of extending and enlarging them. Investigation acquired by the aid of the magnifying glass and the microscope a depth and a solidity hitherto unattainable. The anatomists devoted their attention chiefly to the finer structure of organs, a study more successfully pursued by means of the newly-discovered optical instruments.

LEEUWENHOEK possessed the best microscope of his time, constructed by himself. It magnified 160-270 times, whereas the instruments used by other investigators magnified at most 143 times. LEEUWENHOEK described the tubular structure of the bones, and noticed the bone-corpuscles, which afterwards were rediscovered and more accurately described by PURKINJE.* He referred also to the enamel of the teeth, while other particulars of their structure were explained by MALPIGHI. CLOPTON HAVERS discovered the canals in bones, which still bear his name;† DU HAMEL studied the formation of bony tissue, and recognized that it is developed by the help of the periosteum out of cartilage, the vessels bringing the formative material required according to the pattern laid down in cartilage; J. T. KLINKOSCH, of Prague, taught the origin of bone

* P. J. HAAXMANN in the Nederl. Tijdschr. v. Geneesk 1871, ii, 1-86.

† CL. HAVERS: Observationes de ossibus, Amstelod. 1731, p. 63.

from connective tissue, while HALLER held fast to its development from cartilage and considered the change to proceed from the vessels which surround with bony tissue the primordial bone-granules discovered by him.

At the same time the macroscopical knowledge of osteology was also enriched. NATHANIEL HIGHMORE discovered the antrum in the upper jaw; OLAUS WORM described the sutural bones named after him, but known already to EUSTACHIUS; T. KERCKRING studied the development of the skeleton in the fœtus; and FRIEDRICH RUYSCH drew attention to the differences between the male and female skeleton, especially to the distinction in the form of the pelvis and thorax in the two sexes. The knowledge of the ligaments was improved by the careful work of JOSIAS WEITBRECHT.* The structure of the skin was investigated by MALPIGHI, of whom the *rete mucosum* reminds us to the present day, and by LEEUWENHOEK, who observed the smooth scales of the epidermis, the changes in the skin produced by the formation of callosities and scars, and the deposit of pigment in the coloured races of men. C. V SCHNEIDER afforded some information upon the structure and function of the nasal mucous membrane.† The structure of muscular tissue occupied the attention of A. BORELLI, R. HOOKE, and above all of NICHOLAS STENO, who referred to the similarity of its construction in man and the lower animals, and pointed out that vessels and nerves enter muscles, and that the latter are composed of fasciculi, and are surrounded by an investment which sends processes between the fasciculi. LEEUWENHOEK noticed the transverse striation of muscular fibres, and taught that the growth of muscles results not from an increase in number but from an increase in size of the primitive fasciculi. He declared that muscular tissue is

* Jos. WEITBRECHT: Syndesmologie, Deutsche Ausgabe, Strassburg 1779.

† K. F. H. MARX in the Abhandlungen d. kgl. Ges. d. Wiss. zu Göttingen, Bd. 19, 1873.

built up of little spheres. R. HOOKE considered the bodies observed to be prisms.

The study of angeiology was facilitated in an extraordinary degree by the newly-discovered process of injection,* in the improvement of which SWAMMERDAM and RUYSCH rendered the greatest services. For injections they used coloured, easily coagulating, resinous liquids. RUYSCH, of whom it is said that he possessed the hands of a fairy and the eyes of a lynx, was able thus to determine the presence and distribution of blood vessels in parts of the body which had previously been considered non-vascular. He described also the bronchial vessels and the coronary vessels of the heart; KERCKRING discovered on the portal vein of the horse the *vasa vasorum*, and LEEUWENHOEK threw light upon the structure of the vascular coats. The anatomy of the heart was illustrated by STENO, LOWER, and VIEUSSENS. To their work the labours of WINSLOW and SENAC were added at a later period.

The lungs were carefully examined by MALPIGHI; he stated that they are composed of little sacks the partitions between which are richly provided with vessels.† GLISSON gave an exemplary description of the anatomy of the liver,‡ while MALPIGHI devoted his attention to the spleen and was also the first to recognize that glands are built up of acini.§ JAMES DOUGLAS, whose name has been preserved in the history of anatomy through other observations which he made, described the relative position of organs in the abdominal cavity. The Swiss doctors PEYER and BRUNNER discovered the glands of the intestinal canal, G. WIRSUNG the *ductus pancreaticus,* STENO the duct of the parotid gland, WHARTON that of the submaxillary gland and QUIRINUS RIVINUS those of the sublingual gland. MAL-

* BURGGRÆVE *op. cit.* p. 294 *et seq.*

† De pulmonibus epist. duæ in MALPIGHI: Op. omnia, London 1686, iii, 133 *et seq.*

‡ F. GLISSON: Anatomia hepatis, Amstelod. 1659.

§ M. MALPIGHI: De structura glandularum conglob., London 1697.

PIGHI, BELLINI and BERTIN investigated the structure of the kidneys; while the knowledge of the sexual organs was advanced by W. COWPER who described the gland named after him but known previously, by REINIER DE GRAAF who described the follicles of the ovary, by D. SANTORINI who submitted the *corpora lutea* to a more careful examination, and especially by WILLIAM HUNTER who made public the best observations upon the anatomy of the *testis* and the first correct representations of the changes undergone by the uterus during pregnancy.

Neurology remained on a lower level. STENO frankly confessed that he knew nothing of the structure of the brain and opined that other anatomists were in much the same position. He looked forward to nerve fibres being traced through the substance of the brain, but was himself at the same time conscious of the difficulty of this investigation and doubted whether such a thing would ever be accomplished without special apparatus.* WILLIS, the discoverer of the *nervus accessorius,* SYLVIUS, and HUMPHREY RIDLEY furnished their contemporaries with good descriptions of the brain; J. J. WEPFER illustrated the distribution of its blood-vessels; VIEUSSENS noticed the pyramids and the olivary bodies of the medulla oblongata, and made the discovery that the *dura mater* receives nerve-fibres from the *trigeminus;*† LANCISI drew attention to the distribution of fibres in the *corpus callosum* and examined the structure of the pineal gland; MALPIGHI made some remarks upon the distribution of the grey and white substance of the brain and observed the passage into the brain of collections of fibres from the spinal cord.‡ With regard to the more minute structure of the substance of the brain no clear view was arrived at. As a rule anatomists embraced the hypothesis that the grey sub-

* W. PLENKERS in the Maria-Laacher Stimmen 1884, vii, H. 25, 26.—TH. PUSCHMANN in the Vienna Neue Freie Presse 1886, 26 November.

† R. VIEUSSENS: Neurographia universalis, Lugd. 1685, p. 82, 170.

‡ M. MALPIGHI: De cerebro in Op. omnia iii, 1 *et seq.*

stance of the brain is composed of blood vessels and small follicles from which white nerve fibres arise. The peripheral nerves were more minutely described and several ganglia were discovered as, for example, the Gasserian ganglion on the *nervus trigeminus*.*

The anatomy of the sense-organs was worked at with greater success. RUYSCH discovered that part of the choroid coat of the eye named after him; LEEUWENHOEK described the structure of the lens as being of fibres united into membranes; MEIBOM in 1666 pointed out the glands imbedded in the substance of the tarsal cartilages and STENO described the lachrymal apparatus;† POURFOUR DU PETIT discovered the canal running between the two layers of the *membrana hyaloidea* of the vitreous humour round the margin of the lens capsule. ZINN drew attention to the *zonula ciliaris;* DEMOURS observed the membrane bearing his name on the posterior surface of the cornea. DUVERNEY, VIEUSSENS, VALSALVA, CASSEBOHM, COTUGNO and others occupied themselves with the anatomy of the organ of hearing, while the structure of the organs of voice and especially of the larynx was illustrated by the investigations of DRELINCOURT, SANTORINI and WRISBERG.

Physiological inquiry achieved the greatest success. The age of experiment, as we may call the 17th century, brought about a complete revolution in the views hitherto held on this subject, and raised physiology into a science. The discovery of the circulation of the blood formed the foundation stone upon which the structure of this science was erected. Already SERVET and REALDO COLOMBO had taught that the blood passes from the right side of the heart through the pulmonary artery and the pulmonary veins to the left side of the heart; but WILLIAM HARVEY

* A. B. R. HIRSCH: Paris quinti nervorum encephali disquisitio anatomica, Vienn. 1765, p. 20.

† H. MEIBOM: De vasis palpebrarum novis, Lugd. Batav. 1723, p. 135 *et seq.*

was the first to furnish the proof of this, inasmuch as he caused water to flow by this route from the pulmonary artery into the left heart. It seems but an easy step to have ascribed an analogous course to the blood in the other vessels of the body. But the doctrine which then prevailed, that the arteries chiefly contained air and only but a little blood and that the blood flowed in a centrifugal direction in the veins as well as in the arteries, was opposed to the acceptation of this view. HARVEY corrected these mistakes.* He opened arteries under water and saw that no bubbles of air rose to the surface. He cut into them and observed what a quantity of blood they contained. He studied moreover the mechanism of the then recently discovered valves of veins and made attempts to blow air into the trunks of veins provided with valves. In this manner hed iscovered that the valves are so formed that they impede and check the blood-stream from the trunks to the periphery but on the other hand offer every facility to its flow in the opposite—that is to say the centripetal—direction. Assuming this to be true, the question arose—from whence comes the blood in the minute ramifications of the veins? As it was impossible to think that the arterial blood is completely used up in the organs, the explanation presented itself spontaneously that it passes from the arteries into the veins as had been established to be the case in the pulmonary circulation.

The exact way in which this passage is made was first explained by MALPIGHI, who discovered the capillaries, and was the first to observe with the microscope the passage of the blood from the arteries into the veins.

HARVEY held fast to the erroneous view that the liver is the seat of the formation of blood. The true conditions of this matter were not known until the discovery of the lacteals by GASPARE ASELLI, of the *ductus thoracicus* by JEAN PECQUET, and of the lymphatic vascular system by O. RUDBECK and T. BARTHOLINUS, nor until the establish-

* W. HARVEY: Works ed. by R. WILLIS, London 1847.

ment by these observers of the importance of the vessels above mentioned in the preparation of the blood.

A series of investigations on the vascular system, on the blood, its composition, elaboration, movement, etc., was soon added to the discovery of the circulation of the blood. A. BORELLI was the first to formulate the thought that the vascular system resembles a hydraulic apparatus, and he attempted to calculate the force with which the blood flows through the vessels. It must be confessed that he arrived at inaccurate results, for the circumstances which have to be considered in this investigation were then not sufficiently known. Thus, for instance, his estimation of the resistance offered by the continually narrowing arteries was unduly high.* WILLIAM COLE hereupon drew attention to the fact that the sum of the transverse sections of the vessels increases with their distance from the heart, and that the vascular system may be represented as a cone, the base of which is the periphery of the body and the apex the heart.† BELLINI showed that the blood flows with less velocity in proportion as the vessels become more and more divided into branches. STEPHEN HALES sought to determine the force of the blood-pressure and the velocity of the blood-current by a series of experiments, and introduced for this purpose a glass tube into the divided artery of a living animal, so that he might observe how high the blood was raised in it.‡ MOLYNEUX and LEEUWENHOEK observed under the microscope the velocity of the blood-current.§ The Irish doctor, ALLEN MOULIN, made the first attempt to determine the quantity of blood contained in the body. He opened the hearts of animals by vivisection, and from the quantity of blood which they contained, and from the velocity of the

* ALF. BORELLI: De motu animalium, Lugd. Bat., 1685, i, p. 94 *et seq.*

† WILL. COLE: De secretione animali, Genev. 1696, c. 7, p. 26.

‡ STEPHEN HALES: Hæmostatique ou la statique des animaux; a French transl., with notes by DE SAUVAGE, Geneva 1744, of "Statical Essays."

§ Philos. Transactions, London 1685, No. 177, p. 1236.

blood-current, he calculated the quantity of blood contained in the body. By this somewhat imperfect method he arrived at the result that the weight of the blood constitutes about the twentieth part of the body-weight.* The discovery of the blood-corpuscles, which were first detected by MALPIGHI, threw great light upon the composition of the blood. They were described by SWAMMERDAM as egg-shaped structures, by MALPIGHI as coralloidal strings, and by LEEUWENHOEK, who studied their form in different classes of animals, as small, oval, flattened spheroids. HEWSON thought that they contained each a small vesicle, and expressed an opinion that they originated chiefly in the spleen.

VIEUSSENS and CHIRAC were then already contemplating a chemical examination of the blood. A. BADIA and MENGHINI showed conclusively that the blood contains iron. F. QUESNAY—who, as the founder of the physiocratic system, rendered the highest services to political economy—taught that the blood contains the following constituent parts:—1. Water; 2. Albuminous matters which coagulate by heat, and when putrid develop an alkaline, acrid quality; 3. Fats which solidify in the cold, but at a higher temperature are fluid, and generate a rancid acridity; 4. Gelatinous matters; and 5. Bitter saponaceous substances.† HEWSON continued to investigate the physical and chemical properties of the blood, and gave very great attention to the subject of its coagulation, the causes of which he was at pains to work out by means of various experiments.‡ An opportunity was often afforded during venesection of observing that blood takes on a redder colour when it comes into contact with air; and the ancients even were aware of the fact that arterial blood is

* Philosophical Transactions, London 1687, Decemb., No. 191, p. 433 *et seq.*

† F. QUESNAY: Essai physique sur l'économie animale, Paris 1747, ii, 342 *et seq.*, iii, 31 *et seq.*—HAESER *op. cit.* ii, 592.

‡ WILL. HEWSON: On the Blood, Germ. transl., Nürnberg, 1870.—E. BRÜCKE: Vorlesungen über Physiologie, Wien 1885, i, 81 *et seq.*

of a clearer colour than venous blood. The Iatrophysicists such as MALPIGHI, PITCAIRN, and others explained the phenomenon by saying that in consequence of the inspired air the blood is subjected to a finer division, while the Iatrochemists ascribed a chemical influence to the air. The attempts to come to a conclusion as to what constituent part of the air it is which produces this effect were naturally unsuccessful. R. BATHURST and N. HENSHAW expressed an opinion that it was the same substance that has a prominent place in the composition of nitric acid. The real action of air upon blood was more closely examined by D. MISTICHELLI. He inflated the lungs of dying animals with air, and in this way was able, not only to cause the blood to change colour, but at the same time to revive the movements of the heart.* About the same time PEYER and HARDER instituted experiments with the hearts of dead animals and of men who had been hanged, and restored cardiac movements by inflating the lungs with air.†

SANTORIO, who made himself known by the invention of various physical instruments,‡ wished to determine the relation between the *ingesta* and *excreta* of the body, and with this object during 30 years submitted the nourishment he took and the refuse material which passed from him to accurate weighing; he then compared the results with his body-weight, and found that a portion of the nourishment taken leaves the body in the invisible form of gas and vapour (*perspiratio insensibilis*).§ DENYS DODART repeated these experiments, and remarked that with increasing age the visible excretory products are increased. The processes of digestion, nutrition, and secretion were judged of in quite different ways by the Iatrophysicists and the Iatrochemists. While the former embraced the opinion that

* Philosophical experiments and observations of ROB. HOOKE, etc., published by W. DERHAM, London 1726, p. 372 *et seq.*

† PEYER: Parerga anatom. et medica, Genev. 1681, p. 198.

‡ K. SPRENGEL *op. cit.* iv, 422 *et seq.*

§ SANCT. SANCTORIUS: De statica medicina, Venet. 1614, Sect. 1.

the stomach exercises a subdividing, triturating effect upon the food, the latter thought that in consequence of the chemical powers of the saliva, the gastric juice, the pancreatic juice, and the bile the food is converted into a pap. The ingenious experiments upon digestion, which SPALLANZANI and CARMINATI afterwards instituted, showed how far both agencies enter into the question.* Similar diversity of views prevailed in reference to such subjects as the secretion and nutrition of organs and tissues; but there was no doubt that the explanations of the Iatrophysicists in reference to blood-pressure, to the form, ramification, and tortuosity of vessels, and to the porosity of the capillaries, started from a firmer basis of facts than did those of the Iatrochemists.

The discovery of the circulation of the blood turned the attention of inquirers to the subject of animal motion in general. NICHOLAS STENO made the first attempt to explain muscular action by the laws of mechanics, which are of such general validity.† He took this opportunity of publishing his observations on the changes of form and consistence which the muscles undergo in contraction and relaxation.

Some years after, in 1680, A. BORELLI'S celebrated work, *De Motu Animalium*, appeared, in which the complicated movements executed by particular muscles were analyzed.‡ In it the author compared the bones and the muscles attached to them to physical apparatus for demonstrating levers. To determine the strength of a muscle he suspended weights to it until its fibres were torn. STENO even made the observation that muscular tissue has the power of being stimulated to movement independently of the influence of vessels and nerves, though DE MARCHETTIS

* SPALLANZANI: Versuche über das Verdauungsgeschäft des Menschen und Verschiedener Thierarten, Deutsche Übers., Leipzig 1785.

† NIC. STENONIS elementorum myologiæ specimen seu musculi descriptio geometrica, Flor. 1667.

‡ *op. cit.* i, p. 19 *et seq.*

had admitted independent irritability only for the muscular tissue of the heart and intestine. It was established by experiments on frogs and tortoises that power of movement exists after removal of the brain. STENO drew attention to the part played by the blood in muscular action; he ligatured the descending aorta in the frog, and showed that paralysis of the muscles of the posterior part of the body ensues. BAGLIVI also sought for the cause of the inherent contractility of muscular tissue in the blood, and considered the nerves to be only the exciters of movement; and he made on this occasion certain remarks which may be taken as alluding to the distinction between plain and transversely striated muscular fibres.* MAYOW, on the other hand, attached great importance to the influence of the atmospheric air upon the activity of muscle. GLISSON regarded irritability as a property† belonging to matter in general; WILLIS considered it to belong only to muscles. Afterwards A. HALLER, as the result of a great number of researches and vivisections, established on a firm basis the different degrees of sensibility and irritability possessed by the various tissues and organs of the body. He came to the conclusion that sensibility is associated with the existence of nerves and irritability with that of muscular tissue.

The nerves were held to be filled with a fluid, and GLISSON even spoke of currents flowing to and fro in nerves. Clearly, these have only the name in common with those electrical currents which at the present day are known to manifest themselves in nerves. In the explanation of the action of nerve force the Iatrophysicists and the Iatrochemists were opposed to one another; for while the former, with NEWTON, assumed the presence of vibrations, of tensions, and relaxations, the latter considered

* G. BAGLIVI: De fibra motrice et morbosa in his Opera omnia medico-pract. et anatom., Antwerpen 1719.

† GLISSON: De ventriculo et intestinis, Amstelod. 1677, p. 168 *et seq.* according to G. H. MEYER in HAESER's Archiv, Jena 1843, v, p. 1 *et seq.*

the force in question to be attended with chemical changes in the nerve-contents. Those who were dissatisfied with both explanations, had recourse to the hypothetical "vital spirits," which gave the wished-for answer to all questions.

The brain was generally accepted as the centre of intellectual activity. WILLIS ventured even to localize the different psychical faculties in particular parts of the brain; thus he seated sensation in the corpora striata, memory in the medullary substance, and the animal functions in the cerebellum. R. WHYTT came to the conclusion after numerous vivisections that the capacity for movement is preserved for some time after death, and referred to the fact that decapitated frogs "move in a co-ordinated manner, and, as it were, with intelligence." He concluded from this that the brain cannot be the only centre of intellectual activity.* CALDANI made attempts to investigate the physiological functions of the spinal cord, and with this object destroyed different parts of it.

The great astronomer KEPLER drew the outlines of a correct theory of vision, remarked upon the difference in the curvatures of the anterior and posterior surfaces of the lens, explained that this organ is by no means the seat of vision, as had hitherto been thought, but serves the purpose of refracting the incident rays of light into the direction required. He followed the course of these rays until they impinge upon the retina,† and pointed out that myopia and hypermetropia depend upon abnormalities in the refracting media, and that with suitable spectacles, fitted with concave or convex glasses, a correct image of an object is produced. Father SCHEINER, of Vienna, completed these investigations, and showed by the experiment named after him that an object is only clearly seen when removed to a certain definite distance from the eye. He at the same time

* ROB. WHYTT: An essay on the vital and involuntary motions of animals, Edinburgh 1751, p. 344 *et seq.*, 384 *et seq.*—R. WHYTT: Physiological essays, Edinburgh 1755, p. 107 *et seq.*, 214 *et seq.*

† POGGENDORFF *op. cit.*, S. 168 *et seq.*

observed that the pupils contract when the eyes are fixed upon near objects. The Prior of the Monastery of St. Martin, E. MARIOTTE, made the discovery that the place where the optic nerve enters the globe is insensible to rays of light.*

The foundation of the physiology of hearing was laid by CLAUDE PERRAULT, the famous physician and architect, the builder of the Louvre at Paris. He was the first to see the nerve-fibres distributed upon the *lamina spiralis* of the cochlea, and declared them to be the seat of the sense of hearing.† He also recognized the part played by the labyrinth and the semi-circular canals in the conduction of sound. DUVERNEY followed the distribution of the auditory nerve in the internal ear more closely, and rendered PERRAULT'S results more conclusive on certain points. Then followed VALSALVA'S excellent work.

CLAUDE PERRAULT also attempted to throw light upon the origin of the voice, while drawing attention to the structure of the larynx. DENYS DODART was of opinion that vocal sounds are produced by the constriction or widening of the glottis in association with the passage of air to and fro. ANTOINE FERREIN recognized the fact that vibrations of the vocal cords are of the greatest importance in phonation.‡ P. CAMPER tried to explain the different character of the voice in various classes of animals by the differences in the structure of their vocal organs. AMMANN, W. v. KEMPELEN, and KRATZENSTEIN studied the physiology of speech, and constructed the first specimens of an apparatus for imitating human articulation. The papillæ of the tongue were declared by MALPIGHI and BELLINI to be concerned with

* Lettres écrites par MARIOTTE, PECQUET et PERRAULT sur le sujet d'une nouvelle découverte touchant la veuë par MARIOTTE in the Recueil de pleusieurs traitez de mathematique de l'Acad. Royale des Sciences, Paris 1676.

† Œuvres diverses de physique et de mechanique. Leyden 1721, Vol. i, p. 247 *et seq.* (du bruit, partie iii).

‡ Histoire de l'Acad. Royale des Sciences avec les mémoires, etc., Paris 1700, p. 244 *et seq.*; 1706, p. 136 *et seq.*; 388 *et seq.*; 1707, p. 66 *et seq.*; 1741, p. 409 *etseq.*

the sense of taste. MALPIGHI located the sense of touch in the papillæ of the skin. BOHN referred to the distinction between the senses of touch and of temperature, and the Genevese philosopher, BONNET, already raised the question whether the tongue possesses different nerves for every kind of flavour, and the ear different fibres for every note.*

Amongst the most weighty questions engaging the attention of the natural philosophers of the 17th and 18th centuries may be reckoned the theory of the generation and development of the animal embryo. Here, too, it was WILLIAM HARVEY who gave to these investigations a firm basis in enunciating the proposition, *Omne animal ex ovo.* He taught that the embryo developed from the ovum which took its origin from the mother, the semen of the male only setting the process in motion. The opinion was maintained that during coition the ovum is released from the ovary; but KERCHRING remarks that women had told him that an ovum may be expelled at each menstruation.† The ovum theory was put on a still firmer foundation by SWAMMERDAM, MALPIGHI, and REDI, who gave a wider significance to the HARVEIAN dictum by changing it into *Omne vivum ex ovo*, and even applied it to plants. This doctrine sustained a great shock in consequence of the discovery of the spermatozoa, which J. HAM was the first to notice in 1677. LEEUWENHOEK confirmed this observation, and described the spermatozoa as extraordinarily small creatures, each provided with a tail and a rounded head, and engaged in continual movement; and in view of these facts he put forward the hypothesis that the spermatozoa and not the ova form the real germs of the embryo. HARTSOEKER thought he recognized a resemblance between the spermatozoon and the human form, and looked upon each as a primitive embryo. The witty LEIBNITZ even spoke of the immortality of spermatozoa. ANTONIO VALLISNERI put an end

* Letter of BONNET to HALLER, in HAESER. *op. cit.* ii, 596.

† TH. KERCKRING: Anthropogenia ichnographica, Amstelod. 1671, p. 3.

to these dreams by confirming the view of the high importance of the ovum for the development of the human embryo; and yet he committed the error of considering the spermatozoa as an unessential accidental constituent of the semen, and of declaring them to be without effect in generation. This view was also countenanced by BUFFON, HALLER, and others, and obtained almost universal acceptance. SPALLANZANI was the first once more to submit to a closer investigation the problem of the real cause of impregnation, and with this object undertook a series of experiments in artificial impregnation with the spermatic fluid of the male.* HALLER afforded valuable information upon the development of the embryo, especially upon the formation of the vascular system. The fœtal circulation was thoroughly explained by DUVERNEY.

Most philosophers gave credence to the old theological theory of development, according to which the germs of organic beings are preformed from the time of the creation of the first, and lie embedded in one another like a series of boxes, each enclosing a smaller one. This view of things was replaced by the doctrine of Epigenesis, in which CASPAR FRIEDRICH WOLFF, as the result of a great number of careful observations, delivered his opinion that organs have not existed in their mature shape from the beginning of things, but that the particular parts of the body assume gradually their fully-developed form as the result of a series of differentiations.† With great penetration he referred to the analogous development of plants and animals, and in this connection even pointed to the doctrine of metamorphosis in the vegetable kingdom further developed by GOETHE. He also made the observation that the nervous system, the alimentary canal, and the vasculo-muscular

* SPALLANZANI: Versuche über die Erzeugung der Thiere und Pflanzen, Deutsche Übers., Leipzig 1786.

† C. F. WOLFF: Theoria generationis, Halle 1759.—C. F. WOLFF: Über die Bildung des Darmkanals im bebrüteten Hühnchen, Berlin 1812, S. 57, 125, 148.

structures arise from distinct embryonic layers. He declared the ultimate constituents of the body to be spherules or vesicles. May we not look upon this as a foreboding of the discovery of the cell?

PROGRESS IN THE OTHER BRANCHES OF MEDICAL SCIENCE DURING THE SEVENTEENTH AND EIGHTEENTH CENTURIES.

THE opposition between the Iatrophysicists and the Iatrochemists was manifested as much in pathology as in physiology. They sought to explain diseases, on the one hand by mechanical disturbances such as stagnation of the blood or of the contents of the nerves, on the other hand by chemical processes such as fermentation and decomposition. Prominent thinkers among the doctors, like BORELLI, PITCAIRN, HELMONT, SYLVIUS, WILLIS, BOERHAAVE and F HOFFMANN built upon these theories elegant structures of pathological doctrine, the instability of which became apparent as science advanced. The deficiencies and mistakes and especially the one-sidedness manifested by some of these medical systems led to the blending of them with dynamic hypotheses: PARACELSUS had previously made this attempt and HELMONT and WILLIS had repeated it. But the dynamic theory, which in many respects recalled the doctrines of the Pneumatists of antiquity—remodelled however, of course, in conformity with the Christian faith—was at first only employed to explain the ultimate causes of organic phenomena. STAHL developed it into an animism which suggested the view that all scientific investigation in medicine must be superfluous. The same conclusion, at least in respect of the theoretical foundation of medicine, was arrived at by those doctors who, like SYDENHAM, dissatisfied with attempts to reconcile theory with practice, despaired of the solution of the problem, and declared the final goal of their efforts to

be an art of healing resting upon experience. The artificial systems of the schools, founded on ingenuity and imagination, enjoyed but a short existence and resembled soap bubbles with their changing prismatic hues, dazzling for a moment with the richness of their colour and gone the next without leaving a trace behind. Of this period, only the knowledge which experience gained or scientific observation disclosed, has remained a possession of later times, forming one among the many building-stones in the firm structure of medical science.

A rich clinical literature advanced the knowledge of disease as seen in individual cases, and turned the attention of doctors to groups of symptoms,—a subject which had been little, if at all, studied before. At the same time diagnosis was improved by the introduction of new appliances, and a scientific advance in morbid anatomy was prepared for by the collection of reports of pathological changes noted at post-mortem examinations. SYLVIUS described the deposit of tubercles in the lungs, and considered consumption to be due to the purulent breaking up of such deposits.* WILLIS drew a picture of *diabetes mellitus* and remarked upon the sweet taste of the urine in this disease which he was unable to account for † WERLHOF gave the first description of *purpura hæmorrhagica*.‡ The earliest communications upon the subject of rickets date also from the 17th century: the symptoms of this disease were sketched in outline by B. REUSNER, but more thoroughly portrayed by WHISTLER, A. DE BOOT, and GLISSON. During the same period we find various reports upon the endemic incidence of cretinism, which PARACELSUS had already observed in certain Alpine localities, and also the earliest treatises upon the epidemic

* FR. DE LE BOË SYLVII Opera Medica, Traject. ad Rhenum et Amstelod. 1695, p. 692 *et seq.*

† TH. WILLIS: De urinis in Op. omnia, Amstelod. 1663, p. 333 *et seq.*

‡ P. G. WERLHOF: Opera Medica ed. WICHMANN, Hannover 1775, ii, p. 624, 761.

appearance of syphilitic affections known in Scotland under the name of Sibbens and under that of Radesyge in Scandinavia.

Remarkable progress in certain directions was also made during this period in the diagnosis of disease, but its full significance was certainly not recognized until later. On the examination of the urine as a means of diagnosis SOLANO DE LUQUES, T. BORDEU and others imparted some new and valuable information although they also made many singular and even ridiculous statements upon the same subject. Other means of diagnosis also began to be used. SANTORIO made use of the thermometer to determine the temperature of the body, and BOERHAAVE, COCKBURN and others made extensive use of that instrument in their practice.* ANTON DE HAËN in this way established the fact that in the rigors of fever the temperature of the body is not reduced, as was then generally assumed to be the case, but, on the contrary, raised: he also first drew attention to the remarkable phenomenon of post-mortem elevation of temperature, and observed that the subjective feeling of warmth by no means always corresponds to the real temperature, and that the temperature of paralyzed limbs is lower than that of healthy ones.†

Diseases of the heart excited great interest. LANCISI connected pulsation in the jugular veins with dilatation of the right side of the heart resulting from incompetence of the tricuspid valve.‡ ALBERTINI remarked very appropriately that the difficulty of diagnosis in heart disease depends in great measure upon the fact that in it pathological conditions of various kinds coexist and he advised that in examining the heart the hand of the doctor should be laid upon the cardiac region of the patient.§ By far

* WUNDERLICH: Das Verhalten der Eigenwärme in Krankheiten, Leipzig 1870.

† TH. PUSCHMANN: Die Medicin in Wien, 1884, S. 19.

‡ LANCISI: De motu cordis et aneurysmatibus, Lugd. Batav. 1740, p. 306, pars. ii., cap. 6, prop. 60.

§ ALBERTINI: Opuscula ed. M. H. ROMBERG, Berol. 1828.

the greatest acquisition which diagnosis owes to this period, was the discovery of the art of percussion by the Viennese doctor AUENBRUGGER.* Unfortunately this remained almost unnoticed: only in the 19th century did it become, as C. G. LUDWIG of Leipzig said in the year 1763, "a torch which brought light into the gloom which brooded over the diseases of the thorax."

Morbid anatomy also made a great step in advance. Men ceased to look upon pathological changes observed in the dead body as nothing but curiosities which satisfied the spectacular cravings of collectors ever ready to grasp at rarities, and began to suspect, and to examine into, their connection with clinical symptoms. W. HARVEY declared that a man can learn more from the necropsy of one human being who has died of consumption than he can from the dissection of ten who have been killed by hanging. BENEVIENI, T. BARTHOLINUS, BONET, RIDLEY, LANCISI, VALSALVA and others deposited in their writings a number of valuable observations. WEPFER made the first attempt to set free the subject of cerebral diseases from the chaos of mystical-transcendental speculation in which it was lost, and to explain such diseases by pathological changes in the brain. He observed the seat of apoplectic lesions healed into cicatricial tissue and described the affection named afterwards by FOTHERGILL "a painful affection of the face" *i.e.* tic douloureux. In the 18th century FONTANA made the important discovery that the "staggers" in sheep is a disease caused by hydatids in the brain.

The pathology of the vascular system owed substantial progress to the labours of VIEUSSENS, LANCISI and SENAC. VIEUSSENS † observed instances of adhesion of the pericardium to the heart and described *hydrops pericardii* and *pericarditis*. He portrayed with astonishing clearness the relations between the pathological changes in the dead body and the symptoms during life in a case in which he

* AUENBRUGGER: Inventum novum, Vindob. 1761.

† J. PHILIPP in the Janus ii, 580-598. iii, 316-326.

attributed dilatation of the pulmonary veins, œdema of the lungs, enlargement of the right side of the heart, dropsical swelling of the feet, and smallness of the pulse, all to stenosis of the left *ostium venosum, i.e.,* auriculo-ventricular orifice; and also on another occasion when he observed calcareous degeneration of the *aorta ascendens* and of the semilunar valves with insufficiency of the latter and declared this had resulted in a partial regurgitation of blood into the left side of the heart and cardiac palpitation. LANCISI gave more detailed information concerning these pathological changes especially as to so-called ossification, that is calcareous degeneration of the valves, and as to dilatation and hypertrophy of the heart.* SENAC first drew attention to the abnormal position sometimes occupied by the heart on the right side in consequence of pathological conditions.† Unfortunately the erroneous views of doctors firmly resisted the correct interpretation of facts in regard to the significance of the so-called polypi of the heart, although KERCKRING had already declared them to be due to post-mortem changes.‡

Pathological anatomy reached the highest point attained at this period in J. B. MORGAGNI who, in possession of all the knowledge which had been accumulated in this field, verified and completed the results gained by numerous observations of his own and for the first time gave clear and defined expression to the problems and tasks of this branch of science.§ In his investigations he also sought the aid of experiment.‖ STEPHEN HALES did likewise and produced artificial dropsy by injecting water into the vascular system. HALLER'S labours upon sensibility and irritability were supported chiefly by experiments on animals and by vivisections. He knew well the use of these aids and declared: "One single experiment of this kind has often

* PHILIPP in the Janus iii, 318 *et seq.*

† SENAC: Traité de la structure du cœur, Paris 1749.

‡ TH. KERCKRING: Spicilegium anatomicum, Amstelod. 1670, p. 145.

§ F. FALK: Die pathol. Anatomie des J. B. MORGAGNI, Berlin 1887.

‖ PHILIPP in der deutschen Klinik, 1853, No. 45.

removed the disappointments occasioned by the work of whole years. This cruel proceeding has been of more use to physiology than almost all the other arts, the co-operation of which has given strength to our science."* SPALLANZANI'S experiments upon the reproduction of lost limbs in the lower animals excited great attention.† JOHN HUNTER contributed more than any other to introduce the experimental method into pathology.

Not only do the first beginnings of experimental pathology belong to this period but the same may also be said of bacteriology. LEEUWENHOEK described micro-organisms of rounded, staff-shaped, thread-like and spiral form which he asserted that he had found in the human mouth between the teeth.‡ In consequence of these discoveries the theory arose that many diseases are caused by these "animalcules." This view did not, certainly, admit of demonstration at that period, but for all that, certain distinguished naturalists such as LINNÆUS and PLENCICZ held fast to the doctrine of *contagium animatum.*

Valuable preliminary work in founding a science of hygiene was done by LANCISI who studied the exhalation from marshes and the means of improving the unhealthy condition of the Roman Campagna,§ and by PRINGLE who rendered great service to military sanitation and instituted investigations upon septic and antiseptic substances.

The pharmacopœia was enriched by many remedies. The value of Peruvian bark in fever was recognized; ipecacuanha root was found to furnish a powerful emetic and the use of arsenic was recommended in cancer. Efforts were also made to arrive at correct views as to the causes of the beneficial effects of medicines and the most suitable method of employing them. WILLIS invited an inquiry into

* *Cf.* AD. VALENTIN in the Memoir on A. v. HALLER, Berne 1877, p. 78. SPALLANZANI: Sopra le riproduzioni animali, Modena 1768.

‡ F. LÖFFLER: Vorlesungen über die geschichtliche Entwickelung der Lehre von den Bakterien, Leipzig 1887, Th. i.

§ C. LANGER in den Mitth. d. Ver. d. Ärzte in Nieder-Österreich 1875, No. 2.

the changes which the drugs bring about in the stomach, the blood and the different organs. This suggestion was carried out by WEPFER and, to a greater length afterwards, by A. STÖRCK: they performed numerous pharmaco-dynamical experiments with various medicinal substances.* Under the influence of the discovery of the circulation of the blood, the first attempts were made to inject medicines into the veins as well as to replace great loss of blood by transfusion.† But the unfortunate results of these operations which depended partly upon the indifferent appliances and instruments used in performing them soon brought intravenous injections and transfusion into discredit and by degrees into oblivion. C. STALPERT VAN DER WIEL already made use of a kind of œsophageal tube for artificial feeding.‡ BENNET advanced special therapeutics by recommending inhalations in phthisis;§ DOLÆUS by ordering milk diet in gout; and EDW. BAYNARD and J. FLOYER by causing patients suffering from high fever to be immersed in cold water. The two HAHNS, BRANDIS and CURRIE recommended that cold water should be poured over patients with typhus and thus gave a stimulus to the progress of hydro-therapeutics, while the curative employment of baths was placed on a firm basis by R. BOYLE and F. HOFFMANN.

Surgery made less progress than the other branches of medicine during the 17th century. This was caused partly by the fact that the most gifted representatives of medical science turned their attention by preference to chemical and physical investigations which then promised great results, and also to physiology and microscopical anatomy; partly by the continually increasing separation between internal medicine and surgery, in consequence of

* PUSCHMANN *op. cit.* S. 35 *et seq.*

† P. SCHEEL: Die Transfusion des Blutes und Einspritzung in die Adern, Kopenhagen 1802.—DIEFFENBACH in RUST's Handwörterbuch, Berlin 1838.

‡ STALP. V. D. WIEL: Observat. rar. cent. ii, 27 and KRUL in the Weekbl. v. h. Nederl. Tijdschr. v. Geneesk, 1883, No. 47.

§ CHR. BENNET: Tabidorum theatrum, Lugd. Bat. 1714, Cap. 28.

which students of medicine held themselves aloof fr
studying the art of treating wounds, while on the oth
hand the practitioners who had received but empiri
training were fully occupied in learning to understand a
to assimilate to themselves the teachings of the gre
revolution in their art of which the preceding century h
witnessed the commencement, in respect of the metho
used in surgical operations. Certainly there were n
wanting certain improvements in the technical procedur
connected with operations: but no reforming genius lil
AMBROISE PARÉ, embracing all branches of surgery a
guiding it into new paths, lived at this time. It was not un
the second half of the 18th century that a new impetus w
given to surgery though this did not show itself so much
the development of the art of operating as in the foundatic
of surgical pathology.

Ligature was but seldom employed for the arrest
hæmorrhage, for this demanded more anatomical knov
ledge than the majority of surgeons possessed. Tl
numerous unsuccessful results which followed the attemp
made in this direction may be partly attributed to tl
rough and incomplete methods employed. Compressic
of the vessels was practised by preference and w
considerably facilitated by the invention by MOREL
the fillet-and-stick tourniquet in the year 1674. PET
replaced this by the screw-tourniquet in 1718. Digit
compression also came once more into use at the instance
SAVIARD and LOUIS. The Prussian surgeons THEDEN a
SCHMUCKER recommended the use of the tampon. Besid
these means use was made of the hot iron, of cold, and
various styptic applications. Ligature came to be mo
generally recognized by surgeons only when it was unde
stood what a mistake had been made in including in t
ligature the nerves, veins, and surrounding cellular tissu
and when the practice of ligaturing the isolated artery w
commenced. Even ligature of great arterial trunks, su
as the femoral and axillary was then ventured upon; WA

NER and ELSE went so far as to perform ligature of the carotid in the year 1775.

The amputations performed were chiefly those of the foot, leg, forearm, and hand; above the elbow and knee they were practised less frequently. The methods of performing these operations were somewhat enriched by the introduction of the double and triple incision, of the flap-operation, and of the process of cutting the tissues in the form of a hollow cone, the object aimed at being the preservation of enough of the soft parts to form a covering for the stump. Amputation was, however, performed more frequently than there was any occasion for. Thus SCHMUCKER states that in 1738 he saw in the Hôtel Dieu at Paris a patient both of whose legs had been amputated on account of simple fractures. Conservative surgeons opposed this abuse which had arisen under the influence of the French school, and endeavoured to confine amputation within reasonable limits. The increase of anatomical knowledge and the improvement in the technical details of operations encouraged surgeons to perform exarticulations. A. PARÉ had already practised this method at the elbow-joint; at the knee it was first performed by FABRY VON HILDEN and at the shoulder by MORAND and LE DRAN. The method of exarticulation in the tarsus named after CHOPART was made public in 1791. Exarticulation at the hip-joint was attempted but given up again on account of the unsatisfactory results attending it. Resections of certain bones or portions of bones were also performed; for instance of the humerus by CH. WHITE, of the clavicle by CASSEBOHM, while the first successful excisions of joints were practised by FILKIN (1762) and PARK (1781) in the case of the knee joint; and by CH. WHITE (1768) and J. BENT (1771) in the case of the shoulder.

Trephining was frequently performed for the most trivial causes; it is inconceivable, how readily this measure was resorted to. It was performed 17 times, on PHILIP WILLIAM

Prince of ORANGE as we are told by C. SOLINGEN. Onl here and there was a voice raised against this dangerou mania for operations. The first opening of the maxillar antrum for disease belongs also to this period. Catheterisı of the Eustachian tube owes its invention to the deaf pos master GUYOT of Versailles who practised it upon hin self.* Tracheotomy was recommended and performed nc only for the removal of foreign bodies and the relief c dyspnœa, but also in croup and diphtheria.† Œsopha gotomy was performed for the first time in the 18t century, while gastrotomy was practised as early as th year 1635.‡ GIOVANNI FANTONI reported the first suc cessful extirpation of the spleen. In the subject of herni the influence of the study of anatomical relations, whic are of such fundamental importance, began to make itsel felt. Besides inguinal and umbilical hernia other form began to be distinguished and attention was drawn t femoral hernia and to the pudendal, obturator and sciati varieties.§ Efforts were made to throw light upon th origin of ruptures; HALLER considered congenital hernia to depend upon embryological conditions. In the treat ment, trusses were more generally employed especially after N. LEQUIN had in 1663 introduced the elastic spring The operation for radical cure was less frequently per formed and was gradually more and more confined to case of strangulated hernia. Special care was taken to pre serve the spermatic cord; many surgeons, like DIONIS held it to be justifiable only in the case of priests to com bine castration with this operation.

The operation for rectal fistula was brought into con siderable repute by the fact that LOUIS XIV was obliged to undergo it. The Royal illness even exerted a grea

* Machines et inventions, appr. par l'académie royale, Paris 1724, iv, No 253.

† B. SCHUCHARDT in LANGENBECK'S Archiv 1887, Bd. 36, H. 3.

‡ HAGENS in the Berliner klinischen Wochenschr. 1883, No. 7.

§ J. FANTONI: Opusc. med. Genev. 1738.

influence on politics; MICHELET has, as is well known, divided the reign of this Monarch into the periods *avant et après la fistule*.* The debates upon the performance of the operation led to the invention of several fistula-knives amongst which that of POTT with SAVIGNY'S improvements was most esteemed. Colotomy with the object of the formation of an artificial anus in congenital closure of the natural outlet was performed in 1783 for the first time.

Among the methods of performing lithotomy the *sectio lateralis* was most extensively adopted. CHESELDEN modified the procedure in some measure and FRÈRE CÔME recommended the use of the *lithotome caché*. The high incision over the pubes was less frequently employed. Lithotrity was described by CIUCCI: he made use of a grooved instrument with toothed blades resembling CIVIALE'S lithotrite and enclosed in a sheath. In the treatment of urethral stricture the elastic bougies recommended by DARAN which swelled in the urethra were in great favour.

HENDRIK VAN DEVENTER, A. J. VENEL and others sketched out the principles of orthopædics. About the same time HENDRIK VAN ROONHUYSE and afterwards TULP made the first attempts to cure *caput obstipum* by dividing the sterno-cleido-mastoid muscle. In 1784 M. G. THILENIUS performed the first division of the *tendo Achillis* for club-foot.

Surgical pathology received valuable additions at the hands of PERCIVAL POTT who made chronic inflammation of the joints or *tumor albus* the object of careful observation, as he did also the subject of vertebral caries, the curvature resulting from which disease is named after him; while J. L. PETIT drew attention to the suppurative osteomyelitis which supervenes upon wounds. PETIT and JOHN HUNTER also studied in greater detail the processes which occur in the tissues in thrombosis, suppuration, cicatrization and granulation.

* HÆSER *op. cit.* ii, 432.

Ophthalmology made a great stride at this time, in laying aside the error, that cataract results from an extra-ocular humour which is deposited in the form of an opaque pellicle before the lens, and by adopting the correct view that it consists of a disease of the lens itself. This discovery received a splendid confirmation in the method of extraction by which DAVIEL in 1746 performed the first operation for removal of the lens. Extraction from this time forth maintained an established position in ophthalmic surgery along with the couching operation. The formation of an artificial pupil constituted a further step in advance; this was advocated by WOOLHOUSE and first performed in 1728 by CHESELDEN. The procedure consisted of an incision made in the iris; the elder WENTZEL modified this by excising a portion of the iris—performing an iridectomy in fact.

To this period midwifery owes the beneficent discovery of the forceps. Long led up to by the instruments which obstetricians made use of for the extraction of dead fœtuses, they appeared upon the scene finally in the 17th century and assumed a form calculated to adapt them to their peculiar ends. The CHAMBERLENS in difficult labours made use of appliances consisting of levers, or blades of steel covered with leather. This invention remained a business-secret until JEAN PALFYN made it public after introducing many improvements.* It was then further perfected by DUSÉ, who introduced the crossing of the two blades, by the younger GREGOIRE who had them fenestrated and united by a locking apparatus, and above all by LEVRET who changed the straight form of the blades into a curved one, arranged for the locking by means of a moveable peg, and laid down a statement of the indications which justified the use of the forceps. To avoid the dangers of Cæsarean section—an operation but rarely performed—a division through the symphysis pubis was

* J. H. AVELING: The Chamberlens and the midwifery forceps, London 1882.—A. GOFFIN: Jean Palfyn, Bruxelles 1887.

recommended, by which it was hoped, erroneously however, to increase the width of the pelvis; the bad results of this operation were soon seen and led to its general condemnation. On the other hand the procedure first recommended by CAMERARIUS and SLEVOGT—that namely of inducing premature labour in the 7th or 8th month in a case where, in consequence of a narrow pelvis, a child could not be delivered by the natural passages,—was well received by obstetricians and maintained its place in gynæcological practice.

To this period belongs also the first treatment of medical jurisprudence in a scientific spirit as we see for example in the application of the lung-test to forensic purposes:* the same may be said of the first beginnings of a system of medical statistics.†

If we follow the course of the development of medicine during the 17th and 18th centuries, we recognize in it the same phases as those which characterize the general march of civilization during the same period. That spirit of active investigation, so rich in results, which was displayed in an indefatigable accumulation of empirical facts, gradually to a certain extent ceased to manifest itself: it became apparent that the results gained required to be sifted and to be looked at in their relations to one another and to the general intellectual life of man. Like the traveller, who after a fatiguing march has climbed a height, and who looks back with a proud contentment on the path he has traversed; even so the genius of civilization after great victories won, now halted for a brief rest, before arming once more for new achievements. In the history of mankind such a moment had arrived in the 18th century and the efforts of the Encyclopædists gave clear expression to the fact. In medicine too this tendency of men's minds was noticeable and manifested itself in a series of com-

* BLUMENSTOCK in the Vierteljahrsschr. f. gerichtl. Medicin, 1884, Bd. 38 S. 252-69. Bd. 39, S. 1-12.

† J. GRAETZER: Daniel Gohl und Christ. Kundmann, Breslau 1884.

positions which dealt chiefly with the history of medicine.

The first prominent representatives of medical historical literature were DANIEL LECLERC, JOHN FREIND and JOHANN HEINRICH SCHULZE. It found influential friends and supporters in BOERHAAVE and especially in HALLER who rendered imperishable services to the history of medicine by editing the medical writings of antiquity and by his bibliographical works. PORTAL, also, who was the author of a History of Anatomy, WERTHOF, HENSLER and GRUNER, whose thorough investigations in the history of diseases have an enduring value, ASTRUC, BALDINGER, TRILLER, MOEHSEN, ACKERMANN, MESLER and others bear witness to the fact that the taste for historical inquiry among the doctors of the 18th century was widely spread and abundantly fruitful.

THE CHARACTER OF THAT PERIOD IN REGARD TO ART AND PHILOSOPHY.

THE intellectual life of the 18th, was of a different character to that of the preceding, century. This change manifested itself either in the neglect of experimental inquiry, as was the case in the natural sciences, or else in an alteration of direction in work and aims, as was most clearly indicated by the productions of the painter's art.

The 17th century produced GUIDO RENI, SALVATOR ROSA, the Spaniards VELASQUEZ and MURILLO, the French masters NICHOLAS POUSSIN and CLAUDE LORRAIN and the great artists of the Netherlands, RUBENS and REMBRANDT. The 18th century could place by the side of these but few artists whose names would not pale in the presence of that dazzling company of masters. In the place of the classical beauty of those figures, which have become a pattern to all time by virtue of the noble simplicity of their design and the correct appreciation of the harmony of colours shown

in their composition, and which, even when, as in RUBENS' works, they exhibit a downright naturalism never merely captivate the eye but always speak to the heart as well,—in the place of such works as these appeared others, unwholesomely surcharged with quaint accessories, in consequence of the desire of the painters to appear original, the effect of which was to lead art astray from the true path.

The philosophical ideas and systems which were put forward at this time afforded a life-like image of the intellectual struggles and changes of the period. The inductive philosophy of BACON, founded upon experience and experiment, which was justified beyond all expectations by the rapid strides made in the natural sciences and by a multitude of discoveries and inventions, developed under the influence of these results upon a basis of materialism to which the doctrine of pantheism imparted some bias towards idealism. That belief the unfortunate GIORDANO BRUNO had proclaimed as his sacred conviction and suffered death for in the flames. BARUCH SPINOZA also professed the same creed at a later period, and, expelled from the Jewish community on account of his freedom in religious thought, endeavoured to found it on scientific facts and to make it a method of general application in explaining the phenomena of the universe. He taught the conformability to law of every event in nature and the unity of substance which, as he explained in his appendix to Descartes, manifests itself outwardly in a twofold form—Spirit and Matter.

JOHN LOCKE went a step further. Accustomed as a doctor to exclude metaphysics from the field of discussion, he took up a position on the ground of pure philosophic empiricism and declared that there are no such things as innate ideas but that all knowledge is founded on experience. The human soul, he says, resembles at birth a blank page on which the perceptions of the senses are impressed as experiences, until by reflection and by the understanding —which LOCKE calls the internal sense—they are arranged into pictures of ideas. He thus brought philosophy once

more back into the arms of naturalism inasmuch as he referred his theory of the acquirement of knowledge to the investigation of things by means of the bodily senses.

LOCKE'S philosophical views found distinguished advocates in France in the persons of E. B. DE CONDILLAC and VOLTAIRE, and in England incited to a scepticism which DAVID HUME gave powerful expression to, while Germany produced a mighty opponent to them in LEIBNITZ. The last-mentioned combined the innate ideas of PLATO with the outlines of the atomic philosophy of DEMOKRITUS,—with which G. BRUNO and P GASSENDI had already established some connection,—and adapted these views to the Christian doctrines of the wisdom of the Creator and the suitability of nature to its ends. He assumed the existence of certain metaphysical points indivisible, without dimensions, and probably endowed with perception, which he called monads; he believed that he explained their mutual relations and their connection with the unity of consciousness by the fantastical hypothesis of a "pre-established" harmony settled before the beginning of time.

LEIBNITZ exerted no promoting influence on the development of the natural sciences or of medicine in particular; for philosophy, for literature in general, he has perhaps been credited with greater importance than he deserves. His system was chiefly confined to Germany where CHRISTIAN WOLFF was his most zealous apostle. He arranged the ideas, which LEIBNITZ had jotted down in a loose disconnected form, into an orderly scheme with the pedantry of a schoolmaster, and wherever there were manifest gaps or whenever a too high-flying fancy prevailed he amended matters by the doctrines of other philosophers.

More coherent and uniform in composition, but at the same time more daring and more terrifying in its conclusions was the materialism which made its appearance in France about the middle of the 18th century. The most radical representative of this, the French doctor LAMETTRIE, made an attempt in his "Histoire Naturelle de l'Âme" and his

"L'Homme Machine" to deduce from the material and corporeal organism even the processes of thought, the intellectual faculties, and the moral feelings. He disregarded the transcendental character of the human soul, appealing, amongst other things, to the fact of psychical disturbances which depend upon changes in the brain. Immortality he granted, but only in so far as he held that matter, from which the things of this world are made, does not perish, but only changes its form and participates afresh in the formation of other bodies. Unfortunately LAMETTRIE at the same time preached a philosophy of pleasure which amounted to a shameless glorification of self-indulgence, and especially of venereal pleasures. The violent attacks which he had to sustain were provoked entirely by this circumstance and were by no means the result of his more serious philosophical theories. It may well be that during his life he did not practise the frivolous cynicism which he made so conspicuous a feature of his writings: but even F. A. LANGE who undertook the vindication of LAMETTRIE was able to bring forward in his defence nothing more than the claims that he neither sent his children to the foundling hospital like ROUSSEAU, nor married two brides like SWIFT, that he had not like BACON been convicted of bribery, and had never been suspected of forging documents like VOLTAIRE.* In any case LAMETTRIE by his teachings exerted an injurious influence upon morals and poisoned many pure spirits, and he was chiefly to blame if materialistic philosophy was for a long time identified by ignorant people with an unlimited indulgence in sensual gratifications.

The other adherents of materialism, especially those who have become known under the name of the Encyclopædists, sought not so much to secure a scientific foundation for their philosophical tenets as to wage war against ecclesiastical and political authorities. The author of the "Système de la Nature" developed the theory of the

* F. A. LANGE: Geschichte des Materialismus, Iserlohn 1876, i, 349.

circular course of life and the intimate interdependence of the three kingdoms of nature; but he laid, at the same time, undue stress upon such subjects as the rationalistic enlightenment of the people and their right to self-government.

These theories no doubt contributed largely to lead on the mighty revolutions which, at the end of the eighteenth century, shook France to its foundations and affected the whole of Europe, and make it, to some degree, apparent why many looked upon materialism as the source of irreligion and the foe of monarchy.

THE LEARNED SOCIETIES AND UNIVERSITIES IN THE SEVENTEENTH AND EIGHTEENTH CENTURIES.

THE development of the scientific spirit was essentially advanced in the 17th century, as it had been in the 16th, by the foundation of learned societies and of universities. In Italy Prince FEDERIGO CESI established in 1603 the Accademia dei Lincei, so called because its members required for their investigations the eyes of lynxes and because the coat of arms of the society bore a lynx on it; while in 1657 under the patronage of the Medici princes there arose in Florence the Accademia del Cimento which gave forth that experiment should be its particular charge.

Learned societies were formed after this pattern in other countries also. In Germany, Schweinfurt was the centre of a society of doctors and natural philosophers which in 1672 was raised to an academy by the Emperor LEOPOLD. In Paris the Académie des Sciences came into existence about the year 1666 and in 1793 was converted into the Institut National. The Royal Society was also founded in London in the year 1666: its Transactions have appeared in almost unbroken succession up to the present day, and form for the history of science one of the most

important and valuable series of publications extant.* Upon these followed the Academy of Berlin which was established in 1700 through the efforts of LEIBNITZ; the Philosophical Society of Göttingen in 1733; the Academy of St. Petersburg, which was built, certainly, on Russian soil, but the members of which were chiefly Germans, in 1725; the Academy of Mannheim in 1755; and that of Munich in 1760.

The scientific life of this period brought forth rich fruit in England and the Netherlands. Italy too saw the ripening of some late harvests, which called to mind the best periods of that country's great past. The splendid Court of LOUIS XIV. threw upon France broad beams of light which rendered conspicuous a surprising quantity of talent and energy combined with much inward unsoundness. During the 18th and far into the 19th century, the French people stood at the head of intellectual progress; the learned men and investigators of France not only worked strictly as pioneers in the advance of science, but they also widened its boundaries and increased its subject-matter in various ways. Germany was checked in political and intellectual development by the miserable religious war, which laid the land waste during 30 years, and did not until two centuries later enjoy an assured peace for the full exercise of her power.

At the end of the 16th century, the academies and educational establishments in the different countries were sufficient in number, as a general rule, to satisfy existing requirements. In England the ancient universities of Oxford and Cambridge formed the most important centres for the higher studies. France centralized scientific study more and more in Paris. Holland acquired new academies at Gröningen (1614), Utrecht (1634) and Harderwyk (1648). In Italy universities arose at Parma, Cagliari, Mantua, Urbino, Piacenza, Sassari, and Milan, some of which, indeed, owed their origin merely to the petty jealousies of

* CH. R. WELD: History of the Royal Society, London 1848, 2 Vols.

these towns and their rulers. In 1608 a university was founded at Pamplona, which, nevertheless, remained as unknown as the other institutions of this kind in Spain. Establishments of a kindred nature, which were founded in Eastern Europe, like those at Tyrnau, in Hungary, afterwards removed to Pesth, at Klausenburg, in Transylvania, and at Kiew and Moscow, did not acquire any particular notoriety. An academy for Finland was created in 1640, at Abo, which was moved to Helsingfors in 1828; and Sweden acquired a second university at Lund, in 1668.

The number of academies which during this period arose in Germany was inordinately great. In part they were called into existence not by any want felt for an academical education, but merely through the vanity of the minor territorial lords, who in the foundation of an academy saw a not too costly method of advertising their sovereignty and of hearing themselves extolled in speeches and poems as patrons of the sciences. When the gymnasium at Herborn in Nassau was, in 1652, raised into a university it cost the territorial princes much trouble to find the fee of 4,100fl. required to pay for the grant of the Imperial privileges. The town of Rinteln, when in 1621 it was made the seat of a university, possessed neither an apothecary's shop nor an inn.* The partition of the Hessian countries among various branches of the dynasty led in 1607 to the foundation of the academy at Giessen; but from 1625 to 1650 it was again united with the neighbouring sister institution of Marburg.

The University of Strassburg arose out of the academical gymnasium there, at which, among other branches of scientific instruction, medicine found a place; in 1566 and 1621 this university received the Imperial sanction. In 1602 there were at it 70 students of theology, 77 of law, 11 of medicine, and 145 of philosophy.† Afterwards this seat of learning was less frequented, the number on a

* A. Tholuck: Das akademische Leben des 17. Jahrhunderts, Halle 1854, Bd. i, Abth. 2, S. 96, 303.

† *Id.* i, 2, 122.

yearly average amounting to little more than four students in all the faculties put together; not till 1718 did it once more raise itself from this depressed condition, when under the French rule political circumstances assumed a peaceful aspect.* The University of Altdorf arose in a similar manner in 1622 in the district of the imperial free-town of Nürnberg.† The gymnasium at Bremen also resembled an academy; and a professorship of medicine was founded there in 1610. A similar character was borne by the higher educational establishments at Steinfurt and at Neustadt on the Haardt, that at the former of these towns being intended for the Grafschaft of Bentheim-Tecklenburg, and that at the latter for the Palatinate. Those at Hanau and Lingen also resembled universities. At Duisberg a university arose in 1655 and one at Kiel in 1665. The academy at Dorpat owed its foundation in 1632 to King GUSTAVUS ADOLPHUS, of Sweden; but it existed only a few decades and did not awake to renewed life until 1802.

The system of higher education in the Catholic states of Germany came by degrees completely into the hands of the Jesuits. Several new institutions, founded at the instance of this Order, were, even if they received the rights of a university, essentially only spiritual seminaries. Thus there arose at Molsheim, in Elsass (Alsace), a Jesuitical gymnasium which, in 1617, was raised by the Pope into a university: this in 1702 was transferred to Strassburg and united with the high school at that place. At the same time the cathedral school at Paderborn acquired the character of a university; the same happened to the cathedral school at Osnabrück. The academy founded in 1647 at Bamberg gradually developed in like manner into a complete university. In 1734 the Jesuitical gymnasium at Fulda was also raised into a university, while the cathedral school at Münster did not attain this dignity until 1780.

* F. WIEGER: Geschichte der Medicin in Strassburg, 1885, S. 71.

† G. A. WILLIS: Geschichte und Beschreibung der Universität Altdorf, Altdorf 1795.

To these were added numerous academies in the countries belonging to the reigning house of Hapsburg. At Salzburg, learned Benedictines founded an establishment for the higher teaching, which in 1623 was raised into a university by the Pope. A like honour was granted to the Jesuitical gymnasium at Innsbruck, in 1673. So too at Breslau the Jesuitical college developed, little by little, into a university and in 1702 was recognized as such. The establishment at Brünn acquired in 1779 for the first time the privileges of a university, the high school at Olmütz being removed thither and united with it. But only a few years afterwards it lost this character again and was changed into a lyceum, which later on was associated with an establishment for teaching medicine and surgery and had its seat in Olmütz.*

The universities of Halle and Göttingen exerted an important influence on the development of the scientific spirit. The former was founded in 1694, after the Archbishopric of Magdeburg with the lands belonging to it had come into the possession of Brandenburg. The Great Elector had already occupied himself with the formation of a kind of academy which should form a centre for all things worthy of study; he contemplated providing it with a chemical laboratory, a physical and technological establishment, a zoological and botanical garden, workshops, museums, etc., and decreed that it should be accessible to all desirous of learning, without distinction of nationality or religious belief.† But the time was not ripe, nor was money forthcoming for the completion of a plan of this magnitude and so much in advance of the rationalistic mode of thought of the 18th century. The financial means of the university of Halle were also somewhat limited: its yearly income up to 1786 reached no more than 7,000 thalers, with which it was necessary to meet the salaries of all the teachers, and

* F. J. Richter: Geschichte der Olmützer Universität, Olmütz 1841.

† Erman and Reclam: Mém. p. servir à l'histoire des refugiés françois, T. iii, p. 293 *et seq.*, Berlin.

generally speaking, all the expenses of the academy. In vain did the professors request that the income of the estates formerly belonging to the cathedrals of Magdeburg and Halberstadt should be assigned to them.* It was owing to the ability of its teachers, amongst whom were the jurists STRYX and THOMASIUS, the theologian FRANCKE, the philologist CELLARIUS, and the doctors STAHL and F. HOFFMANN, that the university of Halle maintained for a long time the first position among the German academies. It did not begin to recede from this position until the Hanoverian Government in 1734 founded a university in Göttingen, for the maintenance of which a yearly sum of 16,000 thalers was voted. In the appointments to professorships and in the regulation of studies there prevailed now a freer spirit which strove to accommodate itself in every way to the demands of the time. More respect was paid to the natural sciences here than in other academies. WERLHOF, who was commissioned to furnish a preliminary report upon the proposed foundation of the medical faculty, gave his judgment upon the subject on the 16th December, 1733, and proposed that professorships in anatomy, botany, chemistry with materia medica, and the theory and practice of medicine, should be established, that a botanical garden should be laid out, a chemical laboratory constructed, and that a hospital should be built and used for the purpose of teaching students of medicine.† Smaller universities arose in the 18th century at Erlangen (1743), at Bützow in Mecklenburg (1760), at Stuttgart (1781) and at Bonn (1784), that at Stuttgart having grown out of the Karlsschule, and that at Bonn having developed into an academy, from being a Jesuitical gymnasium, but existing in its new form hardly one year.

* J. C. FÖRSTER: Geschichte der Universität Halle in ihrem ersten Jahrhundert, Halle 1799.

† E. F. RÖSSLER: Die Gründung der Universität Göttingen, Göttingen 1855.

Germany, with a population which scarcely reached half that of the present day possessed about twice the number of academies she does now. Even from this fact we may see that universities at that time differed in many respects from those of to-day. They did not subserve so exclusively the preparation for a particular calling in life as they do now, but often only offered a completion of the general education: and they were contented with a much smaller attendance of students, since the cost of maintenance was also much smaller than it is now. In Vienna there were only 25 medical students in the year 1723, in Göttingen from 50 to 80 during the period between the years 1767-78. Jena, in 1768, numbered 17, and in 1773, 42 students of medicine. In Altdorf no more than 386 medical students graduated between 1623-1794. In Würzburg about the middle of last century medical studies were in an extremely depressed condition. The Russian Court Doctor, M. A. WEIKARD, says in his autobiography (Berlin and Stettin, 1784): "When I began to study medicine in Würzburg with C. C. SIEBOLD and SENFFT in the year 1761, there had been no pupils for several years past and consequently no lectures had been given. A year before two had entered and afterwards the number was increased to nine. The teachers, who received only 200-300 gulden, naturally treated their office as a secondary matter, and were, moreover, unaccustomed to scholastic affairs; indeed we had to complain several times to the Rector Magnificus before we could bring them all to deliver lectures again. They had to be forced thereto by admonitions and serious threats. In spite of this they showed the extremest thrift in their utterances: frequently they remained silent for a whole quarter of a year; and yet for all that the loss was not great."* The attendance at some foreign academies was greater. ALEXANDER MUNRO, during the 50 years that he taught at Edinburgh, had 14,000 pupils: the average number of medical students present

* KÖLLIKER *op. cit.* S. 21.

there during the second half of the 18th century was 400 at a time. At Leyden in the year 1709 the number was about 300. In Padua, when in 1613 not more than 1,400 students matriculated, it was considered a bad year. Pavia, in 1782, among 2,000 students numbered 200 medical.* The arrangements of the German medical faculties were of a less complete and more meagre description than those of Holland, Italy, and France. On this account many students of medicine betook themselves to these countries from Germany, in order to complete their professional education. Especially the universities of Leyden, Padua, † Montpellier, and Paris acquired a great reputation in this respect and were much frequented.

It came about by degrees that France developed into the chief centre of polite learning and education, such being unfortunately much neglected at the German universities. These, in the 16th century, had fulfilled their task and had afforded as much instruction as at that time was looked upon as indispensable for a general education of the higher class. When, however, among the upper classes a knowledge of the Latin and Greek tongues ceased to be the principal object, and the discoveries and progress in the natural sciences pressed other ideas into the foreground, the curriculum of the German universities no longer satisfied requirements and people sought in foreign lands what they could not get at home.‡ In this manner there arose differences between these two systems of education—that for the learned professions, and that in polite literature—which has, in some degree, endured up to our own time. The universities were on their guard against accepting new subjects of education, and, on the other hand, men of

* G. Fischer: Chirurgie vor 100 Jahren, Leipzig 1876, S. 77.

† See the list of the names of the students who matriculated there in "Dell' università di Padova," Padua 1841.

‡ Biedermann (Deutschland im 18 Jahrhundert, Leipzig 1858, ii, 1, S. 18) says: "Most (of the German universities) had degenerated into exercising grounds for the exponents of the narrow views of orthodoxy, pedantic book-learning, and scholastic subtlety."

mark in the political, military, artistic, manufacturing, and industrial walks of life, who by their residence abroad had acquired a wider outlook, laughed at the narrow views of the bookworms who sometimes cut a pitiful figure in consequence of the awkwardness of their manners.

A wild and a rough life prevailed at the German universities of that time. "At our German high schools," writes the doctor LOTICHIUS in 1631, "the attention of the students is devoted, not to books, but to quarrels; not to literary compositions, but to daggers; not to the pen, but to the sword and plume; to bloody feuds instead of to learned discussion; to drinking and riot instead of to assiduous work; to the tavern and the brothel rather than to the study and library."* The fagging of freshmen, a custom which by usage came to be a regular practice, led to terrible excesses, to cruelty and even to crime. The students indulged also in many acts of insolence towards the townsmen.† The senate of the University of Leipzig found themselves compelled, in 1625, to forbid the students "to disturb weddings, to strike strangers, to insult ladies and young women by obscene remarks, or to trip them up."‡ At Jena, in the year 1660, the students gave actual battle to the police, in which conflict many were killed. Similar excesses also occurred at Ingolstadt.

But it was not surprising if such things *did* occur among the students; for the tone which prevailed among the professors was at times not much better. In 1663 a professor was punished by the Rector with imprisonment because he had cudgelled his father-in-law.§ The University of Helmstädt was admonished by the reigning prince not to bring forward as candidates, at the appointment of professors, any "who were given to drinking." ‖ Of the University

* Oratio de fatalibus academiarum in Germania periculis in acad. Rintel. rec. 1631, p. 67 according to MEINERS: Gesch. d. hohen Schulen.

† THOLUCK *op. cit.* i, 1, 264 *et seq.*

‡ GEBHARDT in ZWIEDINECK-SÜDENHORST'S Zeitschr., 1887, iv, 955.

§ PRANTL *op. cit.* i, 500, 503.

‖ THOLUCK *op. cit.* i, 1, 142.

of Herborn STEUBING states: "Not only was the high school completely split up into factions, but, besides this, one professor was opposed to another. They not only taunted one another whenever they could in their lectures, but even carried on their feuds in the presence of the governing body."* Relations of this kind existed even a century later; when in 1760 a professor complained to the senate of the University of Ingolstadt that he had been insulted by the medical faculty, the latter declared: "that they certainly did consider him—the plaintiff—a low fellow, on account of his mean practices, but that they had no recollection whatever of having at any time called him so, officially."†

It was to be expected that a reaction would set in against this growing barbarism in manners and social intercourse. The University of Göttingen took the initiative in recommending its students to adopt polite behaviour. The manners of the French, which had everywhere been adopted at the courts of princes, were taken as a pattern. That which the students belonging to the higher circles learned to value soon found favour with the rest. And thus among a proportion of the students of Germany the praiseworthy endeavour was made to grace social life by pleasing formalities. Those possessing the rudeness of manners which were displayed at many high schools, chiefly of the smaller class, regarded this innovation with scorn, characterizing it as foppery and an unpatriotic aping of foreign usages. Even grave historians have shared this view, and have attached too little importance to the fact that a reform in this direction was required. The German race, without a doubt, owes very much to the circumstance that it has always been intent upon improving its deficiencies and learning alike from friends and from foes.

In the beginning of the 17th century the general education of students embraced the Latin, Greek, and Hebrew languages, arithmetic with some mathematics, Church

* THOLUCK *op. cit.* i, 1, 140. † PRANTL *op. cit.*, i, 606.

history, and the study of ancient authors, which afforded opportunity of giving some information upon subjects connected with history, geography, and the natural sciences. Gradually, however, more scope was given to the last-mentioned subjects. As early as at the conclusion of that century we find appearing as regular subjects of instruction in the curriculum of the gymnasia intended for the sons of noblemen, the French and English languages, sometimes even Italian and Spanish, history, geography, physics, and the natural sciences, with dancing, fencing, and riding. These sciences and arts were designated by the epithet "gallant;" just as people were fond of employing the same expression in other connections as equivalent to "knightly" or "reserved for the upper classes." LEIBNITZ, SECKENDORFF, THOMASIUS, and other unprejudiced men energetically demanded that practical science should receive more attention. But the mother tongue was neglected even more than this in the German schools. In Pomerania the teachers at the Latin schools were enjoined in 1690 always to speak Latin to their pupils and never German, because the latter language was unstable, troublesome, and inconvenient.* The schoolmaster FRANCKE of Halle complained, in 1709, that there was seldom to be found a student capable of writing a German letter without mistakes in spelling. Here too was a reform urgently demanded.

The modernizing of the schools of learning began in the 18th century, and was accomplished at the expense of the studies in the ancient languages, which were advantageously cut down in the curriculum. Some philologists, somewhat crazed on the subject, lamented this course, it is true, and prophesied for Germany a return "to the barbarism of the middle ages;" a prophecy not fulfilled however unless, as PAULSEN wittily remarks, we look upon the appearance of LESSING and KLOPSTOCK as a retrogression in culture.†

* THOLUCK *op. cit.* i, 1, 173. BIEDERMANN *op. cit.* ii, 1, 511.

† PAULSEN *op. cit.* S. 378.

MEDICAL TEACHING IN THE THEORETICAL DEPARTMENTS AND IN ANATOMY, BOTANY, CHEMISTRY, AND MATERIA MEDICA.

THE universities changed but little during the 17th century in the organization and management of teaching. Even in the medical faculties theoretical lectures formed the principal method pursued, although the importance of practical demonstrations was more recognized than before. In the list of lectures of the University of Würzburg for 1604 the following were announced in connection with the medical faculty:—1. HERM. BIRKMAN lectures on the three treatises of HIPPOKRATES upon Prognostics. 2. JOH. STENGEL treats of the diseases of the breast and certain other organs. 3. GEORG LEYER deals with the diagnosis and causes of diseases and their symptoms according to GALEN.* The professors treated their subjects more after the literary and historical method of the schools than in the spirit of the inductive experimentalism of later times.

It was only in the 18th century that there gradually came about a strict division of professorships according to the different subjects taught. This became necessary in proportion as the development of practical teaching in medicine demanded an increased amount of special knowledge in the subjects dealt with. While, heretofore, the professors had been able to exchange their chairs among themselves without injury to their teaching, inasmuch as the condition of science permitted of a similar degree of training in all the subjects, from this time forth each confined himself to a special department, and was thus able to make himself a master of that particular branch. Nevertheless, the smallness of the number of regular professorships, rendered possible by the inferior scientific requirements of the time and demanded by the

* F. v. WEGELE: Geschichte der Universität Würzburg, Würzburg 1885, ii, 226.

poor financial condition of the universities, brought about the result that, nearly everywhere, several subjects were represented at the same time by one professor. Thus, at most academies, the teaching of botany and chemistry was united with that of *materia medica;* in the same way anatomy was joined to surgery, physiology to anatomy, or to general pathology. To such a length was this combining of subjects carried that professors of another faculty—that of philosophy for example—held lectures upon particular branches of medical science just as, on the other hand, it not unfrequently happened that doctors ventured to teach sciences far removed from their proper sphere. H. CONRING not only taught medicine in Helmstädt, but philosophy and politics as well, and was, as O. STOBBE says, "the founder of the history of German law." MEIBOM lectured upon history and the art of poetry, as well as upon medicine, and JOHANN HEINRICH SCHULTZE, besides being professor of medicine at Altdorf, held the chair of Greek also, and in Halle, to which town he afterwards removed, that of elocution and archæology.

The universities of that time resembled, in this respect, our gymnasia of to-day, at which, sometimes, a teacher of mathematics takes over a part of the lectures of the teacher of philosophy, and *vice versâ*. It was at that time not required of an academical teacher that he should have advanced by any work of his own the science upon which he lectured. Patronage, relationship, personal preferences, and accidental circumstances of all kinds were often the causes which led to the conferring of a professorship. The stipends, for the rest, were sometimes so insignificant that there were hardly any candidates. At the small academies they had to be contented, if one of the doctors in the neighbourhood declared himself willing to undertake a professorship in the medical faculty, which, however, he perhaps relinquished as soon as the prospect of a lucrative practice in a larger town was opened to him. It was usual at the German universities for the teacher to make a treatise or

text-book dealing with his subject the foundation of his lectures. He generally added remarks of his own to supplement its contents. The Latin tongue, which the teacher was obliged to use, was not calculated to allow the pupils to arrive at a comprehensive and profound understanding of the subject; it led to misapprehensions, and to the habitual use of meaningless phrases, behind which a pretentious superficiality sought to hide itself.

It may be easily conjectured that all this must have led to the worst results in the education of the doctor. Lectures, without the help of a book, were seldom given, at least at the German universities, for such pre-supposed that the teacher was a thorough master of his subject, and also that he possessed an extraordinary command of the Latin tongue. Not until the 19th century was the custom of using Latin, pressing heavily and uselessly as it did upon teachers and taught alike, at length abolished. The injury inflicted by it upon the students, the patients, medical science generally, and upon the development of German culture constitutes a crime which can never be expiated.

Practical instruction in medical science lay, as has been said, at first outside the University curriculum. It came, however, to be by degrees included; this happened first with anatomy, last with clinical teaching. The progress made by anatomical teaching during this period consisted in the increase of material for study, and the more complete use made of the same, the foundation of anatomical collections, the establishment of separate professorships and schools for this speciality, and the participation of students in actual dissection. The scarcity of human subjects, it is true, rendered it necessary that bodies of the lower animals, as was usual at an earlier period, should frequently be made use of for anatomical study: yet this circumstance was attended with many advantages to anatomical training, and led to the observation of numerous facts in zootomy, and comparative anatomy. Although the number of human subjects at the disposal of the schools of anatomy was

small, we must recollect that the number of students also was not large, so that the individual student could clearly see and note everything. Yet many difficulties were thrown in the way of anatomical teaching by the neglect of the authorities to supply the necessary bodies, by the tedious prolixities and time-killing scribblings of stupid officials, which were connected with this matter,* and, above all, by the prejudices prevailing among the people. In the circles of the well-to-do classes these prejudices were certainly less pronounced; but gave place to a scientific inquisitiveness with which a kind of cultivated sensuality was not unfrequently associated. The dissections were looked upon as racy exhibitions, and spectators crowded to see them; the height of the dramatic situation was reached when the sexual organs were demonstrated, and for this part of the performance a higher entrance-fee was demanded. When the reigning Duke of Würtemburg received in 1604 the visit of three Saxon princes, to provide them with an entertainment he took them to Tübingen, where they assisted at the dissection of a human subject which lasted for eight days.† The anatomist WERNER ROLFINK of Jena was appointed to the Court at Weimar, where, in the presence of princes and distinguished personages, he had to perform a dissection; this formed, as it were, one of the amusements with which the Duke provided his guests.‡

In France it was the fashion to take an interest in science; even ladies of high position were not ashamed to divert themselves at anatomical dissections.

The populace had a different view in this matter. Amongst them was still preserved that kindly pious superstition which regarded a dissection of the human body as a crime committed against it. To this was added the fable which took its origin from remote times, that anatomists,

* PRANTL *op. cit.* i, 496.

† J. SÄXINGER: Über die Entwickelung des medicin. Unterrichts an der Tübinger Hochschule, 1883.

‡ G. W. WEDEL: Oratio funebr. Rolfincio dicta, Jena 1675.

when they had no dead bodies, made use of living men in their investigations. The ill-feeling thus engendered was still more increased by the illegal way in which bodies often came into the possession of the schools of anatomy. In Jena criminals condemned to death used to entreat the favour, before they were given over to the hangman, that their bodies should not be delivered to Professor ROLFINK; and the country-folk in the district around Jena had the graves of their friends watched in order to prevent their bodies being "rolfinked." J. BECHER had to flee from Würzburg in 1661, because he had dissected the body of a woman who had been executed.* In Berlin and Lyons the anatomical schools were stormed by the excited populace, and the anatomists were roughly handled.† Similar causes led to the destruction of the dissecting-room at Edinburgh by the mob in 1725.‡ Even at the present day this prejudice has hardly disappeared. A few years ago the beneficed clergy of Vienna proffered a request to the magistrates that their corpses should not be dissected.

Fortunately people were not everywhere so narrow-minded. VIEUSSENS had the opportunity at Montpellier of dissecting over 500 bodies. LIEUTAUD could rely upon 1,200 reports of dissections. HALLER states that while he was teaching in Göttingen (1736-1753) he performed about 350 dissections; the dissecting-room there which was under his charge received annually from 30 to 40 subjects.§ The same favourable conditions obtained at Strassburg; in the winter of 1725 thirty bodies, and in that of 1760 as many as sixty bodies were dissected at the anatomical department there.‖ At Paris, Leyden, and some Italian academies the greatest possible desire was shown to provide the anatomical schools with the necessary material of study. ALBERTINI

* KÖLLIKER *op. cit.* S. 11.

† J. P. FRANK: System der medicinishen Polizei, Wien 1817, vi, 2, S. 60 Anm.

‡ A. GRANT: The Story of the University of Edinburgh, London 1884.

§ A. VALENTIN in the Memoir on A. v. HALLER, Bern 1877, S. 72.

‖ WIEGER *op. cit.* S. 82.

of Bologna stated that, even in families of good position, permission was readily granted him to perform a dissection where it was a question of determining the cause of a disease. In other places the neglect of anatomical demonstration was caused not so much by a scarcity of bodies as by the idleness and ignorance of the professors. In Prague during a space of 22 years (1690-1712) only three dissections were performed.* In Vienna during the year 1741 not one single *actus anatomicus* took place; when the departmental professor was blamed by the Government for this, amongst other excuses he put forward that of not being supported by a prosector.† The medical faculty of Ingolstadt even proposed in 1753 to abolish the professorship of anatomy, considering that it would be best to begin to learn this science after the completion of medical study, while engaged in the practice of the profession.‡ But arrangements were made in most of the German states in the 18th century to remedy this constant lack of subjects which pressed heavily upon the schools of anatomy. In 1716 the electoral government of Saxony decreed that the corpses of all criminals condemned to death in the district of Leipzig should at the request of the medical faculty be handed over to the dissecting-room without delay. The requirements of the anatomical school at Wittenburg were cared for in the same way. A regulation was made in 1723 that the bodies also of persons who had been drowned or found dead from any cause—so long as it was not a question of the "honoratiores"—or of suicides or of criminals who died in prison should be made use of for the purposes of anatomy; it was further arranged that the poor people, who were cared for at the public expense in the infirmaries, should, in the event of their death in such institutions and of their friends not being able to afford the expense of burying them, be delivered over to the medical

* Hyrtl: Geschichte der Anatomie in Prag, 1841, S. 26.

† Rosas *op. cit.* ii, 256.

‡ Prantl *op. cit.* i, 607.

faculties, "but only to be opened for the demonstration of the viscera, not for complete dissection."* The Prussian Government also issued orders calculated to provide against a failure of the material needful for anatomical study. The dissecting-room at Göttingen received the bodies of prostitutes and of illegitimate children. In Vienna, after 1749, the hospitals had to provide bodies for anatomical investigation and demonstration, when no executions took place.† M. STOLL thought that the material for study would be much increased if the corpses of bankrupts were also assigned to this use. The anatomical school at Abo, in Finland, was even allowed to claim the bodies of all those who had received support from the State.

It was during this period that the first special buildings were erected for anatomical dissection. HAZON has left a description of the anatomical theatre which was built in Paris in the year 1604. The construction of this was effected within a fortnight: it was very small and by no means solidly built. Only a short time afterwards another was erected in its place, of larger size and better suited to the purpose, but which, nevertheless, was also exceedingly inadequate. It had, for instance, no window but only an air-hole, as HAZON, who attended lectures there as a student in 1730, informs us, and was consequently exposed to the cold and wind. At the suggestion and under the direction of WINSLOW, the Paris school of anatomy in 1744 became possessed of a building of free-stone provided with glass windows. The institution for anatomical teaching at Leyden was provided with skeletons of men and of various kinds of beasts and was roomily arranged.‡ The guild of surgeons at Edinburgh founded an anatomical theatre in 1697, in which demonstrations were given, and in 1705

* J. P. FRANK *op. cit.* vi, 2, S. 73 *et seq.*

† J. D. JOHN: Lexikon der k. k. Medicinalgesetze, Prag 1798, vi, 712 *et seq.*

‡ ALB. KYPER: Medicinam rite discendi et exercendi methodus, Lugd. Batav. 1643, p. 112.

created a professorship of anatomy. At Würzburg an anatomical theatre was established in 1724; it was a domed building with sky-lights and had water laid on; the cost of it was 10,000fl. In the Parnassus Boicus (München, 1725, p. 310) mention is made of it thus: "No expense is being spared in the improvement of the *studium anatomicum et chirurgicum,* and a famous surgeon has been summoned thither from Paris—Monsieur SIVERT by name—at a high salary (namely 400 reichsthaler); his duties being to demonstrate the art of surgical manipulation in a skilful manner, and to teach anatomy or the dissection of the human body, for which purpose corpses are provided him out of the splendid hospital: thus he has not long ago completed an examination of a woman who died insane." In 1788, the anatomical institute at Würzburg was enlarged, two rooms being built, adjoining the amphitheatre, to deposit the anatomical collection in; to these were added a hall used by the students in which to practise dissecting, a room in which the Professor worked, and a kitchen.* The University of Breslau was furnished with an anatomical theatre in 1745, and that of Königsberg in 1738; in the latter case thanks to the Professor of Anatomy of the day who had it built at his private expense.† The anatomical theatre at Pavia accommodated 400 spectators, was well lighted and adorned with the portraits of celebrated anatomists. In the hall adjoining it, which was paved with broad squares of stone, and was provided with a fireplace, large boilers, and a constant stream of pure water, the students practised dissecting.‡ Establishments of this kind were also founded in towns which possessed no universities, such as Berlin, Bremen, Frankfort-on-the-Main, Nürnberg and others, and were given up to the use of the doctors and surgeons. At many places a shed or some other place of which no use was otherwise made,

* KÖLLIKER *op. cit.* S. 25, 75, 78.

† D. H. ARNOLDT *op. cit.*—FRANK *op. cit.* vi, 2, S. 88.

‡ J. P. FRANK *op. cit.* vi, 1, S. 327.

was assigned for anatomical dissections and demonstrations.

In addition to these schools of anatomy, there arose anatomical museums which were soon recognized as forming valuable aids to medical teaching. F RUYSCH made a collection of anatomical preparations which he sold in 1717 to PETER THE GREAT at the enormous price of 30,000 florins. Within ten years he succeeded in making a new collection the greater part of which became the property of King JOHN SOBIESKI who paid 20,000 florins for it. JOHN HUNTER'S famous museum consisted of 14,000 anatomical preparations; at his death it was bought by the English Government for £15,000 and was presented to the Royal College of Surgeons in whose possession it remains to this day. J. N. LIEBERKÜHN'S injected preparations acquired a great reputation, as did J. G. WALTER'S anatomical collection, the fruit of 54 years' assiduous labour; the latter consisted of 2,868 numbered specimens, was acquired in the year 1803 by the Prussian Government for 100,000 thalers, and formed the foundation of the museum of human and comparative anatomy at the Berlin University. Imitations of anatomical preparations were also executed in wax by skilled artists and served for medical teaching. Some Italians attained to astonishing ability in making models of this kind. The Emperor JOSEPH II. bought up a celebrated collection of preparations in wax, which had been made in Florence under FONTANA'S direction, for 30,000 fl.: he had them brought to Vienna and handed over, for purposes of teaching, to the Military Medical Academy. But P. FRANKS early drew attention to the fact that these wax-models are not so suitable for teaching anatomy to students of medicine as they are for giving a general superficial knowledge of the human body and its different parts to laymen, who always have an invincible horror of corpses.

Another important aid to instruction was found in the anatomical plates and drawings which were either separate,

or bound up with text-books of anatomy. J. REMMELIN resumed the method, which was formerly practised, of showing the muscular layers and the viscera by means of pictures pasted and superimposed on one another ;* a similar practice was adopted by CLOPTON HAVERS. We owe some excellent anatomical plates, especially on the distribution of the nerves, to the painter PIETRO DA CORTONA ; the vignette on the title-page of the edition of 1741 represents the transfusion of blood. GERARD DE LAIRESSE made the drawings for the anatomical text-book of G. BIDLOO. The following were intended chiefly for artists ;—the anatomical work of B. GENGA with the drawings of C. ERRARDS ; the *Anatomia dei pittori* of CARLO CESIO, which appeared also in a German translation ; the representation of the muscles of the body, designed by MARTINEZ the Spanish anatomist and painter, and remarkable for its faultless proportions ; the plates of ERCOLE LELLI ; and others. The copper plates too, which adorned the anatomical writings of W CHESELDEN and D. SANTORINI were conspicuous for their high artistic value : the latter were held by MORGAGNI to be of supreme merit. The introduction of coloured drawings of anatomical subjects constituted a further advance ; by this method the arteries, veins, nerves and different organs could be more sharply distinguished. This method was first employed in the wood-cuts with which C. ASELLI enriched his work upon the lacteal vessels. In the beginning of the 18th century J. C. LE BLON, the miniature-painter, made the first attempt to produce coloured etchings ; in 1721 he published the first sheet illustrative of anatomy which had been prepared by this method. But the new invention of tinted copper engraving became more widely known and was made use of for anatomical representation first by JAN LADMIRAL, who provided several treatises of the anatomists B. S. ALBINUS and F. RUYSCH with illustrations by this process, and by J. F. GAUTIER D'AGOTY who made use chiefly of the anatomical preparations of

* CHOULANT : Geschichte der anat. Abbildung, Leipzig 1852, S. 39, 82 *et seq.*

DUVERNEY as copies. ALBINUS left a thorough description of the way of producing anatomical pictures, giving valuable advice as to the mistakes to be avoided and the rules to be observed.* He spent out of his own resources, as he tells us himself, the sum of 24,000 gulden in the preparation of anatomical plates.† JAN WANDELAER was associated with him as designer. HALLER also, who made a collection of anatomical drawings, and W. HUNTER, whom his contemporaries had to thank for the best representation of the gravid uterus, were supported by skilful artists. Finally PIETER CAMPER who understood how to handle his pencil as skilfully as his dissecting scalpel, supplied valuable information upon the dimensions of the cranium, and drew attention to the importance of the facial angle (named after him "CAMPER'S facial angle") in estimating the intellectual endowments of the races of man.

We possess clear evidence of the manner in which anatomical instruction was imparted in numerous pictures of the Dutch school, which represent distinguished doctors of that period in the act of holding discussions upon anatomical or surgical questions surrounded by their pupils or colleagues. REMBRANDT'S celebrated painting, "The Lesson in Anatomy," which forms one of the most important works of this great master, shows the Amsterdam anatomist NICHOLAUS TULP, who at that time filled the office of burgomaster, in the act of demonstrating a human subject to his medical colleagues; this picture is now in the Royal Gallery at the Hague and has become very well known by copper engravings. In another picture REMBRANDT has represented Dr. DEYMANN, TULP'S successor as teacher, preparing a brain after removal of the cranial vault. Similar pictures are preserved in Amsterdam and other places in Holland;

* B. S. ALBINUS: Acad. annotat., Lugd. Bat. 1754, lib. i, Praef. p. 7 *et seq.*, lib. viii, p. 30, 50.

† ALBINUS *op. cit.*, lib. iii, p. 73.

among them are found works of AART PIETERSEN, T. DE KEYSER, MICHAEL VAN MIEREVELD, ADRIAN BACKER, C. TROOST and T. REGTERS. They were mostly intended for the Surgeon's Guild at Amsterdam.* To us they offer a series of important lessons upon the history of medical teaching and upon the social position which doctors, at that period, occupied in the Netherlands.

Anatomical teaching was no longer limited as formerly to demonstrating the organs of the large cavities of the body, but a detailed examination was given as well to the muscles, vessels, and nerves. The students were also urged to participate in anatomical work themselves. HALLER when a student at Leyden had the opportunity of dissecting three corpses under the guidance of his teacher ALBINUS.† Arrangements were made at the College of St. Côme at Paris, in 1750, for the students to practise anatomical dissections.‡ At Vienna, the talented JOSEF BARTH introduced the practice of the students performing their own dissections. STOLL and P. FRANK explained the necessity of future doctors themselves taking an active part in dissecting.§ At most universities the anatomists had also the additional duty of demonstrating and explaining the pathological changes as seen in the dead body. WERLHOF expressly demanded that this should be done, in the opinion he gave concerning the arrangements of the medical faculty of Göttingen. This circumstance is moreover rendered evident by the fact that the representative anatomists of that period, such as LANCISI, VALSALVA, MORGAGNI, LIEUTAND, PORTAL, SANDIFORT, J. HUNTER, HALLER and others, laid also the foundations of pathological anatomy. Already collections of specimens illustra-

* J. B. TILANUS: Beschrijving der Schilderijen afkomstig van het Chirurgijnsgild te Amsterdam, Amsterdam 1865.—P. TRIAIRE: Les leçons d'anatomie et les peintres Hollandais, Paris 1887.

† VALENTIN *op. cit.* S. 68.

‡ P. FRANK *op. cit.* vi, 2 Abth., S. 331, Anm.

§ FRANK *op. cit.* vi, 2, S. 87.

tive of pathological anatomy were in process of formation. Even in the 17th century G. RIVA preserved at Rome a number of specimens which had come into his possession while doctor at the hospital. And afterwards this was more generally done. SÖMMERING possessed a rich pathological collection, which at the suggestion of BRAMBILLA was secured for the Josefinum (Academy of Medicine) at Vienna at the price of 400 ducats.*

Botanical gardens in which medicinal plants were cultivated and the apothecaries' shops gave opportunities for instruction in materia medica. The "Jardin des Plantes" in Paris was laid out in 1626 at the instigation of the Royal physician-in-ordinary LABROSSE. A decree of King LOUIS XIII. set forth at the same time "that in view of the fact that pharmaceutical operations are not taught at the medical schools, three doctors be chosen from the Faculty of Paris in order to demonstrate to the students the intimate character of plants and of all drugs, and to show the mode of preparation of every kind of medicine according to the simple chemical method, and specimens of all the different medicines and of the rarer natural objects of all kinds be exhibited in a room."† A yearly sum of 21,000 livres was devoted to the maintenance of this institution. Investigators of nature, like TOURNEFORT, the two JUSSIEUS, DUFAY, DAUBENTON, and above all BUFFON, who worked there, made the botanical garden of Paris famous throughout Europe. In the course of the 17th and 18th centuries most universities were provided with botanical gardens. That at Chelsea, presented, in 1686, by Sir HANS SLOANE to the Society of Apothecaries of London, was especially remarkable for its rich collection of officinal plants. Botanical gardens arose also in the first half of the 17th century at Amsterdam, Utrecht, Copenhagen, and Upsala; and at Oxford in 1632,

* RUD. WAGNER: Soemmerings Leben, Leipzig 1844, ii, 89.

† ESQUIROS und WEIL: Die wissenschaftlichen Institute zu Paris, Stuttgart 1850, i, S. 28.

Edinburgh (1680), Cambridge (1702), Harderwyk (1709), St. Petersburg (1725).

In Germany the following universities had botanical gardens attached to them at the dates indicated:—Giessen (1609), Altdorf (1626), Jena (1629), Helmstädt (1634), Kiel (1669), Halle, Tübingen (1675), Würzburg (1695), Wittenburg (1711), Ingoldstadt (1723), Göttingen (1737), Frankfort-on-the-Oder (1744), Vienna (1749), Greifswald (1765), Prague(1776), and Salzburg, Marburg and Rostock.

Collections of dried plants were also used to some extent for the purposes of instruction in botany, as were atlases of botanical paintings, many of which were surprisingly true to nature.* With the same object in view the students with their teachers undertook excursions together, which were called "herbations." Just as in botanical, so also in chemical teaching, especial regard was had to pharmacy, theoretical and practical. There were already at that time, in several universities, professorships of chemistry, and chemical laboratories in which the art of compounding pharmaceutical preparations could be learnt. The attitude of the senate of Innsbruck University, which in 1740 declined to form professorships for botany and chemistry, was certainly exceptional; this demeanour the senate assumed because they considered that a thorough botanical training required ten years, "for in this inquisitive age some new thing in vegetables is perpetually coming to light," while on the other hand a professorship of chemistry was too expensive.†

The apothecaries' shops afforded the best opportunity for instruction in chemistry; the interior arrangements of these places have been made generally known by H. PETERS, who in his book has published pictures of the apothecary's establishment attached to the Court at Rastadt in 1700, of that designated the "Star" at Nürnberg in

* H. PETERS *op. cit.* S. 57.

† J. PROBST: Geschichte der Universität zu Innsbruck, Innsbruck 1869.

1710, and of that at Klattau in Bohemia in 1733.* The training of the apothecaries resembled that for a handicraft. The scientific knowledge required of them was insignificant.† Thus F HOFFMANN wrote: "An apothecary must be acquainted with the fact that an acid and an alkali (*i.e.*, a carbonate) if mixed together effervesce, but it is quite sufficient if he knows the effect even though he has nothing to say as to the cause." Another duty fell upon the apothecaries in addition to making up medicines, that, namely, of preparing and administering clysters. This business was very profitable at one time, for LOUIS XIII. in a single year had 212 clysters given him, in addition to 215 purgings. A Canon of Troyes in the space of two years brought the record up to the inconceivable number of 2,190, a fact which has been preserved for posterity because he refused to pay the fees demanded, and was consequently sued for them. Clysters were in fact the fashion, and the ladies of Paris whispered in strict confidence to one another that the secret of NINON DE L'ENCLOS, who preserved to advanced age her greatly-admired beauty, rested purely and simply upon the frequent use she made of them.‡

CLINICAL TEACHING IN THE SEVENTEENTH AND EIGHTEENTH CENTURIES.

THE greatest acquisition gained by medical education during this period consisted in the introduction of clinical instruction into most universities and the adoption of it by them as one of the subjects in their curriculum. The first attempts which were made in this direction, as has been mentioned, in the 16th century at Padua had no lasting effect and exerted no visible influence upon the other universities. To the University of Leyden the credit is due, of having made

* H. PETERS *op. cit.* S. 78 *et seq.*

† F. HOFFMANN: Medicus politicus, Lugd. Batav. 1746, ii, 2, c. 16.

‡ PHILIPPE *op. cit.* S. 131 *et seq.*

clinical teaching a permanent institution and of having transmitted by its students the custom to other places.

The Professors OTTO VAN HEURNE and E. SCHREVELIUS inaugurated this system about the year 1630 in the Infirmary at Leyden. The method adopted was for the students first of all to examine the patient on his complaint, then for each one to state his view upon the nature, causes, symptoms, prognosis and treatment of the disease, and last of all for the Professor to confirm the correct opinion, to confute erroneous ones, and to add any explanation required. But this procedure did not please the students, for they ran the risk of having their ignorance exposed by questions which they could not answer, and O. V HEURNE found himself obliged reluctantly to give it up and in its place to undertake the examination of the patients himself and to follow this up closely with directions for treatment. The bodies of the patients who died in the hospital were opened in order to arrive at certainty as to the cause and seat of their diseases. An apothecary's shop was also attached to this hospital where the students could see and learn how to prepare medicines.*

In 1648 ALBERT KYPER, to whom we owe this account, coming from Königsberg in Prussia took over the direction of the clinic at Leyden. After a few years he was succeeded by F. DE LE BOË (SYLVIUS) who has been thus described, when engaged in clinical instruction, by his colleague LUCAS SCHACHT:† "when he came with his pupils to the patient and began to teach, he appeared completely in the dark as to the causes or the nature of the affection the patient was suffering from, and at first expressed no opinion upon the case; he then began by questions put to different members of his audience to fish out (*expiscabatur*) everything and finally united the facts discovered in this manner into a complete picture of the dis-

* ALB. KYPER *op. cit.* p. 112 *et seq.*, 256 *et seq.*

† Oratio funebris in obitum F. DE LE BOË SYLVII in Sylvii opera medica, Amstelod. 1680, p. 931, and NEUBERT *op. cit.* 1836, ii, 162.

ease in such a way that the students received the impression that they had themselves made the diagnosis and not learnt it from him." Under his direction the Leyden clinic acquired such a reputation that students and doctors came thither, as SCHACHT says, from Hungary, Russia, Poland, Germany, Denmark and Sweden, from Switzerland, Italy, France and England, in fact from every country in Europe.

The clinic of Leyden maintained for a long time the first rank among institutions of the kind. BOERHAAVE, who occupied the chief position there till 1738, was known all over the world and numbered among his pupils HALLER, G. VAN SWIETEN, A. DE HAËN, PRINGLE, H. D. GAUB, RIBEIRO SANCHEZ and others, who filled the 18th century with their fame. Clinical instruction was given also in other universities of Holland the infirmaries of which country were highly praised * by eye-witnesses. At Utrecht, W VAN DER STRATEN held a clinic : his method of leading students on to a knowledge of diseases excited the highest approbation in the mind of KYPER.† An establishment for clinical teaching was founded in 1715 at the Hospital of S. Spirito in Rome at the suggestion of LANCISI. The university at Edinburgh got a hospital (the Edinburgh Royal Infirmary) in 1738 : this since 1746 has been used for clinical instruction.‡

The policlinical instruction in Paris—a system which had there been practised for centuries—was, in 1644, incorporated with the curriculum of the medical faculty. It appears that this measure was adopted at the instance of THEOPHRASTE RENAUDOT. This clever and enterprising man, who founded the first loan-office and the first bureau d'addresse in Paris and who also edited the first French newspaper—the "Gazette de France,"—organized in conjunction with some medical colleagues an institution of the nature of an ambulance for relieving poor patients gratis. This brought him many marks

* *Cf.* THOLOCK *op. cit.* i, 2, S. 205. † KYPER *op. cit.* p. 255.

‡ A. GRANT *op. cit.*

of ill-will from the medical faculty, with which he lived at continual feud, as he would not fall in with the exclusive party spirit which animated that body. To such a point did they carry their opposition that after the death of his patron the powerful Cardinal RICHELIEU, RENAUDOT'S policlinic, which had been a source of so much benefit to the poorer population, was closed.* This resulted in the medical faculty taking the duty upon itself of maintaining a similar institution. It was arranged that six doctors, three old and three young, should be commissioned to examine and supply with medicines twice every week in the École de Médecine patients able to get about: the attendance was to be gratis. Surgical operations they were either to undertake themselves or else to get a skilful surgeon to perform. In difficult cases they were bound to hold consultations among themselves: the Dean of the Faculty was charged to be frequently present at these. Poor patients not in a condition to come to the consultation were visited and treated gratis in their dwellings. The bachelors, in other words the senior students of medicine, were obliged to attend the policlinical consultations: they were occupied there in writing down the prescriptions dictated by the doctors and in rendering other services. They also had to be present at the medical visits to the Hôtel Dieu or some other hospital.† These policlinical studies lasted for two years. Stationary clinics were not instituted in Paris until the end of the 18th century.

Even in Germany the first clinics did not come into existence before the middle of last century. It is true that, on the occasion of the foundation of the University of Göttingen, WERLHOF proposed that a clinic should be associated with it, but in vain. The circumstances were similar in the case of the medical faculty of Vienna in 1718. F. HOFFMANN, of Halle, even pronounced a decided

* GILLES DE LA TOURETTE: Theophraste Renaudot, Paris 1884.

† HAZON *op. cit.*—SABATIER *op. cit.*

opinion that no one is properly educated for a doctor by attendance on medical lectures alone, but that clinical instruction is a necessary adjunct.* The conviction that the clinic is an indispensable feature of medical teaching was thus general: but the small amount of power possessed by the professor of medicine, the indifference of the authorities and, above all, want of money resulted in a continual postponement until later times of the realization of any schemes there might have been for erecting the necessary establishments.

Vienna was the first German university to institute a clinic. At the instance of GERHARD VAN SWIETEN in 1753 a clinical department was founded in the so-called City Hospital; consisting of six beds for men and six for women; to supply this with cases the right was reserved of removing thither from the other departments of the establishment, and from the Hospital of the Trinity, any patients required for clinical instruction. The Dutchman A. DE HAËN was summoned to assume the direction of the clinic and he organized it throughout after the model of that of Leyden. "Daily, at an early hour, he appeared at the hospital and examined the sick in order to inform himself of any changes which might have taken place in their condition. At eight o'clock began the clinic, the patients being examined and handled by the students under his guidance. In this he followed a plan of teaching much to be recommended; each of his pupils had to whisper to him the result arrived at after examination of the case and at the conclusion DE HAËN imparted the correct diagnosis to those present in a loud voice, so that those who had made mistakes could be assured of it without being made to look foolish. After the clinic, began the prescribing for those patients who were not being treated in the hospital. The students attended this function also. Here, as in the clinic, a register was kept of each patient and the history of his illness was entered together with the prescriptions

* F. HOFFMANN: Medicus politicus, Halle 1746, i, 1, 6.

which were employed. If patients died in the clinic the autopsy was performed by DE HAËN in the presence of the students, the results of it were compared with the diagnosis formed during the course of the disease and the value and utility of the treatment which had been adopted were discussed."* DE HAËN founded the fame of the Vienna clinic. His successor MAXIMILIAN STOLL increased it by his great success in teaching and attracted to it students and doctors from every country. Under him it reached "a degree of perfection which justified it in standing forth as the unique pattern of all clinical schools."†

The Academy of Sciences at Paris proposed to King LOUIS XVI. of France a plan for founding a clinic there modelled on the school directed by STOLL.‡ The arrangements of the Vienna school were imitated by the clinics which arose in the provinces of Austria and in Germany. Prague acquired a clinic in 1769; under PLENCICZ, in 1778, the beds were increased in number from 8 to 50 and an unqualified right was granted of claiming patients, required for teaching purposes, from the other departments of the infirmary.§ BORSIERI, in 1770, introduced clinical teaching into Pavia; in 1774 it was introduced at Modena. In Würzburg the students of medicine had, long since, been directed to attend the visits of the doctors to the Julius Hospital. As early as 1729 clinical teaching was practised there under BERINGER'S guidance; but it appears not to have been continued afterwards or only to have taken place intermittently,‖ for, in the "Regulation of Studies" for 1749, attention had again to be drawn to the high

* Freimüthige Briefe an den Herrn Grafen von V., Frankfurt-a-M. und Leipzig 1774, S. 69, *et seq.*—TH. PUSCHMANN: Die Medicin in Wien während der letzten hundert Jahre, Wien 1884, S. 17.

† J. F. C. HECKER: Geschichte der neueren Heilkunde, Berlin 1839, S. 506.

‡ M. STOLL: Über die Einrichtung der öffentlichen Krankenhäuser, Wien 1788, S. 28.

§ SEBALD: Geschichte der medicinisch-praktischen Schule zu Prag, Prag 1796.

‖ J. N. THOMANN: Annales instituti medico-clinici Wirceb., Vol. i, p. 24, Würzburg 1799.

importance of the professors taking students and young doctors with them in visiting the hospitals and in their private practice and there making them acquainted with the treatment of the sick with a view to the perfecting of their medical education. Clinical teaching of a regular and systematic character was not introduced into Würzburg till 1769.

In Strassburg, too, after 1738 clinical demonstrations were occasionally held. GOETHE, when studying there in 1770, was, as is well known, among those who attended them.* But a right to make use of the clinical material in the City Hospital was not granted to the Strassburg clinic until long afterwards.† Göttingen was, in 1764, provided with a *collegium clinicum* by R. A. VOGEL, which, in 1781, was replaced by a stationary clinic. In Halle, JOHANN JUNCKER was the first to practise clinical teaching: but a stationary clinic set apart for university teaching was not founded there until 1810.‡ Clinics were established at the following places at the dates indicated: Erlangen (1779), Altdorf (1786), Kiel (1788), Jena (1791), Tübingen (1793), Leipzig (1798).§

At most of the other universities only policlinical institutions were to be found. Efforts were made in some places to induce students to visit the hospitals where they might have the opportunity of observing patients. So, too, in other countries these methods of teaching had to suffice, in the absence of clinical teaching proper, that is to say lectures at the bedside. Education in the practice of the healing art was materially benefited by the very widely-spread custom of allowing the older students and the young doctors to work as practitioners for a considerable time in a hospital, where they were, by the leading doctors, made familiar with the requirements of practice. In France and England,

* Aus meinem Leben in GOETHE's Werken, Leipzig 1870, iv, 167.

† F. WIEGER *op. cit.* S. 113 *et seq.*

‡ P. FRANK *op. cit.* vi, 2, S. 221.

§ G. W. A. FIKENTSCHER: Geschichte der Universität Erlangen, Nürnberg 1806, ii, 104.

where this arrangement exists to the present day, members of the medical staff of hospitals often took pupils who paid stipulated fees for the practical instruction which they received. As J. HUNCZOVSKY states, such opportunities were afforded at St. Bartholomew's Hospital in London, in the Seaman's Hospital at Portsmouth, in the Hôtel Dieu at Paris, and at Rouen.* In Italy a similar custom appears to have prevailed. LANCISI, after completing his course of medical studies, entered the S. Spirito Hospital at Rome in order to prepare himself for medical practice by further practical work of several years' duration.† He recommended students of medicine to see numerous patients and to visit the hospitals, and he advised them to spend several years in this mode of study.‡ Again, at the Trinity Hospital in Vienna, a number of students of medicine were constantly admitted in the capacity of practitioners.§ In the town hospital at Bremen also the doctors in authority gave clinical instruction to the students who took part in the visits to the patients.‖ There is no doubt that arrangements of this kind prevailed at many hospitals.

The archives of many an institution must contain important information upon this subject; it would be a thankworthy task to collect and to complete the arrangement of such material, which, as yet, especially in the case of Germany, has been but very imperfectly done. But the facts already adduced will be found sufficient to prove that the view reiterated in works on the History of Medicine even to weariness, that before the establishment of institutions for clinical teaching young doctors relied simply upon books

* J. HUNCZOVSKY: Medicinisch-chirurgische Beobachtungen auf Reisen durch England und Frankreich, Wien 1783, S. 7, 62, 84, 162.

† EUS. SGUARIUS: Vita LANCISI in the preface to Lancisii opera vera, Venet. 1739.

‡ LANCISI: De recta medicorum studiorum ratione instituenda, Romæ 1715.

§ Nachrichten von dem Kranken-Spital zur allerheil. Dreifaltigkeit, Wien 1742.

‖ KULENKAMPFF: Die Krankenanstalten der Stadt Bremen, ihre Geschichte und ihre jetziger Zustand, Bremen 1884.

and theoretical lectures for their technical knowledge, is incorrect, at least as a rule of general application. The circumstance that practical instruction at the bedside generally lay outside the curriculum of university study, and was not generally sought for until after the conclusion of such study and after promotion to the degree of Doctor, must have contributed to this mistaken view. On the other hand it may frequently have happened that young Doctors of Medicine, possessed with a high sense of their new dignity, were unconscientious and daring enough to commence practice before they had acquired the practical skill which it demands; but the majority recognized the necessity of practical training, and visited the hospitals with this object in view, as is clearly shown in the numerous biographies and writings of the distinguished doctors of that period.

TEACHING IN SURGERY, OPHTHALMOLOGY, AND OBSTETRICS.

ONLY a small place was allotted to surgery in the scheme of studies at the universities. The students of medicine were given a general view of the subject, and the most important operations were demonstrated to them upon the dead body. HALLER, who, in addition to his other posts, held for a time the professorship of surgery at Göttingen, could never, as he says himself, make up his mind to operate upon a living man, although he had had considerable practice upon the dead body. Since the doctors of that time were not called upon to perform surgical operations, this theoretical teaching might perhaps suffice to give them a knowledge of the important bearing of surgery upon internal medicine; but it was by no means sufficient to permit them to form a judgment upon surgical questions. When the doctors were conceded the right of controlling and advising the surgeons in their work, and

the latter had the duty imposed on them of consulting the doctors upon the necessity and the nature of surgical interference, a state of things was created which necessarily led to quarrels. The doctor was exposed to the risk of making an exhibition of his ignorance, and the surgeon felt himself subjected to a mortification which he did not deserve, in having to rank below a man who understood but little or nothing at all of the subject.

F HOFFMANN in the "Medicus Politicus" gives doctors the reasonable advice that "they should place themselves on a satisfactory footing with the surgeons, should not address them harshly in the presence of patients, but only admonish them with modesty; moreover they should not dispute with them, especially upon surgical subjects, since the surgeons may be more experienced in these matters than themselves." But with most doctors, especially with those who lacked experience, pride prevailed over prudence, and they looked down upon surgeons and surgery with haughty disdain. The author of the book, "The Unworthy Doctor of the Trusty ECKHART" (Augsburg and Leipzig, 1698), describes these relations (p. 428 *et seq.*): "Your young doctor is indeed a high-mettled animal, what time the brain is filled with all manner of vanities and fantasies and will submit to no manner of influence or control. His opinion is that everyone must give way to him, and must see at once by his face that he is a physician."

It is certain that the low social position of the surgeons was founded to a large extent upon the fact that their general education was very scanty, and the distinction between them and the bagnio-keepers and barbers was not strictly defined. In Paris an official union was even effected between these callings in 1655; fortunately this lasted only until 1699. Under these circumstances the Collège de St. Côme suffered a loss in importance and respect. More favourable conditions began to prevail once more when in 1724 success crowned the efforts of the

Royal body-surgeons, MARÉSCHAL and LA PEYRONIE, who possessed great influence at Court, to establish the appointment of five teachers, for anatomy, theoretical and practical surgery, operative surgery, and midwifery.

The foundation of the Académie de Chirurgie at Paris, which received the Royal sanction in 1743, contributed still more to raise the surgical profession. This formed from that time forth the centre for all the chief representatives of surgery; and not only in France, for among its members it numbered many distinguished surgeons of other countries. By offering annually prizes for essays on surgical questions, by material support extended to investigators, and by editing its transactions, in which valuable matters of observation and experience were made public, this body advanced the development of surgery and established its scientific basis. The Academy was made to rank as equal with the Faculty of Medicine, was rendered independent of the latter, and received the right of granting the degree of Master of Surgery; but this might not be conferred on anyone who had not attained to the dignity of Master of Philosophy.

The Académie de Chirurgie was also in connection with the Collège de St. Côme, inasmuch as numerous distinguished members of the former were teachers at the latter. In 1750 a regulation was made that the curriculum for surgeons who studied in the Collège de St. Côme should be of three years' duration; practical exercises in anatomy and in operative surgery were also introduced.* The medical faculty lost almost entirely its influence over the education of surgeons and was now only represented at the actual conferring of the degree of Magister. It is true, the medical faculty opposed by all means in its power this emancipation of the surgical profession, and sought to prove by references to history and by the opinions furnished by the medical faculties of Göttingen and Halle that the

* P. FRANK *op. cit.* vi, 2, p. 331, note, *ou les élèves feront eux-mêmes les dissections et les opérations qui leur auront été enseignées.*

subordination of surgery to medicine had existed from all time and was necessary and natural: it even went so far as to make the absurd assertion that the possession of a higher general education is detrimental to surgeons; but all in vain. The surgeons maintained the independence they had struggled after for centuries, and their deeds proved that they were worthy of it. Only the *élite* of the surgeons received their technical training at the Surgical Academy of Paris; the majority learned surgery like a handicraft with a master, getting the necessary practice and skill by frequenting, and acting as surgical practitioners in, the hospitals. A regulation was made that no master should have more than one pupil, so that he might be in a position to devote sufficient attention to his training.

In towns where several surgeons were practising they formed societies, took duty in the hospitals by turns, and furthered the instruction of their pupils by means of lectures and practical demonstrations in anatomy and surgery. At the beginning of every year each surgical guild submitted a list of its masters to the Royal body-surgeon who stood at the head of the surgeons of France.*

In England and Holland the system of higher surgical education lay entirely in the hands of the surgeons' guilds, which at a very early period in these countries appeared as exclusive corporations with defined privileges. Although CROMWELL in 1656 empowered the College of Physicians in Edinburgh to deal with surgery because it was simply a branch of medicine, this arrangement only lasted for a short time.† The societies of surgeons in London, Edinburgh, Dublin, Amsterdam, at the Hague and elsewhere, arranged courses of instruction for students of surgery and took care that they were able to get a practical education in anatomy and surgery. JOHN KAY was summoned to London in the time of HENRY VIII. to instruct surgeons in the performance

* G. FISCHER: Chirurgie vor hundert Jahren, Leipzig 1876, S. 254 *et seq.*

† Historical Sketch of the Royal College of Physicians of Edinburgh, Edinburgh 1882.

of operations.* What care the Dutch surgeons devoted to anatomical dissection is shown by the already mentioned pictures of the painters of the Netherlands. The students had the opportunity of observing patients and seeing surgical operations in the private practice of their teachers and in the service of the hospital.

The German surgeons as a general rule occupied the position of barbers; only a few rose above this and were capable of regarding the treatment of wounds in a scientific spirit. Whoso adopted this calling† learned in the first place from a master of the art, how to shave and cut hair, to spread plasters, to cup and to bleed. After this he was shown how wounds and ulcers are treated, dislocations reduced and fractures set and cured. Only such surgeons as had been matured in the school of experience, or specialists who had attained conspicuous skill in very limited fields of work, ventured upon the higher surgical operations. The town-surgeon of Zürich was ordered in 1716 to invite young surgeons to the operations which he performed "that they might have the opportunity of gaining further knowledge in such methods of cure."‡ At Würzburg the chief surgeon at the Julius Hospital was commissioned, in 1725, to give instruction in his art at the bedside.

In the treatise entitled "The Bold Surgeon of the Trusty ECKHART" (Augsburg, 1698) the students of surgery were advised to study anatomy thoroughly, and, should human subjects fail, on the bodies of the lower animals, for if learned doctors were not ashamed to pursue this study "a saucy barber's or bathman-fellow's honour will be unscathed." Further, the advice was given them to visit hospitals and to attend operations which famous surgeons performed, even after their student-life was passed. The remaining

* A. CORRADI *op. cit.* Ser. ii, Vol. vi, p. 638.

† O. BUCHNER: Aus Giessens Vergangenheit, Giessen 1885, S. 27.

‡ MEIER-AHRENS: Geschichte des Zürcherischen Medicinalwesens, Basel 1840.

admonitions given them throw a strong light upon the social aspect of their condition. Thus: "he is not to brag about his cures over the tavern tables, or approach a patient as a pig would a beggar's bag, or treat him in a tyrannical or wrathful manner. He is not to demand twelve thalers when he only deserves two. He must not use the knife without due consideration; for it is a question of human flesh, not mere slaughtered beef or pork: a man sets a high value on his skin. When danger threatens he is to call in doctors and brother-surgeons to consult withal."* M. G. PURMANN even complained that surgeons, in order to win patients from one another "perpetrated tricks and treacherous artifices with the instruments."† The surgeons of Germany attained a higher position when schools began to be founded for their education. These were first intended to train up a body of medical officers for the military service; but the want of practitioners soon led to pupils being taken from the civilian classes. In 1716 an institution of this kind was founded in Hanover. Berlin in 1713 acquired a *theatrum anatomicum,* forming the first completed portion of an establishment intended for the instruction of military doctors and "medico-surgeons," which was opened in 1724 and became associated with the Charité Hospital, the founding of which followed a few years later. Six professors and a demonstrator of surgical operations constituted the teaching staff; the instruction given embraced not only anatomy and surgery, but also pathology, materia medica, botany, chemistry, and even mathematics. "Following the example of Paris, London, and Amsterdam, 'Medici and Chirurgi were, in the Charité, to be given ample opportunity of seeing and practising methods of treatment for both internal and external diseases."‡ A military medical school was founded in Dresden in 1748.

* G. FISCHER *op. cit.* S. 33 *et seq.*

† G. PURMANN: Lorbeerkrantz oder Wundartzney, Frankfurt u. Leipzig 1722.

‡ A. GUTTSTADT: Die naturwissenschaftlichen und medicinischen Staatsanstalten Berlins, Berlin 1886, S. 344.

The students of these establishments were clever barbers, who had already served for a considerable time in the army, or had been busily occupied in the hospitals or in private practice, and thus were by no means beginners, but men who already possessed a certain amount of experience in the healing art. It was intended that in the surgical school they should receive a scientific professional education, and thus be able, in future, to take prominent positions as operators and teachers of surgery.

An arrangement of this kind existed also at the military medical school of Vienna, which was opened in 1781. This school, named at a later period after its founder, the Emperor JOSEPH, was provided in 1785 with a new building for the purposes of teaching, which was raised at the cost of one million gulden; it contained lecture rooms, a library, scientific collections, and the residences of the teachers. The military hospital, which afforded accommodation for 1,200 patients, and contained two wards for the wives of soldiers when lying-in—a small obstetric department in fact—was associated with this school.* Moreover, in the vicinity of the establishment a botanical garden was laid out, and a small chemical laboratory fitted up. The course of instruction lasted for two years. Thirty of the ablest military doctors were ordered to attend this course, and at the end of their studies were promoted to be regimental surgeons. At the same time the school was the resort of students who were making their earliest studies for the surgical profession.

The teaching staff at first consisted of five professors, of whom one had to teach anatomy and physiology, as well as that amount of elementary mathematics and physics necessary for a proper understanding of the former sciences; a second had to treat of general pathology and therapeutics, with hygiene; a third lectured on instruments and bandaging, conducted the surgical clinic and the practice of

* DE LUCA: Wiens gegenwärtiger Zustand unter Josephs Regierung, Wien 1787.

operations, and represented midwifery and forensic medicine; a fourth held lectures on internal medicine and conducted the clinic for internal diseases; while the duty of the remaining professor was to lecture on botany, chemistry, and materia medica, and to superintend the botanical garden. A prosector was also appointed; he had to get ready the anatomical preparations required for teaching and to perform the autopsies on patients who died in the military hospital.*

In teaching, the words of the Emperor were to serve as the guiding motto: "My design is that not merely the outside of the various sciences dealt with should be taught to the surgeons who are to be trained here, and that they should be sent forth hence with nothing but a knowledge of technical terms and with an over-hurried and shallow training. I desire rather that they should get a firm hold of their subjects and, thus provided, return to the regiments."† An academy, organized after the pattern of the Académie de Chirurgie at Paris, was in connection with this establishment; it offered prizes for the solution of questions of surgical interest and published the compositions sent in.‡ It received, moreover, the rights and dignity of a university and could grant the degrees of Magister and Doctor in Surgery. In this way educated surgeons were placed in the same social position as representatives of internal medicine.

Reasonable, unprejudiced doctors welcomed these arrangements with enthusiasm as being the first step towards the wished-for reunion of these two important branches of the healing art.

Professor AUGUST RICHTER of Göttingen gave expression in the following words to the expectations formed generally

* G. PIZZIGHELLI: Accademia medico-chirurgica Giuseppina, Vienna 1837.

† Allerh. Entschliess. v. 3. April, 1781, im Archiv des k. k. Kriegsministeriums.

‡ J. A. v. BRAMBILLA: Verfassung und Statuten der Jos. med.-chir. Akademie, Wien, 1786.—TH. PUSCHMANN *op. cit.*, S. 96 *et seq.*

on this subject: "All Germany assuredly takes an interest in the honour of this academy, in the happy issue of its endeavours, and in the election of its members, for these are they from whom the surgery of Germany may now expect direction, guidance, and enlightenment; by the successful or unsuccessful results of their efforts will the foreigner henceforth appraise the value, positive or negative, of German surgery as a whole; among the members of this academy will the most eminent surgeons of Germany be sought, and in their performances will every important achievement of German surgery be looked for."* These hopes were only fulfilled in a minor degree. The early death of the Emperor JOSEPH II., by which the academy lost a devoted and generous patron, the political events and the continual wars which robbed military doctors of all leisure for scientific work, and above all the feeble development and dependent position of German surgery were the baneful causes which prevented the attainment of these lofty aims.

Modelled upon the Josefinum of Vienna, schools of medicine and surgery arose at St. Petersburg and Copenhagen in 1783 and 1785 respectively. In Spain a school for the education of naval doctors was founded at Cadiz in 1748, and was placed under the superintendence of a director and ten teachers.†

Numerous other schools were founded in the 18th century, and in them barbers and bathmen were, by a course of instruction of from two to three years' duration, trained into district medical officers and surgeons. In Austria these schools were in some instances departments of medical faculties or lyceums, in others separate institutions in places where there was no university. In other German countries, establishments of this kind arose at Frankfort-on-the-Main, Hamburg, Regensburg, Brunswick, Bruchsal, Celle, Cassel, Gotha, Dillingen, Zürich, and other

* A. G. RICHTER: Chirurgische Bibliothek, Göttingen 1788, Bd. ix, St. 2, S. 191.

† MOREJON *op. cit.* T. vi, 341.

places. About the same time greater attention began to be bestowed upon practical teaching in surgery at the universities. The clinics, which arose at this time, at first, indeed, were limited to the treatment of internal diseases; all surgical matters which required attention were as a rule put into the hands of a surgeon, who was subordinate to the chief of the clinic.

In Holland alone had medical students the opportunity of assisting in surgical operations at the hospitals. J. J. RAU, at Leyden, instituted a course of surgical operations on the dead body, demanding a fee of 100 Dutch thalers for the same. Many German practitioners, anxious to acquire practical knowledge in surgery, betook themselves, therefore, to Holland, as FRIEDRICH HOFFMANN, in his "Medicus Politicus" (i, 1, 6), advised them to do. In the same way France and England were also visited with this object. In Germany the first surgical clinic arose in the year 1769 at Würzburg; CARL CASPAR SIEBOLD organized it in a highly satisfactory manner, illustrated the surgical lectures by the demonstration of anatomical preparations, and introduced the practice of surgical operations on the dead body.* At Vienna a surgical clinic was opened in 1774. Göttingen acquired a similar institution in 1781; Germany's most celebrated teacher of surgery, A. G. RICHTER, gave clinical instruction there.

Ophthalmology, too, and midwifery, which, in BOERHAAVE'S time, had been taught in association with other subjects, especially surgery, by degrees met with greater consideration in the plan of studies. France, England, and Italy produced some able ophthalmic surgeons; it is not until the close of the 18th century that we find several Germans occupying a position of equal importance. Celebrated ophthalmic operators were then, like famous tenors at the present time, summoned from great distances to give illustrations in their art. N. J. PALUCCI was induced by G. VAN SWIETEN to come to Vienna, and he there performed the

* F. v. WEGELE *op. cit.*

operation for cataract in the presence of the students of medicine and surgery at the Trinity Hospital. The elder WENTZEL came thither afterwards for a similar purpose, and it was under his guidance that JOSEPH BARTH was educated to become an ophthalmic surgeon. The success of the latter in this field of practice induced the Emperor JOSEPH to order him to train up two young doctors in ophthalmology. An extraordinary honorarium of 1,000 gulden was promised him for this service, but he was not allowed to receive it until his pupils had furnished a proof of their skill by performing successfully six operations for cataract. His first pupils were his prosector EHRENRITTER, who died very young, and ADAM SCHMIDT, with whom G. J. BEER was afterwards associated, having been at first employed by BARTH as a designer. These were the founders of the ophthalmological school of Vienna, to which the world owes a succession of able ophthalmic surgeons. At the same time in Göttingen, Jena, Leipzig, and other places ophthalmology began to be drawn into the domain of clinical teaching.

In the 17th century midwifery was still almost exclusively practised by midwives. They acquired their knowledge of the subject by personal instruction from an elderly experienced practitioner of their own sex, and were examined therein by ladies of good position, or by doctors of the town where they desired to reside. In Leipzig the wife of the Burgomaster conducted the examinations of the midwives; but in most places the doctors and surgeons, and especially those who held public appointments, undertook this duty. This led to the latter commencing to teach the midwives as well,—a very necessary proceeding; for GERVAIS DE LA TOUCHE states that through the ignorance of the midwives a large number of women and children perished annually, and FABRICIUS VON HILDEN declares that the midwives had no idea of the structure of the female sexual organs, or of the duties of the midwife.*

* C. J. v. SIEBOLD *op. cit.* ii, 132 *et seq.*

Certain highly-gifted women, like LOUISE BOURGOIS, who attended MARIA DE' MEDICI, consort of HENRI IV., and advanced the literature of obstetrics, must be looked upon as exceptions. In Paris the midwives received a systematic education. In the Hôtel Dieu there was a lying-in institution in which the obstetric probationers were taught by the head-midwife. The well-known MARGUERITE DE LA MARCHE, whose handbook for midwives is among the best literary productions of that age, worked for some time in this position.

The course of instruction lasted for three months. During the second half of this period the probationers had themselves to perform all the services required during labour. Only in extraordinary cases was the surgeon of the department—himself also an obstetrician—called into consultation. As a general rule women in labour refused to accept the assistance of a man. This unseasonable modesty derived support from the ignorance of most of the doctors and surgeons who had no opportunities of getting experience in midwifery. This state of affairs was not altered until such exaggerated prudery was given up,* and the help of the male sex was claimed in cases of labour. The Duchesses DE LA VALLIÈRE and DE MONTESPAN, and other ladies of the French Court, made a beginning. "Their example was soon copied," writes P. DIONIS, "and even women of the lower classes declared that they would rather have obstetricians of the male sex than midwives, were they not deterred by the high fees of the former."† A school of obstetrics was in 1720 founded at the Hôtel Dieu in Paris. In 1743 a course of instruction in gynæcology was also started in the surgical school, and in 1754 the medical faculty even felt itself called upon to create a professorship of obstetrics.

* On certain other occasions quite different conditions obtained. *Vide* Les consultations de MME. DE SÉVIGNÉ, ed. p. P. MENIÈRE, Paris 1864, p. 21 *et seq.*

† SIEBOLD *op. cit.* ii, 189.—SUE d. Jüngere: Versuch einer Geschichte der Geburtshilfe, Deutsche Übers, Altenburg 1786, S. 99.

Already in the 17th century Holland was in possession of a system for the regulation of midwives. The females who devoted themselves to this calling were taught and examined by surgeons practised and experienced in midwifery. Among their instructors were men like H. VAN ROONHUYSEN, F. RUYSCH, and others.

A number of lying-in institutions arose in England during the 18th century. These were to some extent made available for the instruction of midwives and students in the obstetric art. The Westminster Lying-in Hospital, founded by private charity in 1765 through the exertions of J. LEAKE, gave young doctors and surgeons the opportunity of getting a practical education in midwifery. Again, many doctors who conducted lying-in institutions took pupils, who were trained at these to become obstetricians.* A professorship of midwifery was founded at the University of Edinburgh in 1726. At Dublin, the College of Physicians, and afterwards the College of Surgeons, instituted courses of instruction in this branch; while the Lying-in Hospital founded there in 1746 gained a high reputation.

Germany in the 17th century did not produce one single male obstetrician of note; on the other hand, certain midwives made themselves widely known. "The court midwife of the electorate of Brandenburg, JUSTINE SIEGEMUNDIN, née DITTRICHIN," "the Mother Grete," who also assisted DOROTHEA SIBYLLA, Duchess of Brieg, as a "trusty privy counselloress," as SIEBOLD (*op. cit.* ii, 207) remarks, and had the duty of superintending the "maids of honour," they, together with the town midwife of Brunswick, A. ELISABETH HORENBURG, won for their art a well-deserved respect by their services, and contributed by their writings to its extension and advancement. The obstetric physicians were seldom called into consultation. The conception which many of them had of their duties must have filled the breasts of women needing assistance with fear and dismay. LORENZ HEISTER narrates that

* C. G. BALDINGER's Medicin. Journal, Göttingen 1787, St. 15.

they "were sadly wanting in experience of the arts of turning and extracting the child. When they intended to perform any operation they came with a hooked instrument, and in a pitiful and horrible manner tore the child into many pieces in the mother's womb in cases where, had they possessed the befitting knowledge, they might easily have reached it with their bare hands, and thus have prevented the uterus being lacerated as well as the child and extracted with it, as it actually was frequently in the case of these unhappy women."*

Dr. DEISCH was called by the populace "the butcher of children and women." Augsburg was his slaughter-house. "He perforated and dismembered without intermission, whether the children were alive or dead. He practised decapitation, too. If he had performed turning he was astounded if the child came into the world alive." In 1753 he used sharp instruments 29 times in 61 births, 10 of the mothers perishing. His colleague MITTELHÄUSER, who resorted to similar practices as town physician of Wiessenfels in Saxony, considered he had been especially successful if out of ten women whom he attended only two died.†

In other places matters do not seem to have been at times much more satisfactory; NICHOLS' choice satire "The petition of the unborn babies" (London, 1751) in which they complain of the rough handling they get from the obstetricians, and the figure of Dr. SLOP in STERNE'S "Tristram Shandy,"—the accoucheur with his instruments, all ready for action,—were certainly more than mere products of the writers' fancy.

We can easily understand how a universal disgust at this kind of midwifery arose. The progress which this branch of knowledge made in the 18th century opened men's minds to a more correct recognition of the laws of

* LOR. HEISTER: Medicinische, chirurgische und anatomische Wahrnehmungen, Rostock 1753, Vorrede.

† SIEBOLD *op. cit.* ii, 426 *et seq.*

nature in the act of birth, and to more humane views as to the part allotted to the accoucheurs' art. The introduction of regular teaching in obstetrics at the university, and the increase in the number of lying-in institutions were conspicuous among the causes which brought about this beneficent reform. Besides the theoretical lectures upon midwifery which at most universities were held in connection with those on surgery a commencement was made in the practical instruction of students. In this, Strassburg was in advance of all other German Universities: in 1728, a school for obstetricians was founded in the Lying-in Institution there which had already for a considerable time been made use of for the instruction of midwives.* It was under the direction of FRIED and, as OSIANDER says, was the parent of all other institutions of this kind in Germany. The pupils practised the manipulations of midwifery in the first instance upon a model, then visited women in pregnancy and superintended the labours. The fee which they had to pay their teacher for this course of instruction was somewhat high: it came to about 100 thalers. Several of the best obstetric physicians of last century proceeded from this school; among these was J. G. ROEDERER who, in 1751, was summoned to Göttingen as Professor of Midwifery and Director of the recently founded Lying-in Institution. A school of midwifery was at the same time opened at the Berlin Charité. In 1786, there were in the Kingdom of Prussia, without the province of Silesia, as many as 14 teachers of this branch. So also in other German countries institutions of a similar kind arose and at them midwives and students received instruction in obstetrics, for example at Würzburg (1739), Copenhagen (1760), Cassel (1763), Brunswick (1768), Karlsruhe, Dresden (1774), Jena (1781), Marburg (1792), Detmold, Mannheim, Weimar, Bern (1782), etc.

At Vienna the instruction of midwives was introduced in 1748, and in 1754 a professorship of midwifery was founded

* WIEGER *op. cit.* S. 100 *et seq.*

at the university. A special clinic was arranged for this department in 1789, courses of instruction in obstetrics having already, since 1774, been held in a hospital, and cases of this nature having also been received into the surgical clinic. But at many institutions instruction in midwifery, like that in ophthalmology, remained until far into the 19th century associated with instruction in surgery.*

MEDICAL TEACHING AT THE CLOSE OF THE EIGHTEENTH CENTURY AND THE POSITION OF THE MEDICAL PROFESSION.

THE changes which medical teaching underwent in the universities during the period between the beginning of the 17th and the end of the 18th century were very considerable. Instead of two or three professors whose teaching was limited to a few theoretical lectures and only occasionally concerned itself with practical training in anatomy, materia medica and the healing art proper, now, at least at the greater universities, boards of teachers were formed the members of which represented the various branches of medicine and had anatomical schools, laboratories, and clinical establishments at their disposal.

According to the "scheme of studies" for the year 1749, there were then five ordinary professors in the medical faculty of Würzburg. Of these professors the first had to give the students a concise review of the history of medicine, to treat of the "Institutes of Medicine" (physiology) upon a scientific physical basis, to discuss the causes and effects of health and disease in relation to anatomy (general pathology) and in this way to smooth the path to medical practice; the second taught botany and was director of the botanical garden; the duty of the third

* A. GUSSEROW: Zur Geschichte und Methode des klinischen Unterrichts, Berlin 1879.

was to give lectures on chemistry and to show the methods of compounding medicines in the dispensary attached to the Julius hospital; the fourth gave lectures on the special pathology and therapeutics of internal diseases, took the students to the hospitals and made them familiar with the treatment of the sick; and the fifth had to teach anatomy and surgery: the last-mentioned was assisted by a prosector, who acted also as chief surgeon and teacher of obstetrics.*

The medical staff at Heidelberg had in 1763 four ordinary professors, that of Göttingen in 1784 six, and that of Pavia, about the same time, eight.† The curriculum, which P FRANK drew out in 1785-86 for the medical faculty of Pavia, shows what demands were made upon the head of a department at that time.‡ The natural sciences assumed a position of higher consideration than before; this is clearly indicated by a decree of the reigning Prince Bishop of Würzburg in 1782, in which he says: "If in former times men had reason to consider it a settled truth that physics formed a subject of study not only very useful but absolutely indispensable for those who had a mind to devote themselves to medicine, in our days when physics has assumed such a greatly improved form still less can we venture to doubt it; and although physics may be of less use to theologians and jurists than to students of medicine, yet the advantages which future students of theology and law may expect from mathematics and the so-called practical philosophy are at length beyond dispute."§

The medical faculty of Vienna possessed already in 1780 nine regular professorships devoted to the following subjects:—anatomy, physiology, natural history, chemistry and botany, general pathology and therapeutics with materia medica, medicine and clinical teaching, theoretical

* WEGELE *op. cit.*—KÖLLIKER *op. cit.* S. 75.

† P. FRANK *op. cit.* vi, 2, S. 46.

‡ *Ibid.* Suppl.—Band i, S. 176 *et seq.*

§ WEGELE *op. cit.* ii, 428.

surgery, clinical surgery, and midwifery; besides the professors numerous assistants and a prosector took part in the teaching, the duty devolving on the professor of anatomy to train "a person competent to succeed him in course of time, at his own expense."

The Emperor JOSEPH II. took a lively interest in the system of medical teaching. In a rescript of the 27th April, 1786, he gave expression in the following words to his opinions about the curricula of the medical faculties which had been submitted to him: "That surgery, the whole of operative surgery and bandaging, can be properly taught in six months appears to me to be barely possible, and, in general, I distribute the subjects of medical study after the following fashion. In the first year, anatomy associated with physiology in such a way that on exposing, for instance, a lung in the course of dissection its use and function in the healthy body may be dwelt upon at the same time, and so for every muscle in the body it should be shown what its action is. Both *medici* and *chirurgi* must complete this year of study. The necessary prosectors and all else he requires must be provided for the Professor of Anatomy and Physiology so as to maintain his department in a fitting state. Also let the *medici* in the first year be taught botany and chemistry, and the *chirurgi* operations, bandaging, and midwifery. In the second year the surgeons must learn surgical and medical practice, devote themselves to clinical work in the hospital, and also practise midwifery in the hospital, and then have finished. The physicians, however, must attend lectures on materia medica, pathology, and all that belongs to the learned profession of medicine, but in the third year they must give themselves up entirely to practice and clinical work, and to treating patients in the hospital. And in this way let able surgeons be trained for the country and doctors for the town. I await a further elaboration of the scheme in this sense.—JOSEPH."*

* Archiv. des k. k. Unterrichtsministeriums zu Wien.

The curriculum which was published soon after this diverged from these principles mainly in the period of study for medical and surgical students being fixed at four years, and a course of studies being arranged applicable to both classes in most of the departments, the only difference being that the *medici* had to spend a longer time on materia medica, chemistry and internal medicine, while the *chirurgi* had to enter more deeply into surgery and the subjects associated with it, and to give proof of this in examinations.

So in this way at last in Austria and Germany, as was already the case in other states, surgery had assigned to it a more dignified position. Physicians and surgeons were recognized as two classes of doctors enjoying an equal rank, in possession of an equally sound education, and differing only in the kind of work assigned them. At the same time there arose an inferior class of practitioners whose acquirements were of a lower order, and who were intended chiefly for attendance upon the peasantry. They practised as doctors for both internal and external diseases. The opposition which had hitherto existed between physicians and surgeons was now transferred to the more highly-educated practitioners on the one hand and the less thoroughly trained physician-surgeons on the other. In forming an opinion upon the state of affairs which was thus produced, we must not forget that a shifting of position had taken place among the factors in question which justified many things which would before have been indefensible and wrong.

It is, then, certain that the surgeons of the 17th century occupied a somewhat low position from an educational point of view; but have we any reason to suppose that it was otherwise with the physicians of that period? In the eyes of many a clear image of fresh and living nature was perverted by the distorting atmosphere of a lifeless desert of unprofitable learning. "They understood their GALEN but not their patients," as MONTAIGNE said. The figure of Dr. DIAFOIRUS, in "Le Malade Imaginaire" of MOLIÈRE,

must have been drawn from life.* The great majority of doctors sought to impose upon the public by the grandiloquence of a Græco-Latin phraseology; their impression was that, as KANT says, in giving a name to their diseases they had rendered their patients a service.† They endeavoured to remove a disease by pills and plasters, medicines, clysters, and repeated blood-letting; so that at times it took a good constitution to resist these frequently inappropriate or preposterous measures. The title of Doctor of Medicine by no means afforded a guarantee that the bearer of it possessed medical knowledge. Outside the universities the right to confer this dignity was assumed by the EMPEROR, the POPE and his plenipotentiaries, and the Counts Palatine. At Naples, even during last century, the D'AVELLINO-CARRACIOLO family enjoyed the privilege of conferring the degrees of Doctor of Medicine and Doctor of Law; they made extensive use of this privilege,—and made it correspondingly profitable.

But even at some universities a disgraceful misuse was made of the privilege of granting the degree of Doctor. Many professors found in the fees paid a desirable increase of income, and sought to allure candidates by making the least possible demands upon their knowledge. Examinations were either omitted altogether or reduced to a mere formality. The theses for the doctorate might be bought at a fixed price from certain learned contractors who made a profitable business by the preparation of such essays.‡ At Greifswald a cobbler in the year 1788 got the diploma of Doctor of Medicine; on the strength, too, of a dissertation upon the therapeutic effects of pitch. The University of Erfurt created 97 Doctors of Medicine in a single year while not numbering more than 30 students in all the Faculties put together. At other universities the cost connected with the acquisition of the doctor's degree

* M. RAYNAUD: Les médecins au temps de Molière, Paris 1862.

† IM. KANT: Versuch über die Krankheiten des Kopfes in der Ausg. sämmtl. Werke von Rosenkrantz u. Schubert, Leipzig 1838, vii, 16.

‡ Kais. priv. Reichsanzeiger, Gotha 1802, No. 169-170.

was so great that candidates without means had to renounce it altogether. The consequence was that persons of this kind either repaired to places where less money was demanded or remained content to engage in practice as licentiates of medicine. At Vienna the advancement to the doctor's degree cost up to the year 1749 about 1,000 gulden, at Göttingen some 130 thaler in 1765, at Paris 7,000 livres, and at Oxford one hundred pounds.* And this degree did not by any means give special rights in all places.

Besides numerous other practitioners entitled by law to practise medicine there was no special difficulty experienced at many places by wandering quacks, rupture-curers, cutters for stone, and cataract operators in getting permission to practise their art.

In a showy *cortége* tricked out with all manner of parti-coloured finery and attended by a harlequin, like the Dr. EISENBART immortalized in the popular ballad, these gentry roamed about to the annual fairs and Church festivals and detailed to the public the remarkable cures which they professed to have performed. With shameless effrontery they extolled the healing virtues of their medicines against consumption, deafness, and all the incurable diseases imaginable. Many declared that they had the power of at once restoring the sight, even if it had been lost for many years; others recommended pills to cure barrenness, which according to their account produced the desired effect even without coition. The executioners, who occupied a prominent position among the quacks, sold human blood which in a fresh and frothy state was regarded as a remedy for epilepsy; it was retailed according to a fixed tariff—depending on the *kind* of humanity it had flowed from: dearest was the blood of a virgin or youth; cheapest, that of a Jew† However, the wandering operators wrought the

* P. FRANK *op. cit.* vi, 3, S. 291.

† G. FISCHER *op. cit.* S. 49 *et seq.*—Des getreuen Eckharts medicinischer Maulaffe oder der entlarvte Marktschreier, Frankfurt und Leipzig 1719.—*The Tattler*, London 1723, iv, No. 243.—O. BUCHNER *op. cit.* S. 145 *et seq.*

greatest mischief. When in the public squares they exhibited proofs of their skill to the astonished multitudes amid the blasts of trumpets and the beating of drums, which were intended to drown the cries of the unfortunate patients, none thought of the sad consequences entailed too often by these surgical manipulations. But does not the saying of BACON hold good to the present day that every charlatan and every old woman is regarded as a rival of the most skilful doctor, and does not scruple to contend with him for mastery at the bedside of the patient?

END OF PART III.

IV.—MEDICAL TEACHING IN MODERN TIMES.

THE WIDE OUTLOOK OF THE NATURAL SCIENCES IN THE NINETEENTH CENTURY.

THE history of modern times begins with the great events of the last decade of the eighteenth century. The political and social forms of the present day first took shape during the French Revolution and amid the intellectual movements of that time.

The French Revolution was directed less against Monarchy than against Feudalism, the representatives of which had abused their high position in unheard-of ways. For the first time it was recognized to be a grievous injustice that one portion of the population should have to bear all the burdens of the State, while another enjoyed all the rights and privileges it had to confer; for the first time the principle was enunciated that those who maintain the State are also entitled to have an important influence upon its management. This thought was universally prevalent, forming, as it were, a constant residual product in the manifold political processes of decomposition and change which were taking place at that time. It led to the Parliamentary system, which became a legal institution in the nineteenth century in nearly every civilized country. With the removal of historical privileges and of the subordination of one class to another in the State, with the abolition of serfdom, with the introduction of civic independence, of the principle of the equality of every individual person before the law, and of the participation of the masses of the people in the government, a social revolution was effected of far-reaching importance.

Contemporaneously with the political emancipation of the middle-classes began also the increasing activity of the daily press, the development of journalism, and the popularization of art and science. An interest in the efforts made in these directions penetrated into circles which before had been entirely uninfluenced by them. All nations of any moral elevation took part in the development of culture, but especially the French, the English, and the German.

The German race, which already in the eighteenth century had produced LESSING, HERDER, GOETHE, SCHILLER, MOZART, BEETHOVEN, KANT, and other enlightened spirits, and in poetry and literature, in music and philosophy had attained a position which commanded respect, by degrees assumed the lead in medicine and the natural sciences. While at first in the history of these branches of knowledge the names met with are those of Frenchmen and a few Englishmen, since the middle of the nineteenth century the men of learning and the investigators of German origin have acquired a preponderating influence.

It was otherwise with philosophy, for this unfortunately in Germany lost touch completely with practical life under the baneful influence of scholastic pedantry, and has only rediscovered the lost path in the most recent times. The great thinker of Königsberg had with critical acuteness indicated the sources, the extent, and the limits of human thought; but the philosophers following KANT were able to add but little to his theory of knowledge, and confined themselves to a further development of his system in this or that direction. Inasmuch as they attacked directly the question of the essential nature and ultimate foundation of things—a question KANT himself had declared to be superfluous and unanswerable, limiting inquiry, as he did, to the world of phenomena—they displaced once more the problems of philosophy into the mystico-transcendental realms of speculation. The subtle hypotheses of a FICHTE who sought an answer to the enigma of existence in the conception of an *Ego*, thus arriving at an unlimited idealism, of a SCHELLING

who preached the identity of nature and spirit, and so founded "the philosophy of nature," of a HEGEL who saw complete salvation in the idea of the Absolute, and of a SCHOPENHAUER who declared the world to be will and subjective representation, might for a time captivate but could not permanently convince.

None of these systems have influenced the natural sciences more than that of "the philosophy of nature." Distinguished doctors and natural philosophers like BLUMENBACH, OKEN, KIELMEYER, J. DÖLLINGER, OERSTED, BURDACH, NEES v. ESENBECK, KIESER, K. G. CARUS, and others attached themselves to it, finding in it a definite standpoint from which to view, and form a just estimate of, the collections of empirical facts which surrounded them. Like the Romanticism which at that time dominated art and literature—the true child of an age which was struggling towards some satisfying conclusion to its efforts, self-contradictory and incomplete as they were—so too did the philosophy of nature pursue throughout noble ends, for it penetrated into the depths of men's hearts, reminded medicine of her high ethical functions and gave expression to the doctrine of the unity of the various natural sciences.

The philosophy of nature, having been injuriously affected by contact with religious mysticism, at first assumed a hostile attitude towards experimental inquiry and chose metaphysics for its arena: in the words of HAMANN "from a general knowledge of the possible it arrived at a thorough ignorance of the actual." When natural philosophy, in a spirit of senile self-glorification, applied its vague and often antiquated definitions to natural science in its state of daily progress, the only result was that the latter became entirely alienated from the former. That clumsy form of stating a proposition, introduced into philosophy chiefly by HEGEL, which, with great labour, in a newly-made dialect, succeeded in rendering the simplest things incomprehensible, contributed not a little to the

estrangement which grew up gradually in Germany between natural science and philosophy.

In other countries better conditions prevailed in this respect. In these philosophy was in close touch with the sciences and arts of real life and placed her powers at their disposal with a view to their methodical improvement. In France Positivism was founded by AUGUSTE COMTE. Like KANT, to whom in genius he was allied, COMTE had received a school-training in mathematics and the natural sciences. Positivism, in harmony with the sudden great increase of activity which experimental inquiry manifested at that time in France, excluded metaphysical and teleological explanations and demanded that every philosophical speculation and every science should appeal to our understanding in virtue of support received from facts corroborated by experience or experiment. Such a doctrine was bound to be found agreeable by investigators of nature, and it found among them numerous disciples and advocates. It was promulgated in Germany by FECHNER, H. LOTZE, H. CZOLBE and other distinguished men of science, and material necessary to its secure foundation was contributed by them. The exact school of the present day began once more to take account of philosophy, and one of the greatest investigators of nature, KARL ROKITANSKY, drew attention to its uses and significance in reference to the natural sciences and medicine. But the philosophers also were well aware that the positive knowledge of scientific facts must be presupposed as a self-evident requisite for any intellectual activity on their part which was to prove fruitful or could hope to win any serious regard.

At certain universities the chairs of philosophy were handed over to experts in natural science, such as had tested the value of observation and experiment, and thus a clear expression was given to the importance which a scientific view of nature had acquired in reference to the development of modern civilization. The civilization of

the present day has been established on the abundance of newly-discovered facts which have enriched the natural sciences during the nineteenth century, and in the knowledge of their mutual relationships and common laws, which has rendered possible a simplified view of the life of nature.

In bringing forward certain facts from the history of the various natural sciences I desire only to indicate the course of their development in a few words.

Already in the eighteenth century attempts had been made to classify minerals on a rational basis. Their external characteristics and resemblances formed the foundation of the arrangements of LINNÆUS and WALLERIUS. On the other hand AXEL F. CRONSTEDT, the Swede, regarded their chemical constitution as all-important; ABRAHAM GOTTLOB WERNER, the Saxon counsellor of mines, then made a classification of them, founded both upon their chemical and physical peculiarities, and upon their external form. To him is due the credit of having defined the limits of oryktology and geognosy and of having founded the latter science.

The improvement of the science of crystallography * was commenced by ROMÉ DE L'ISLE and HAUY and was successfully carried on by WEISS and MOHS. Others studied the chemical, optical, and electrical properties of certain minerals, and also the phosphorescence and phenomena of polarization observed in them. The appreciation of the value of chemistry as an aid to mineralogy led to the intimate association of these two sciences, which proved to be suggestive and advantageous in many ways.

LEOPOLD VON BUCH did the work of a pioneer in the subjects of geognosy and geology. At the same time, too, the subject of the formation of fossils, to which SCHEUCHZER was the first to direct attention, was

* CUVIER: Geschichte der Fortschritte in den Naturwissenschaften seit 1789, Deutsche Übers, Leipzig, 1828, 4 Bde.

diligently worked at, and afforded material for the solution of many questions of geology and anthropology.

In botany various attempts were made to discover a natural system of plants. ADANSON declared that "nature everywhere exhibits to us natural groupings," and was of opinion that classification should not certainly be based upon the similarities and differences of one particular organ, but only upon the collective phenomena and characteristics of the organism. In order to reveal this system he compared individual plants in respect of their various organs and arranged them into classes of varying degrees of affinity according to the greater or less correspondence between them. His method of classification was, above all things, wanting in lucidity, and could not, therefore, gain for itself any approval.

A more correct method was introduced by A. L. DE JUSSIEU, A. PYRAMUS DE CANDOLLE, ROBERT BROWN and others: they insisted first of all upon an accurate definition and delimitation of the families of plants, and did a quantity of valuable preparatory work in this direction. A. P DE CANDOLLE, who himself described with great care more than one hundred families, founded the doctrine of the symmetry of the plant-form. The investigations of J. GAERTNER upon the fruits and seeds of plants and R. BROWN'S monographs were of fundamental importance for morphology.

GOETHE'S doctrine of metamorphosis excited the attention of philosophers of nature rather than that of men of science. It was of a confused and indefinite character, and was first explained scientifically by ALEXANDER BRAUN who brought forward valuable information upon the form of the leaf and the development of the plant.* The anatomy of plants was diligently worked at by BRISSEAU-MIRBEL, the younger MOLDENHAWER, LINK, MEYEN, HUGO MOHL and others, who succeeded in giving definiteness to men's views upon the structure of plants. Their micro-

* WIGAND: Geschichte und Kritik der Lehre von der Metamorphose der Pflanzen, Leipzig 1846.

scopical formation was also closely examined, and the discovery that the cell is the unique ultimate element of their structure gave a new direction to morphological investigation: it demanded that a greater attention should be given to histogenesis. This was studied first upon the lower cryptogams, since the facts to be dealt with in them were simpler and less difficult to examine; then gradually the more highly organized plants were taken in hand. The results thus arrived at cast a remarkable light upon the origin and growth of organs. MOHL observed various modes of spore-formation, and in 1835 described an instance of vegetable cell-partition. SCHLEIDEN in 1838 brought forward a theory of cell-formation, which however was disfigured by so many mistakes that it was soon afterwards abandoned. Its place was taken by the theory of NAEGELI which was of a more comprehensive character, gave a defined image of the different kinds of occurrences and determined the law which controlled them. In 1839 SCHWANN enunciated the proposition that the animal cell is analogous to the vegetable cell, and in 1855 UNGER drew attention to the similarity between the protoplasm of the vegetable cell and the sarcode of the most lowly organized animals: this observation received increased support by investigations made upon the myxomycetes.

These things led to a more correct appreciation of the puzzling relations between the vegetable and animal kingdoms and also helped to remove the doctrine of the fixity of species which had for long prevailed as an incontrovertible dogma. The fecundation of plants was studied by DU HAMEL who described the way pollination is effected, and the part which is here played by many insects. This subject was thoroughly worked at from 1830 onwards, the processes which take place in the interior of the ovules being made the subject of careful examination, and sexuality being proved to exist even in cryptogams.

So, too, the processes of nutrition, of absorption and excretion, and of growth were fully described. The move-

ments of the sap, on which STEPHEN HALES had already made some interesting experiments were elucidated chiefly by DUTROCHET who asserted their connection with the phenomena of osmosis.

INGENHOUSZ found out that the green parts of plants under the influence of light absorb carbonic acid gas, separating and giving out the oxygen and retaining the carbon which in the form of organic combinations is stored up in the plants: he thus was the founder of the doctrine of the respiration and nutrition of plants. SENEBIER added some investigations upon the influence of light upon the life of the plant. Numerous works at this time dealt with the chemistry of the nutrition of plants and with the movements exhibited by them.*

Their pathology, too, was not overlooked and especially of recent years has been advanced in an extraordinary degree. Finally the subject of the geographical distribution of plants assumed a definite shape: this, inasmuch as it indicated and explained the dependence of the vegetable world upon climate and soil, acquired high importance for medical science and especially for the subject of the geographical distribution of disease.

By the discovery of new species of animals and by the careful investigation of their anatomical structure zoology gained not only a great increase of its subject-matter and improvement in its system of classification but was enabled with the help of the history of development, of comparative anatomy and of palæontology to arrive at broad views of natural history apparently capable of embracing the whole range of living and extinct forms of life. BUFFON† already approached this point of view when he declared that there is no essential difference between animals and plants, and that the series of organic life shows one uniform plan. His popular and clever way of representing the subject, of interweaving bold hypotheses with abundant facts, stimulated men of science to new investigations and aroused far

* SACHS *op. cit.* S. 276 *et seq.* † V. CARUS *op. cit.* 522 *et seq.*

and wide an interest in matters connected with natural science among large classes of the educated public.

BUFFON entered also upon the subject of the geographical distribution of the animal kingdom, and, like LINNÆUS before him, drew attention to the difference between the species inhabiting the different continents. He concluded from the fact that the forms of animal life belonging to the Arctic regions of America and Europe are identical, that there once existed a connection between the two continents, or at least that migrations of animals from one to the other were possible. An acquaintance with the trans-oceanic fauna was brought about chiefly by scientific expeditions to which naturalists were appointed. Thus SONNERAT described numerous animals inhabiting islands off the southern shores of Asia; but the greatest services in this respect were rendered by the elder FORSTER, ALEXANDER VON HUMBOLDT, and LICHTENSTEIN. So also a closer study was made of the distribution of animals in the different countries of Europe. PALLAS described several new forms.

In the meanwhile men's knowledge of the species already recognized was enriched by important observations. BONNET was the first to notice the asexual propagation of *aphides* or plant-lice. P. CAMPER and J. HUNTER discovered simultaneously and independently of one another the air-cavities of the bones of birds and the connection of these with the lungs. FABRICIUS and afterwards LATREILLE turned their attention chiefly to entomology, RUDOLPHI worked at helminthology, and LAMARCK, O. F. MÜLLER, and EHRENBERG applied themselves to the vast subject of the infusoria.

Zootomy afforded important information upon the structure of the various animals, and a comparison of their organization opened up a view which rendered it possible to form a comprehensive judgment on this subject. Comparative anatomy and physiology gained rich accessions of scientific material through the labours of J. HUNTER, F. VICQ D'AZYR, BLUMENBACH, KIELMEYER, GEOFFROY

ST. HILAIRE, CUVIER, TIEDEMANN, C. G. CARUS, J. F MECKEL, and J. MÜLLER, and the advancement of these sciences was looked upon as the proper object of zootomy. IGNAZ DÖLLINGER wrote in 1814: "The task of zootomy is to unfold the structure of animals, and in it to show the nature of life. The parallels drawn by the zootomist will be in this wise: he must collect facts and examine as to how far they tally with one another or how far they are opposed; he must compare them with the theory of life and investigate *how* one individual object has been formed through a series of metamorphoses."* GEOFFROY ST. HILAIRE laid down leading principles which might serve for the guidance of investigators.

CUVIER discovered the law of the correlation of parts—a law which J. HERMANN had already had a presentiment of—according to which every organic being forms a complete whole, particular parts or organs of which cannot be modified without modifications also occurring in the other parts or organs.

On the strength of these newly-disclosed facts classification was ventured upon. BATSCH attempted in the first place to separate the bony animals from the others; but LAMARCK was the first to bring the division into *vertebrata* and *invertebrata* clearly before the world; this distinction was universally accepted.

The greatest advance made in classification was owing to CUVIER, who founded the doctrine of types. His explanation was that in the animal kingdom there are four principal branches simultaneously existing, or "general plans on which the animals belonging to them appear to be modelled, and the subdivisions of which are characterized only by slight modifications founded upon the development or suppression of particular parts, no change, however, being made in the essential nature of the plan." K. E. v. BAER gave more definiteness to the conception of the type and

* J. DÖLLINGER: Über den Werth und die Bedeutung der vergleichenden Anatomie, Würzburg 1814, S. 17.

rendered the theory more correct, especially in regard to the history of development which CUVIER had completely disregarded.

The scientific treatment of development began at this time to assume a more conspicuous place than heretofore, and to exert an influence upon the branches of knowledge allied to it. PANDER published his original and helpful investigations upon the development of the chick, proving that the avian body is formed out of three embryonic layers. K. E. v. BAER made observations upon the other classes of the vertebrata, and referred to the different processes of cleavage in the ovum. The changes of the ovum after impregnation were observed, and its segmentation described by others also. Moreover, the development of particular organs, of the brain, for instance, the eye, the Wolffian bodies, etc., was made the subject of special study. In this way attention was drawn to the similarity of embryonic development in the various kinds of animals. JOHN HUNTER, KIELMEYER, and afterwards OKEN founded the theory that the embryos of the more highly-organized animals pass through the stages of development of the lower classes of animals.

The facts in the history of development associated with palæontological discoveries, which rendered it possible to recognize the differences existing between fossil plants and animals and the representatives of their species at the present day, shook men's faith in the immutability of form in zoology, and prepared the way for the theory of descent from other forms. As early as in the year 1804 LAMARCK declared, in referring to hybridization and the formation of varieties, that it is only because the judgment of man is accustomed to deal with small periods of time that a species is conceived by him to be unchangeable, but that in reality it does change and adapts itself to external conditions.

In 1830, LYELL published his Principles of Geology in which he contended that to explain the changes in the

earth's crust it is by no means necessary to assume that great and stupendous catastrophes have occurred, but that the forces of nature, slowly but continuously at work around us, are a sufficient explanation. He referred to the action of rivers and seas, of springs and glaciers, and compared the changes of the *inorganic* world to the minute-hand of a clock, "the advance of which one can see and hear, while the fluctuations of *living* creation are hardly to be seen and resemble the movement of the hour-hand." *

The dogma of fixity of species was gradually abandoned by most investigators of nature. Men saw that species *do* change within certain morphological limits and they were constrained to adopt the opinion that species had developed in a similar way into their present forms.

To CHARLES DARWIN belongs the never-to-be-forgotten merit of having raised the hypothesis into a scientific fact. Supported by a rich collection of observations he undertook to fathom the causes which lie at the root of an explanation of the origin of species, and he came to the conclusion that the struggle for existence and natural selection lead to a survival of the better and fitter organisms, followed by a suppression of the conquered and the gradual perfecting of the conquerors. This theory, corrected and enlarged at certain points by WALLACE, NAEGELI and others, formed the foundation of a new method of contemplating the world of organic nature.

When, soon after, the attempt was made to construct a history of creation in accordance with the ordinary course of nature, and when the place of man in relation to the other inhabitants of the earth was introduced into the sphere of discussion, the new doctrine excited the vehement animosity of those who discerned in it an assault upon religion and upon the dignity of the human race. The incompleteness of the facts, especially in palæontology, and the meagre knowledge which we possess of many processes in physiology and the history of development did

* O. SCHMIDT: Descendenzlehre und Darwinismus, Leipzig 1873, S. 117.

not certainly justify deductions of such magnitude as those which were sometimes advanced; but these clothed themselves in the unassuming garb of hypothesis and did not ask that people should accept them unconditionally, but rather that they should criticize them freely.

Religion will never have anything to fear at the hands of science if she ceases to be hostile to freedom of inquiry and recognizes her true calling to lie in the ethical education of the human race and in the perfecting of the spiritual life.

PHYSICS AND CHEMISTRY IN THE LAST HUNDRED YEARS.

WHILE mineralogy, botany, and zoology were changing from sciences merely descriptive of objects to sciences involving explanations of processes, physics and chemistry also were assuming a new form in consequence of improvement in the methods of investigation and the number of new discoveries.

This period in chemistry was inaugurated by the discovery of oxygen and the abolition of the theory of phlogiston, and was characterized by the introduction of the method of quantitative analysis.

In 1774, JOSEPH PRIESTLEY discovered oxygen by heating red oxide of mercury. At the same time he observed that the gas so obtained supported breathing and combustion better than ordinary air; but he was unable to draw the conclusions which the facts offered. He was a highly-gifted amateur who prosecuted science extensively rather than deeply. He enriched chemistry with a multitude of discoveries, and, as KOPP says, did more than professional men of science to improve our knowledge of the gases.*

LAVOISIER was the first to recognize the full significance of the discovery of oxygen. Two years anterior to it he

* KOPP *op. cit.* i. 239.

furnished an experimental proof that both in the combustion of metals and in the ignition of phosphorus and sulphur an increase of weight occurred (contrary to what was postulated by the phlogiston theory), and that such increase of weight was due to absorption of air; he was unable to say, however, whether this absorption was of the air as a whole or of only a part of it. When, thanks to PRIESTLEY, he became acquainted with oxygen, it occurred to him to seek in it the cause of this phenomenon. After numerous experiments he came to the conclusion that only one-fifth part of the atmosphere takes part in combustion and that the air consists of one part of oxygen and four parts of a gas which subserves neither combustion nor respiration. His statements upon the composition of air, water, and various acids were confirmed and rendered more complete on some points by CAVENDISH.* The theory of phlogiston being thus refuted, several questions asserted themselves which had hitherto been explained by means of it or by analogous reasoning.

LAVOISIER, finding oxygen to exist in all the acids which he examined, pronounced it to be a necessary constituent part of all these bodies—to be that, in fact, which had previously been designated "primitive acid;" he also alluded to the part which the element plays in the oxidation or so-called "calcination" of metals. BLACK had already correctly described the nature of caustic alkalies. LAVOISIER disclosed more thoroughly the importance of oxygen in respiration and its effect upon the blood, and thus led the way to a fundamental change in the physiological explanation of these processes.

The discovery of oxygen also exerted a great influence upon pathology and therapeutics. Some doctors discerned in it the "air of life" upon which health depends. They thought that certain diseases depended upon the excess or deficiency of oxygen and they employed it in therapeutics.

* KOPP: Beiträge zur Geschichte der Chemie, Braunschweig 1875, iii, 254 *et seq.*

LAVOISIER'S doctrines found acceptance first in France, the country of his birth. Among his disciples were GUYTON DE MORVEAU who rendered a service by introducing a rational chemical nomenclature, FOURCROY who gave his attention to medical chemistry, and BERTHOLLET who found out the composition of ammonia, was the first to observe the bleaching property of chlorine and recognized its importance in daily life, discovered chlorate of potash and fulminate of silver, carefully analyzed hydrocyanic acid and determined its composition, corrected LAVOISIER'S mistake in asserting that all acids contain oxygen, founded the doctrine of chemical affinity referring to the importance of the quantitative relations which here assert themselves, and advanced industrial chemistry, especially in the departments of the manufacture of steel and saltpetre.

KLAPROTH was the first in Germany to support the antiphlogistic theory. Chemistry owes to him the discovery of several elements and the correction of various erroneous statements which had been made by other investigators. His analytical labours were characterized by their accuracy, surpassing in this respect even those of VAUQUELIN, who about the same time was elaborating mineralogical chemistry and discovered chromium and glucinum. He directed his attention also to organic chemistry, and discovered, amongst other things, quinic acid.

In the beginning of our own century J. L. PROUST enunciated the law that chemical combinations always manifest a definite composition. He also made important contributions to the chemistry of certain metals and discovered grape-sugar.

The Englishman DALTON attempted to explain the definiteness of chemical combinations by the atomic theory, in which he assumed that the atoms of the various elements unite with one another in definite proportions depending upon their weight; he discovered also the law of multiple proportions.* The stoichiometrical investigations of

* A. WURTZ: Geschichte der chemischen Theorien, Deutsche Übersetzung, Berlin 1879, S. 29 *et seq.*

DALTON were confirmed and extended by BERZELIUS, and also by WOLLASTON, who introduced a classification by equivalencies instead of that by atomic weights.

This subject received enlargement at the hands of GAY-LUSSAC who recommended that in analyzing chemical combinations attention should also be paid to the volumetric relation of bodies when in the gaseous state. In 1805, he, in conjunction with ALEXANDER VON HUMBOLDT, discovered that water is composed of one volume of oxygen and two volumes of hydrogen. Afterwards he examined other combinations in the same way and established the fact that their constituents in the gaseous state stand in definite relations of volume to one another; he thus laid the foundation of the theory of volumes. GAY-LUSSAC published the valuable results of his labours upon the expansion of gases by heat; upon the density of vapours, for the determination of which he contrived peculiar methods of investigation; upon iodine (which had been discovered shortly before) and its combinations, and also upon several combinations of chlorine. He gave the first correct description of the composition of hydrocyanic acid, explained the nature of cyanogen, discovered hydriodic acid and hyposulphuric acid and simplified the examination of many bodies made use of in daily life.

The quantitative analysis of chemical combinations entered upon a new stage when it became known that the electrical current decomposes them. NICHOLSON, CARLISLE, CRUIKSHANK, BERZELIUS and HISINGER made several interesting observations on this subject, and HUMPHREY DAVY gave them a theoretical basis. He pointed out that water is decomposed by means of the electric current into oxygen and hydrogen, and salts into acids and bases of which the former bodies in each case are discharged at the positive, the latter at the negative pole of the Voltaic battery; he proved the decomposability of several compounds, as for instance the fixed alkalies, the alkaline earths, baryta, strontia, magnesia, lime, etc., and gave it as his opinion that chemical and electrical effects

are manifestations of the same force; he thought that these manifestations took the form of electricity when larger masses come into contact, that of chemical affinity when smaller particles met. DAVY'S labours gave the impulse to a series of electro-chemical investigations which were instituted by THÉNARD, the discoverer of peroxide of hydrogen, and GAY-LUSSAC; they greatly increased our knowledge of certain elements, especially potassium and sodium, and improved the technical methods of research.

At the same time SCHWEIGGER and BERZELIUS elaborated the theory of electro-chemistry; the latter proceeded upon the assumption of the electrical polarity of the atoms of bodies, and, in conformity with it, asserted that chemical combinations arise from the juxtaposition of the opposite poles of the atoms of different bodies.

In 1834 FARADAY discovered the important fact that the chemical effect varies in quantity directly as the amount of current electricity producing it. By this he succeeded in establishing a measure for determining the quantity of electrical action present in any case. By studying the effect of electrical action upon different combinations he found that the weights of the bodies decomposed by the electric current correspond with their chemical equivalents. The whole subject of electro-chemistry thus served to illustrate the doctrine of chemical affinities.

Much successful work was done in other parts of chemistry. DAVY corrected the erroneous views about chlorine, and introduced the conception of hydrogen-acids; he was moreover the first to draw attention to the intoxicating effect of nitrous oxide, a gas discovered by PRIESTLEY. His investigations upon the pigments of ancient works of art and upon the means of rendering legible the manuscripts found at Pompeii also deserve mention. BERZELIUS did suggestive and original work in all departments of chemistry and created a school which produced a succession of distinguished chemists during the nineteenth century such as C. GMELIN, MITSCHERLICH,

GUSTAV and HEINRICH ROSE, WÖHLER, MAGNUS, ARFVEDSON and others. He facilitated quantitative analysis by bringing the blowpipe into more general use, discovered and described several elements not known before and made valuable contributions to animal chemistry.

FARADAY worked at the liquefaction of gases and at the improvement of the steel and glass manufactures, while DUMAS instituted experiments upon the specific weights of various gases. MITSCHERLICH formed inorganic substances synthetically and showed that they were identical with the minerals occurring native; published the results of important work upon the combinations of sodium with iodine and upon the degrees of oxidation of manganese, and, by his discovery of isomorphism and dimorphism in chemistry, opened up a branch of the subject having a direct physical bearing and full of importance for mineralogy. The discovery of the fact that bodies differing in chemical composition may possess the same crystalline form and may have their constituent elements replaced by others without changing such form, whereas other bodies like sulphur may exhibit different forms while retaining the same chemical composition exerted a great influence upon the further development of chemistry.

With LIEBIG and WÖHLER organic chemistry came into prominence. A field of work was here opened to scientific research hitherto scarcely, if at all, cultivated. The study of organic combinations, their composition and properties, and the attempt to produce them artificially, constituted a series of problems, the solution of which has fully occupied the chemists of the nineteenth century.* Then it came to be recognized how manifold and far-reaching are the relations between chemistry and practical life, and of what value that science is in agriculture, in the various handi-

* A. LADENBURG: Vorträge über die Entwickelungsgeschichte der Chemie in den letzen hundert Jahren, Braunschweig 1887, S. 117 *et seq.*—H. KOPP: Die Entwickelung der Chemie in der neueren Zeit, München 1873, S. 518 *et seq.*

crafts and industries, in painting, in war, in dietetics, physiology, pharmacology, and in the work of the dispenser. Agricultural chemistry, technological, physiological and pharmaceutical chemistry have gradually developed into independent branches, and chemistry in a broad sense has become the science of everyday life which regulates and satisfies the wants of man.*

In physics this period was inaugurated by the discovery of the remarkable electrical phenomena which were rightly interpreted by VOLTA. This aroused extraordinary interest and furnished the occasion for a series of labours which resulted in the improvement of the Voltaic pile, the recognition of the effects produced by it and of the conditions required to produce them, and the discovery of other important things. The identity of galvanism and electricity was recognized, and the relative value of the different metals in giving rise to electrical currents was established. The observation of OERSTED that the magnetic needle is deflected by the current was one of fundamental importance; for the connection between electricity and magnetism was thus shown. ARAGO and GAY-LUSSAC soon pointed out in addition that the current not only deflects but magnetizes.

SCHWEIGGER constructed the first galvanometer and AMPÈRE discovered the influence exerted by electrical currents upon one another, tried to give an explanation of the real nature of magnetism, and was the first to evolve the idea of the electro-magnetic telegraph. At the same time the relations between heat and electricity became the subject of observation and SEEBECK discerned a new source of electricity in the so-called thermo-electricity. OHM discovered the laws which hold good for the conductivity of wires and for the relation existing between intensity of current, electromotive force, and resistance, and reduced them to a mathematical formula which can be easily grasped.

FARADAY was the first to detect induction currents, and

* KOPP: Geschichte der Chemie, i, 270 *et seq.*

studied the relations existing between electricity and light. The improvements in the technical methods of investigation, the invention of suitable instruments and apparatus, and the scientific data afforded by their help, constituted a further extension of our knowledge in this direction.

For physiology two discoveries in physics were of the highest significance, namely, the establishment of the fact that electrical currents exist in the animal body, and the discovery of the law of conservation and transformation of energy. It was proved by the latter that electricity, heat, and mechanical work can be transformed or resolved into one another, and are correlated manifestations of the same energy. In this way was discovered that bond which unites in common the most important functions of organic life. The application of electricity to technical purposes, for instance, to telegraphy, to lighting, to driving machines, etc., belongs also to the most recent times.*

The close connection which united physics to mathematics, and which enabled the latter to be used as a pioneer for advance as well as a check on the progress already made, and the conscientious and firmly-grounded method of experiment secured important results for research in the other branches of the former science. These were destined to stand out most conspicuously in the domain of mechanics. LAPLACE, YOUNG, GAUSS and others undertook the task of establishing a clear conception of the laws which lie at the root of various phenomena, such, for example, as capillarity. Astronomy, meteorology and climatology also owed to these labours many a suggestion and great extension of their scientific boundaries.

The development of the theory of heat was affected by the same influence. Count RUMFORD observed that heat is produced by friction, and thence laid the foundation of the mechanical theory of heat.† Observations upon the specific

* E. HOPPE: Geschichte der Elektricität, Leipzig 1884, S. 118 *et seq.*

† G. BERTHOLD: Rumford und die mechanische Wärmetheorie, Heidelberg 1875.

heat of bodies, investigations upon the degree of expansion which they undergo through the influence of heat, upon the elasticity of steam, and especially the experiments in respect of the heating-power of fuels claimed the attention of physicists more and more in proportion as they subserved the requirements of daily life. The law of the mechanical equivalent of heat* cast a strong light upon many of these questions, and pointed out the way in which a solution might be found.

Optical science was advanced by the victory of the undulatory theory of light, and by numerous experiments. YOUNG made use of the principle of the interference of light to explain many phenomena, and FRESNEL studied the diffraction of light. In 1809 MALUS discovered polarization by reflection, and not long after BREWSTER† drew attention to biaxial crystals and to the intimate relation between optical properties and crystalline structure. He afterwards constructed also the first stereoscope. The chemical effects of light were, moreover, subjected to a careful examination. This led to the discovery of photography, with which are associated the names of DAGUERRE, NIÈPCE, and TALBOT. FRAUNHOFER, like WOLLASTON before him, observed the dark lines in the solar spectrum; but KIRCHHOFF was the first to give an explanation of them.

The discovery of spectrum analysis afforded information upon the physical nature and chemical composition of the heavenly bodies, and threw open a new field of research. The improvements in optical apparatus, especially the invention of achromatic telescopes [by DOLLOND], as well as that of achromatic microscopes, which were first constructed by HERMANN VAN DEYL and FRAUNHOFER between 1807 and 1811, and were afterwards rendered still more complete through the labours of PLÖSSL, SELLIGUE, CHEVALIER AMICI, OBERHÄUSER, HARTNACK, and others, had the

* Determined by JAMES PRESCOTT JOULE.—E. H. H.

† D. BREWSTER: Philos. Transactions, Lond. 1818, p. 199 *et seq.*

highest significance for all departments of natural investigation.

The science of acoustics was enriched by some valuable work at the hands of CHLADNI, OHM, and others; but the scientific foundation of this branch of physics was first laid in the most recent times, and is chiefly due to the labours of HELMHOLTZ.

Physics and chemistry have become the sciences pre-eminently ancillary to medicine, and are called to its aid in physiology as in pathology, in surgery no less than in the treatment of internal diseases.

MEDICAL SYSTEMS AND THE PROGRESS IN ANATOMY AND PHYSIOLOGY.

THE doctrine, which gained general acceptance through the teaching of HALLER, that sensibility and irritability form the distinguishing peculiarities of the animal organism, the new discoveries in chemistry, and above all the phenomena of galvanism called into existence a number of medical systems in which the attempt was made by the aid of these facts to explain the processes undergone by the human body in health and disease, and to gain a firm basis for the science of therapeutics.

A certain proportion of doctors discerned, like the Methodists of antiquity, in every physiological and pathological manifestation a stimulation or a relaxation, the cause of which was at one time assigned to the action of the nervous system, as by CULLEN, at another sought for in greater or lesser irritability, as by JOHN BROWN and his adherents. The theory of irritation was extended and elaborated by C. GIRTANNER, who alleged oxygen to be the actual principle of irritability, by RÖSCHLAUB, who referred to the influence of the natural disposition or organization, by BROUSSAIS who substituted "inflammation" for "stimulation" and tried to support the theory by patho-

logical anatomy, and by RASORI who adapted the theory of BROWN, intended for the cold torpid natures of the north, to the conditions of his own southern home. This theory became very widely spread, but was as quickly given up again as soon as its untenability became manifest. Its position in reference to scientific research was one of coldness and indifference and it encumbered practical medicine with a troublesome polypharmacy which often did more harm than good.

The vitalistic theory was of more solid worth; it contended with the irritation theory for dominion in medicine and finally wrested victory from it. It took its origin from Montpellier, and in many respects recalled the animism of STAHL; but it differed advantageously from the latter in the fact that in considering the general principle of life which gives rise to order and harmony in the organism, it by no means neglected the study of the special functions and component parts of the body, and did not, like it, make use of the soul to explain all, even the simplest, processes of life, but only had recourse to it to elucidate the ultimate active causes at work in the animal organism. It never succeeded in becoming the chief figure in the picture of contemporary medicine, but had to be satisfied with imparting to it its characteristic and predominant colour.

Among its representatives were investigators like BORDEU, BARTHEZ, GRIMAUD, PINEL, BICHAT, CHAUSSIER, and others in France, ERASMUS DARWIN in England, BLUMENBACH, J. C. REIL, and others in Germany; men who stood at the head of scientific advance and afforded by their works the proof that the vitalistic theory was not a barrier to progress. This is, to a large extent, the reason why it still endured when natural philosophy was the prevailing influence in Germany and the physiological school of medicine in France.

But it led to certain errors, especially in the field of therapeutics. Those who practised mesmerism and homœopathy maintained that their method of treatment

acted directly upon the vital powers. If a cure resulted it was, in the case of the first, chiefly dependent upon the phenomena of hypnotism, metallo-therapeutics or other agencies which only in the most recent times have been subjected to careful observation; in the case of the second, to the effects of mechanisms and forces already present in the body and which exercise a controlling and curative power. Vitalism got beyond its depth when it strove to analyze the complicated processes of life into their several factors and to explain them in accordance with the general laws of nature.

Experimental research, which all enlightened spirits since the time of ARISTOTLE had cherished as the unique source of knowledge, became gradually the order of the day and men looked askance at the invention of medical systems in which facts had the smallest, hypotheses and speculations the largest, share. Whenever, in the medical history of the 19th century, research took any special direction, as for instance towards questions of physiology, of pathological anatomy, or (in the most recent times) of hygiene, and in this way influenced the development of the whole science, it was not owing to an arbitrary love of systematizing, but rather to the experience which had been gained that the elaboration of particular branches is the course most calculated to enrich the science as a whole.

It is not my purpose here to enumerate all the discoveries and advances made during our century in the various branches of medical science. I must confine myself to citing the great achievements of medicine and not allow myself to describe the individual stones which enter into the composite mosaic structure of the science of to-day.

The anatomical formation of the human body was already fairly well known to science at the beginning of this period; it was merely a question of filling up some gaps in the knowledge of special parts, notably in the case of the vascular and nervous systems and of the sense organs.

So too it was incumbent upon investigators to get a clear insight into the minuter structure of the organs now that, with the improvement of the microscope and the introduction of new technical aids, this could be attempted with better prospects of success.

An endeavour was also made to regard anatomy from other than the purely descriptive standpoint. The various parts and organs of the body were considered in order according to their positions and were studied in their relations to the structures adjoining them and the importance of these relations in regard to surgery was discussed. While detailed study was thus being given to topographical and surgical anatomy, the influence of development upon the build and formation of the parts of the body was the subject of research; and in this manner an opportunity was given of viewing anatomy from a purely morphological point of view. A rich store of material, still continually increasing, lay already at hand for the study of comparative anatomy, and now attention began to be turned to the peculiarities of, and the differences between, the races of mankind and in this way the ground began to be prepared for a scientific treatment of anthropology.

Among the most distinguished doctors who lived at the end of last century was T. SOEMMERING. His scientific work extended over all the paths in which contemporary anatomical research was moving. Even his inaugural dissertation upon the base of the brain was a work of enduring value. He abundantly fulfilled the expectations which he then aroused. His excellent illustrations of the eye and the other sense organs, his luminous description of the anatomical structure of the human body, his researches into the corporeal differences between Negroes and Europeans and his embryological writings have advanced science in many ways. He even attempted to explain the origin of malformations by means of the history of development.

Descriptive anatomy has in the course of the last hundred

years received valuable contributions to its subject matter and by its connection with the history of development and with comparative anatomy has become of much deeper scientific import.

Osteology was in its macroscopical aspect brought to a state of comparative completeness. SOEMMERING sought to lay down the lines of an ideal female skeleton just as S. ALBINUS had done in the case of the male skeleton; he employed for this purpose the corpse of a wonderfully beautiful maiden of twenty years of age who had lived at Mainz, and which had been handed over to the anatomical institution; he compared this body with the consummate proportions of antique statuary just as ALBINUS had based his portraiture on the form of the Belvedere APOLLO.*

In myology care was taken to observe the origin and insertion of muscles, their relative positions and their participation in the structure of particular parts of the body, and the occurrence of any varieties.

The subject of the vessels and nerves was most in need of improved teaching. The former were successfully worked at by MASCAGNI, G. BRESCHET, J. and C. BELL, TIEDEMANN, BERRES, V. FOHMANN and others: the most important progress made in the knowledge of the latter was due to ANTONIO SCARPA who was the first to describe the naso-palatine nerve and who gave fresh information on the course of the cranial nerves and on the structure of nerves and of the sense organs; to CHARLES BELL who published a comprehensive description of the brain and the nervous system; to EMIL HUSCHKE and BENEDICT STILLING whose wonderful labours upon the fasciculation of the brain and spinal cord formed the starting point for the more recent investigations on these parts.

The researches into the minuter structure of different parts of the body led to the foundation by BICHAT of a new

* RUD. WAGNER: Soemmerings Leben und Verkehr mit seinen Zeitgenossen, Leipzig 1844, ii, 59.

branch of learning, that namely which treats of the tissues. Even in his dissertation upon the membranes which corresponds somewhat closely with A. BONN'S treatise on the same subject, but chiefly in his General Anatomy he argued that the body is made up of different kinds of tissues, and he illustrated their peculiarities and distribution. These observations were of great importance not only for anatomy but also for pathology; for they threw light upon the origin and extension of diseases from a point of view which had till then not been thought of.

The improvement of optical aids and especially the construction of achromatic microscopes rendered possible a thorough investigation of the minute structure of the tissues. The results of these researches to which SCHWANN'S discovery of the animal cell imparted a histogenetic interest affected our knowledge of every organ of the body and laid the foundation of a storehouse of learning on the subject of microscopical anatomy, to the building and extension of which JOHANNES MÜLLER, EHRENBERG, PURKINJE, HENLE, R. WAGNER, VALENTIN, MAX SCHULTZE and nearly all the distinguished anatomists of this century have contributed.

For mastering the subject of the origin and development of the human embryo a valuable store of scientific material was afforded by the facts known of the general history of development, of comparative anatomy, and of the generation of animals. The discovery of the germinal vesicle by PURKINJE, and of the germinal spot by R. WAGNER, followed close upon the labours of PANDER and of BAER, which are spoken of by KÖLLIKER as "the best work that embryological literature of any age or country has to show."*

Numerous observations were made by celebrated investigators,—among whom only HEINRICH RATHKE, REICHERT, T. BISCHOFF, and R. REMAK can be mentioned here,—upon the phenomena of generation and upon the gradual

* A. KÖLLIKER: Grundriss der Entwickelungsgeschichte, Leipzig 1884, p. 3.

formation of the human embryo, and satisfactory answers were given to most of these uncommonly difficult questions.

Comparative anatomy was worked at with diligence and with success. J. F. BLUMENBACH collected all the facts touching on comparative anatomy which had been stored up in literature by earlier observers, and added to them a number of observations of his own. It was he who first undertook the task of determining the anatomical differences between the various races of man,—especially Europeans, Negroes, and Indians,—and the anthropoid apes, having regard in this to the conclusions suggested by the contemplation of the sculpture of ancient times, and by the dissection of several Egyptian mummies. Amongst his discoveries was that made during the dissection of the eye of a seal, namely that the axis of that organ admits of being readily lengthened or shortened so as to permit the animal to see clearly in media of such different densities as air and water.* His far-famed collection of skulls of various nationalities had a stimulating influence upon the study of this important part of ethnology. A series of important achievements was now effected in the subject of comparative anatomy, and this science formed even up to modern times an inexhaustible field for investigators. The discoveries, following so quickly on one another, gave life to zoology, anatomy, and the history of development, and contributed chiefly to give a firm footing to that thorough morphological conception of organic life which at the present day characterizes these branches of knowledge. The application of anatomy as an aid to the statuary's art, and its cultivation for surgical purposes at the hands of MALACARNE, FRORIEP, VELPEAU, ROSENMÜLLER, T. BOYER, and others were measures followed by considerable results.

Much more conspicuous, however, has been the progress made by physiology during our century. From being a

* K. F. H. MARX in den Sitzungsber. d. Göttinger Soc. d. Wissensch. vom 8 Februar 1840, S. 22.

subject still for the most part founded upon speculation and hypothesis and dominated by mystical, teleological, and vitalistic ideas, it has now become one of the real natural sciences, the facts of which are supported by mathematical and physical laws, by chemical processes, and by anatomical observations, and are susceptible of experimental proof.

The special physiological functions of the human body have stepped into the place of an ambiguous "vital power," an expression once used to cover up great gaps in men's knowledge of organic life. These physiological functions have had their significance in relation to the process of life determined and tested by observation and experiment. This has been achieved by the help of an improvement in the details of the methods of research which has been rendered possible by the invention and employment of suitable apparatus, and favoured by the use of greater precision in the questions put and the answers given, and in the way seemingly secondary matters have been taken into account. Experiment came to be appreciated at its full value, and MAGENDIE, FLOURENS, CLAUDE BERNARD, and numerous German investigators prized most highly this powerful aid to inquiry.

Chemistry yielded some conclusions upon the composition of the body and its constituent parts. The analysis of the various tissues and fluids of the body, especially of the blood and urine, led to a new conception of the human organism and its functions.

Some insight was thus gained into the chemistry of nutrition, and into the part played by the albumenoids, carbohydrates, and fats in the economy of the human body. The relations between the income and output of the body, the metabolic processes, the renewal of the blood, the formation of the secretions and excretions, the source of animal heat, and other matters were specially illustrated by the labours of LIEBIG, WÖHLER, DUMAS, GMELIN, and their pupils and successors.

The subject of digestion was studied more particularly

by MAGENDIE, GMELIN, J. N. EBERLE, HELM, BEAUMONT, and BLONDLOT, whose experiments with gastric juice led to important results, by CLAUDE BERNARD, who investigated the action of the pancreatic juice upon fats, and discovered the glycogenic function of the liver, and by many other distinguished investigators. DUTROCHET explained the processes of absorption and elimination by the phenomena of osmosis discovered by the Abbé NOLLET, and studied the degrees in which various animal membranes permit diffusion to take place through them. ANDRAL and GAVARRET, BECQUEREL, SCHERER, NASSE, LEHMANN, and others worked at the physiology of the blood.

The chemical composition of the blood, its colouring matters, its corpuscles, its coagulability, etc., were investigated, and the physical conditions of its movement in the vessels, the blood-pressure, the mechanism of the heart considered as a pump, the phenomena presented by the heart in all other respects and by the pulse, were, with the help of suitably constructed apparatus, rendered subjects of more exact knowledge.

In addition to the labours of E. H. WEBER, VOLKMANN, FLOURENS, and others, who in this department rendered distinguished services, mention must also be made here of the important researches upon the influence of the nervous system on the movements of the heart and on the vascular system. EDUARD WEBER referred to the part played by the *vagus* in regulating the action of the heart; it was recognized afterwards that it is here really a question of the fibres of the *accessorius*. CLAUDE BERNARD discovered the vaso-motor functions of the cervical sympathetic, and probably by this suggested those researches which led to the discovery of the vaso-motor centre in the *medulla oblongata*. The centre for the respiratory movements, the *point vital*, was discovered in 1837 by FLOURENS after LEGALLOIS had already drawn attention to the importance of the *medulla oblongata* in regard to the respiratory act.

Other investigators threw light upon the mechanism of respiration, the functions of the muscles which take part in it, the interchange of gases in the lungs and the relation this bears to the colour of the blood; they attempted also to measure the force exerted by the lungs in inspiration and expiration, as well as the volume of air employed in these acts. The foundation of spirometric and manometric measurements of lung capacity, by which some help is given in diagnosing pulmonary diseases, was the work of JOHN HUTCHINSON and WALDENBURG.

The phenomena of motion also aroused earnest attention. Ciliary movement, which had before been thought to be limited to the lower animals, was observed by PURKINJE in the human body also; molecular movement only came under observation in quite recent times. The mechanism of human locomotion was well-nigh exhaustively treated by the brothers EDUARD and WILHELM WEBER.

The discovery of electric currents in muscles directed attention to the chemical and physical processes which take place in the interior of muscles. In the same way the electricity of the nerves suggested a multitude of problems, the solution of which still occupies the minds of philosophers and investigators.* I have already pointed out how important for forming a judgment upon the acts performed by the organism is the law of the conservation and metamorphosis of energy discovered by J. R. MAYER.

In 1811, CHARLES BELL raised into the position of a scientific fact the anatomical distinction, already suspected by GALEN, between the motor and sensory nerves, by bringing forward the proof that the former arise from the anterior, the latter from the posterior roots on the spinal cord. He hit upon a discovery of such extraordinary importance for the physiology of the nerves by a comparative study of the anatomical and physiological relations of the cranial nerves and especially of the two roots of the

* E. DU BOIS-REYMOND: Untersuchungen über thierische Elektricität, Berlin 1848, Bd. i, S. 29 *et seq.*

trigeminus, the analogy of which with the spinal nerves had already been noticed by SOEMMERING and PROCHASKA. MAGENDIE, and JOHANNES MÜLLER in a greater degree still, confirmed BELL'S discovery by convincing experiments.

The doctrine of reflex movement already advanced by DESCARTES, and plainly enunciated by PROCHASKA, to which MARSHALL HALL, in 1833, gave a scientific foundation by his observations, and which JOHANNES MÜLLER corrected in certain points and demonstrated in a clear, intelligible manner, now constituted a recognized addition to science. The functions of the several nerves and the significance of the different nervous formations, as of ganglia, for instance, were determined by experiment. Even a solution of the difficult problems offered in the physiology of the central nervous system was attempted.

F J. GALL thought that in examining and comparing the skulls of persons, possessed of definite peculiarities of intellect or character, he had observed that certain localities were more prominent than others. Adhering to the old theory that the faculties of the mind are definitely localized he inferred that intellectual centres are accurately mapped out in the brain and can be recognized by the increased vaulting of the cranial surface at particular spots. Although he was anxious to support this hypothesis by anatomical investigations, speculation really had a preponderating influence. His method of localizing and distributing the faculties of the mind was an arbitrary one, and his assumption that such give any characteristic indications upon the surface of the skull was an entirely erroneous one. For all this, he must be credited with having rendered the service of advancing the anatomical investigation of the brain and of stimulating men to a scientific study of the skull, a subject undertaken with great success by C. G. CARUS, HUSCHKE, and others.

It was reserved for the improved methods of research of modern times to throw some light into the dark places of cerebral physiology. By the help of these it became

possible to trace out carefully the course of the nerve-fibres in the brain and spinal cord, to determine their distribution in these organs, and to observe the minuter structure of the grey substance and the different forms of its cells; while at the same time by experiments on living animals, which consisted of effecting a local destruction of, and consequent abolition of vital functions in, certain parts of the central nervous system, men sought to determine the normal functions of such parts. A comparison was made between the results thus obtained and observations made at the bedside or in the post-mortem room.

The physiology of the sense organs was also the subject of assiduous study. The origin of the visual act, the perception of colours, the importance of that part of the eye which is sensitive to light, the mechanism of accommodation, the action of the refractive media, intraocular appearances, binocular vision, the subject of the horopter, etc., were all submitted to thorough examination and rendered intelligible by the accumulation of numerous facts. In the same way the senses of hearing, smell, and taste, and tactual and general sensation were studied individually and made subjects of scientific knowledge.

Physiological research however has not only succeeded in rendering an almost complete account of the problem of the functions and laws of the human organism in health: it has, in addition, brought forward a number of observations which have prepared and smoothed the way for an explanation of phenomena manifested by the body in disease.

DIAGNOSIS, PATHOLOGICAL ANATOMY AND EXPERIMENTAL PATHOLOGY, NOSOLOGY AND MATERIA MEDICA.

PATHOLOGY, the science which deals with disease, has been marked throughout by stages of development similar to those which have characterized physiology. After men

had come to recognize the hopelessness of attempts to fathom the essential nature of disease by bold but ill-founded hypotheses and philosophical speculations, they applied the analytical method to this subject also and began by making sure of and examining those concrete facts of which the whole picture of disease is made up.

The perfecting of the appliances used in diagnosis gave rise to a deeper and more thorough study of the symptoms of disease and the startling advance made in pathological anatomy held out a promise that valuable conclusions would be arrived at concerning the changes lying at the root of such symptoms. By a comparison between clinical observations and notes taken in the post-mortem room, the development and essential nature of most diseases became, by degrees, more intelligible.

To physics and chemistry for the most part we owe the advances made in the art of diagnosis. During last century percussion was practised only by a few as, for example, by M. STOLL; it fell almost completely into oblivion and first under the influence of CORVISART assumed the place which it deserves among the means of diagnosis used at the bedside. Having had his attention drawn to it by AUENBRUGGER'S almost forgotten treatise, CORVISART tested the observations there laid down during a period of twenty years, corrected and extended them by his own private experience and then published his famous work on percussion, in which he did full justice to the services rendered by the discoverer. Percussion was rendered more perfect in many ways by PIORRY, who introduced the plessimeter, by WINTRICH who recommended the employment of a hammer, by SKODA especially who furnished a correct explanation of the various sounds heard on percussion and showed a reforming and inventive genius in all directions, by TRAUBE and others.

Auscultation also at the same time underwent reformation and scientific improvement. Whereas before it had been only occasionally practised and then by the direct

application of the ear to the body of the patient, since the time of LAENNEC, who introduced the use of the stethoscope or mediate auscultation, it became a method systematically and constantly used as an aid to diagnosis. It became well-nigh indispensable for examining cases of pulmonary or cardiac disease being here the most important, at times the only available, aid to diagnosis.

But other departments of medicine also owed it much; thus LEJUMEAU DE KERGARADEC and soon after him MAYOR discovered the sounds of the fœtal heart while auscultating the abdomen of a pregnant woman, and in this way furnished us with a way of recognizing the presence of life in the fœtus.

Besides these physical means of research to which must be added mensuration and the use of the clinical thermometer—a method elaborated in modern times chiefly by WUNDERLICH—the advance of the art of diagnosis was largely contributed to by chemistry and microscopy.

The existence and the severity of many diseases as well as their aggravation or abatement can be certainly affirmed only by the chemical proof that definite substances found in certain excretions—such as albumen or sugar in the urine—are either contained in a certain proportion or show a tendency to increase or to diminish in quantity as the case may be. The chemical analysis of pathological products acquired high importance in the study of diseases; particularly in reference to the theory of toxic agencies.

And in no less degree was microscopical research in many cases entitled to respect, since it gave information of the presence of histological elements of a certain kind, which justified certain conclusions concerning the nature of the disease under investigation. A careful observation of all the symptoms and a scrupulous consideration of all the conditions bearing on the case constituted the necessary and proper preliminary to every diagnosis.

The post-mortem appearances and their bearings upon the symptoms during life were, with a similar object, sub-

jected to careful study. Pathological anatomy acquired an unexpected importance in relation to the subject of disease; it assumed, as it were, the control of, or became a check upon, diagnosis. It developed first under the influence of BICHAT'S labours in France: numerous works dealt with general and special pathology, for illustrating which a considerable mass of facts had been discovered. In England, too, under the influence of J. HUNTER'S work, and in Germany, distinguished anatomists and clinical observers like P. FRANK, A. R. VETTER, J. F MECKEL, LOBSTEIN, JOHANNES MÜLLER and others directed their attention to pathological anatomy.

The period of this science's prime however began with ROKITANSKY who laid under contribution the rich pathological material of the General Hospital at Vienna. Possessed of opportunities enjoyed by none of his contemporaries he was enabled to collect a series of specimens illustrating natural and obvious types of pathological changes which included nearly all important diseases. While ROKITANSKY facilitated the understanding of the subject of pathological anatomy he at the same time enlarged its boundaries by a number of discoveries and went deeply into the investigation of pathogenetic influences. He was not contented with asking *what* pathological processes were, but sought also to discover *how* and *why* they arose, and to get an insight into their cause and development; as WUNDERLICH says, he tried to turn pathological anatomy into anatomical pathology.

Cellular pathology, a system constructed by VIRCHOW upon the basis of the cellular theory, impelled men more and more to examine minute pathological changes,—microscopical elementary forms—and led to the foundation of pathological histology. It is true that afterwards by the discovery of many new facts some rotten supports of the cellular pathology were removed; but the foundations remained firm and to this day bear the edifice of pathological teaching.

The stability and precision of the science were extraordinarily increased by the introduction of experimental tests into pathological investigations. CLAUDE BERNARD by injuring a particular part of the *medulla oblongata* produced glycosuria. By the administration of phosphorus its remarkable effect upon bony tissue was recognized and its connection with what is now known as phosphorus-necrosis was inferred.

The methodical employment of experiment constituted a great advance in pathology; it decided many weighty questions in that science and created "a physiology of man in sickness," which in conjunction with pathological anatomy laid the foundations of a "biology of disease" and proved that the same natural laws prevail both in pathology and in the physiology of the healthy organism. Pathology has in this way become one of the true natural sciences.

The general processes of disease as well as the conditions present in the special affections of particular organs were carefully investigated and brought within range of scientific observation. CORVISART studied the pathological alterations of the heart and great vessels, a subject worked at also by HODGSON, LATHAM, HOPE, STOKES, BOUILLAUD, SKODA, TRAUBE and others. Later on, the changes in the blood were brought within the sphere of observation and chlorosis and leukæmia recognized as individual diseases. G. L. BAYLE published investigations, which attracted attention, upon pulmonary consumption and its relation to the appearance of tubercle, and remarked on the similarity of this deposit in the different organs. ANDRAL, SCHÖNLEIN, TROUSSEAU, who published a treatise on laryngeal phthisis, and others also studied the same subject, on which however no certain conclusion was arrived at until the most recent times, when the discovery was made that tuberculosis is an infective disease. By his work on the inflammations of the mucous membranes BRETONNEAU founded the teachings upon diphtheria, the relations of

which to catarrh and to croup were explained by later observers.

The invention of the laryngoscope and its adaptation to medical practice brought about a complete revolution in laryngological inquiry, and rendered possible greater precision in the observation and treatment of diseases of the larynx.

At the same time endoscopy, a method of observation previously attempted, led to remarkable results in other directions. CRUVEILHIER and ROKITANSKY explained the origin and nature of "simple ulcer" of the stomach; PETIT, SERRES, P. A. LOUIS, and others established the diagnosis of the so-called abdominal typhus or enteric fever, and J. R. BISCHOF observed the intestinal ulcers characteristic of that disease.

The pathology of the liver was advanced chiefly by G. BUDD, ANNESLEY, FRERICHS, and others, and that of the kidneys by P. RAYER, BRIGHT, and TRAUBE, the last of whom drew attention to the interdependence of affections of the kidneys and of the heart. ADDISON first described the degeneration of the adrenals, and BASEDOW drew a picture of the group of symptoms constituting the disease named after him.

Dermatology was scientifically treated by ALIBERT, BIETT, WILLAN, BATEMAN, C. H. FUCHS, ERASMUS WILSON, and F HEBRA, and the subject of venereal diseases by BAERENSPRUNG, K. W BOECK, RICORD, and others, while a scientific foundation was given to the study of nervous affections by VALLEIX, DUCHENNE, ABERCROMBIE, ROMBERG, REMAK, and others.

The treatment of the insane, a subject already for some time regarded as a special branch of medicine, was by degrees extricated from the chaos of mystical fancies which surrounded it, and which led people to regard mental diseases as the consequences of sin, or as the punishments of God, or, at all events, as purely psychical defects. The causes of mental aberration were at last sought for in

corporeal lesions. This path, already trodden by PINEL, ESQUIROL, and CHIARUGI, was afterwards pursued further, especially by SPURZHEIM, the disciple of GALL, by REIL, FOVILLE, and CALMEIL, who by his work on general paralysis initiated observations upon this disease, by the two FALRETS, by MOREL, who turned his attention to the ætiology of derangements of the intellect, by SCHROEDER VAN DER KOLK, GUISLAIN, JACOBI, C. F. NASSE, and GRIESINGER. The results of autopsies were next called in evidence to establish and furnish strict proof of these views. Nevertheless, success was not met with in making diagnoses founded upon symptoms tally with the anatomical facts observed. Such an attempt could not be expected to succeed until the anatomy and physiology of the central nervous system had been placed in a clearer light.

More remarkable than the progress in mental pathology was the improvement in the treatment of the insane. What a beneficent change has taken place in this since the time when, at the command of the philanthropic Emperor JOSEPH II., the "mad house" was built in Vienna, and the patients there, as at St. Luke's, in London, were exhibited to a spectacle-loving populace, were caged up in prison with criminals, and punished for their "mad tricks" by depriving them of food or by giving them the whip! It was one of the greatest achievements of humanity when PINEL gained his point with those in power during the French revolution, and released the insane—those most unhappy of men—from chains which had been forged by religious prejudice, and secured by the ignorance of the doctors. Tender nursing and appropriate medical treatment were now extended to those afflicted with insanity; institutions were founded in which they were protected and kept under observation. JOHN CONOLLY promulgated the system of "no restraint," by which mechanical coercive measures were as far as possible banished from the treatment of the mentally afflicted, and still further progress was made in this direction by the foundation of colonies of

lunatics where, as at Gheel, the patients enjoyed a certain amount of freedom combined with careful supervision and nursing, and were provided with work suited to their conditions.

In no department of pathology, however, were the changes greater than in that of infectious diseases. New forms of disease were now recognized which had previously escaped observation, and those affections already on the nosological list were more correctly and accurately distinguished from one another, especially in respect of their ætiology. The nature of the infective material of disease, its origin within or without the human body, its development in different media, its relation to climate, soil, etc., the duration of its virulence, and the possibility of its being transported from place to place were all subjects carefully investigated.

Asiatic cholera in the 19th century outstepped the limits of its native land, and spread itself over the globe. The grievous loss of human life which its presence entailed rendered it incumbent upon the doctors to examine into the causes and real nature of this disease. The remarkable relations existing between its origin and extension on the one hand, and conditions of the soil on the other, were the subject of observation. With the discovery of the comma-bacillus, made not long since, it would seem that the real and essential cause of the disease has at last been found.

Yellow fever, which had often been brought to Europe, was carefully studied, as also were other exotic diseases, such as beriberi.

The appearance of cerebro-spinal meningitis in an epidemic form directed public attention to this previously unknown disease.

At the same time enlightened views began to prevail on many other diseases. The conception of typhus, a term at first chiefly of symptomatological significance and lending itself to qualification according to the prevailing

phenomena of the disease, under such forms as abdominal typhus, brain typhus, pulmonary typhus, and spotted typhus, underwent a complete revolution as ætiological considerations advanced into the foreground. It was recognized that three diseases which hitherto had been comprised under the name of typhus, namely, exanthematic typhus, abdominal typhus, and recurrent typhus (or relapsing fever) are distinct in their origin, in their extension, and in their essential nature, so that one never arises out of another.

The exanthematic fevers came also to be more clearly understood. The relation of measles, German measles, small-pox, and scarlet fever to one another and to other affections was closely studied.

The discovery that cow-pox protects, at least for a considerable time, from small-pox led to one of the most beneficent discoveries mankind has ever been blessed with. The imperishable merit of this discovery belongs to EDWARD JENNER; its utility can only be doubted by those who are ignorant of the history of small-pox.

The pathology of infectious diseases entered upon a new phase when the parasitic character of a number of these was recognized. Observations upon certain diseases of plants, and upon muscardine, a disease of the silkworm caused by a fungus, examination of the itch-mite, of the fungi causing *favus, pityriasis versicolor, herpes tonsurans* and other skin diseases, of the different entozoa of the human body, the discovery of the *trichina spiralis* and of the symptoms produced by it, all led to more attention being paid to parasites and lowly organized forms of life and to their pathogenic significance being made the subject of inquiry.

The experience acquired of pellagra and diseases of that kind arising from the consumption of tainted food, as too, observations made upon those diseases which are capable of being transferred from animals to men had a similar effect. When, in the splenic fever of cattle, in relapsing

fever, in pyæmia, puerperal fever, erysipelas, osteomyelitis, and many other diseases, microscopical organisms resembling fungi of different kinds were found in the blood and in certain secretions or tissues, the idea inevitably suggested itself of ascribing the origin and cause of such diseases to these bodies.

The scientific proof that these lowly organized forms do actually stand in a causal relation to particular diseases was only possible after these organisms had been successfully isolated by special methods of research, inoculated on healthy animals and found to produce the diseases in question. These demands have, up to the present, only been satisfied in splenic fever, relapsing fever, malignant erysipelas, diphtheria, and Asiatic cholera. But a multitude of facts and probabilities point to pathogenic bacteria being the active cause of the origin and spread of tuberculosis, leprosy, typhus and enteric fevers, scarlet fever, septicæmia, malarious and many other forms of disease.

The difficulties encountered in carrying on these inquiries experimentally, especially in the choice of an animal suitable for inoculation and susceptible to the diseases, render it evident that results can only be arrived at slowly. The facts hitherto established have given a firmer basis to ætiology, inasmuch as they have rendered manifest the really active causes of the diseases and have consequently indicated both to pathology and to therapeutics the paths upon which, for the future, they must travel.

Materia medica has during the latter decades changed from a study of pharmaceutical wares into a science of pharmacodynamics which, being in close association with physiology and experimental pathology, is supported by clinical experience and experiments on living animals. By means of it a bridge may here and there be thrown across the deep chasm which divides the theory and the practice of medicine.

During the same period the pharmacopœia has been

enriched by the addition of a great number of remedies. Chemistry has shown us the way to extract the active principles of many vegetable and animal substances so that they may be used in therapeutics, while avoiding undesirable effects due to the admixture of other bodies with such active principles. A number of alkaloids, especially of narcotic drugs, were thus discovered and introduced into medicine, for example morphia, in 1804, simultaneously by SERTÜRNER and SÉGUIN; cantharidine, in 1812, by ROBIQUET; strychnine in 1818 and quinine in 1820, by PELLETIER and CAVENTON; veratrine, in 1818, by MEISSNER; caffeine, in 1820, by RUNGE; solanine, in 1821, by DESFOSSES; conine, in 1830, by GEIGER; atropine, in 1831, by MEIN; aconitia, in 1833, by HESSE; colchicine by GEIGER and HESSE; cocaine, in 1859, cumarine, curarine, saponine, santonine, pilocarpine, pepsine, pancreatine, etc. For many other remedies such as iodine, discovered, in 1811, by COURTOIS in the waste liquors produced in the manufacture of carbonate of soda; bromine discovered by BALARD, in 1826; iodide of potassium, bromide of potassium, chloroform, iodoform, chloral hydrate, salicylic acid, and carbolic acid we have to thank the progress made in chemistry, whereas others again like kamala, kusso, condurango, etc., have been brought to Europe from distant parts of the world. Their effects upon the healthy and diseased organism have been studied as well as the most suitable way of using them.

In regard to the application of remedies the healing art in the nineteenth century has made important progress; the introduction of subcutaneous injections by PRAVAZ and A. WOOD, of treatment by inhalation, and of pulmonary therapeutics with the excellently adapted apparatus which supplies the diseased respiratory organs with vapour in a more or less concentrated state as required, are real advances in the method of exhibiting curative agents. The foundation on a scientific basis of balneology, climatology in relation to disease and its cure, hydrotherapeutics,

electrotherapeutics and the Swedish gymnastic exercises are also achievements of our own time.

SURGERY, OPHTHALMOLOGY, OBSTETRICS AND STATE MEDICINE.

THE startling advance made in pathological anatomy and the light thrown upon pathological theories, in conjunction with the progress made in physics and chemistry exercised a powerful influence upon surgery. The processes of suppuration, ulceration, cicatrization and regeneration of tissues and other questions of surgical pathology were made subjects of precise knowledge by observation and experiment. The development and diagnosis of pathological new growths occupied in an equal degree the attention of surgeons and of pathological anatomists.

Operative surgery also made important advances. This however did not consist so much in the improvement of methods of operating or in the invention of new operations as in the fact that it came to be understood that the task of surgeons is not to remove diseased parts so much as when possible and safe to retain them. This idea introduced the "conservative" surgery of our day. It could only become realized with the help of anæsthetic inhalations, to free the patient from pain during the operations and to prevent the reaction entailed by it upon the organism and by the invention and introduction of the antiseptic treatment of wounds by means of which the morbid conditions apt to follow operations were avoided and a successful result insured. These two great achievements of the healing art of the nineteenth century have completely transformed the character of surgery. They have endowed the surgeon with courage and self-confidence; for he knows that the success of his art will no longer be imperilled by accidents it is impossible to foresee; and the breast of the patient is filled with hope so that he no longer looks upon

the surgeon with fear and horror but regards him rather as the dispenser of healing and health.

Far back in ancient times and in the middle ages, as I have mentioned already, narcotic potions and inhalations were employed for the alleviation of pain. The imperfect success of this practice and above all the disastrous results which ensued make it very probable that but little use was made of such methods. After HUMPHREY DAVY had discovered the stupifying effect of nitrous oxide gas, experiments were made with it which led to its being used during operations, especially in the field of dentistry. About the same time the narcotic properties of ether were discovered, a substance which was especially submitted to investigation and recommended by JACKSON. In 1847 FLOURENS by experiments on animals established the fact that chloroform, which had been simultaneously discovered by SOUBEIRAN and J. LIEBIG, is a more desirable narcotic. SIMPSON, the obstetric physician, soon after introduced it into medical practice. The advantages possessed by this over other kindred substances are sufficient to explain the fact of its having by degrees superseded them.*

Many other substances have been used for producing anæsthesia by inhalation; chloroform has been associated with ether or with injections of morphia in order to increase or to prolong the narcotic effect, and the production of local anæsthesia in those parts of the body about to be operated on by means of cold produced by the ether-spray, etc., has been recommended. J. CLOCQUET, J. BRAID and others have attempted to perform surgical operations during hypnotic insensibility. The use of anæsthetic inhalations rendered the operator free to perform his task thoroughly and without hindrance. Difficult, prolonged and very painful operations might now be ventured upon which before did not admit of being performed.

To obviate dangerous bleeding at or after operations,

* O. KAPPELER in "Deutsche Chirurgie," her. v. BILLROTH u. LUECKE, Stuttgart 1880.—MARION SIMS: The discovery of anæsthesia, Richmond 1877.

besides ligature and other methods previously used, torsion again came into vogue. SIMPSON recommended acupressure while other surgeons preferred forcible flexion of the limbs, styptics like *liquor ferri perchloridi,* or else cold or the cautery in various forms. BRÜNNINGHAUSEN suggested the idea of previously rendering the part of the body about to be operated on bloodless by means of a tightly applied bandage, but it was reserved for a talented surgeon of the present day to discover a method of accomplishing this end. The galvano-cautery, the credit of the introduction of which rests chiefly with MIDDELDORPF,* and the method of operating invented by CHASSAIGNAC called *écrasement linéaire,* both aimed at effecting the removal of diseased parts without loss of blood. By the first method the layer of charred tissue served at the same time as a covering under which the wound produced by the operation could cicatrize; another advantage afforded by it was that it was applicable in very vascular tissues and in parts of the body which are not easily accessible to the knife or actual cautery. The difficulties which present themselves in the removal of extensive morbid growths were by this method materially lessened.

The methods of amputation were but little improved except for the introduction of the oval amputation by SCOUTETTEN, of the oblique incision by BLASIUS, of the elliptical (resembling the last mentioned) by SOUPART, and of improvements in the flap operation. But greater care was devoted to the after-treatment than formerly. In many cases exarticulation was preferred to amputation through the bone. The removal of the limb at the hip joint was first performed by LARREY. Exarticulation at the knee-joint was given a further development by sawing off the condyles as recommended by SYME and by the attempt to secure a union between the patella, after sawing off its articular surface, and the end of the femur. Special pains were taken to perfect the exarticulations in the

* A. TH. MIDDELDORPF: Die Galvanokaustik, Breslau 1854.

tarsus and at the ankle. Besides CHOPART'S method in the mid-tarsal joint, the operation at the tarso-metatarsal articulation was recommended by LISFRANC, that immediately below the astragalus by TEXTOR, and that at the ankle-joint by SYME and PIROGOFF. The conservative character of surgery at this period and the anxiety felt to retain as much of the body as possible were manifested by the increased favour in which resections were held. These operations aimed at a total or partial removal of bones and were practised both in the extremities, on the spinal column by the removal of a spinous process or a transverse process, or of the posterior part of a vertebral arch, on the ribs as in empyema, on the pelvis and shoulder (especially on the scapula and clavicle) and on the upper and lower jaw-bones.

The operation of resection of the joints reached a high degree of perfection. After the first successful attempts which had been made in the 18th century upon the shoulder and knee they were performed at other joints, for instance at the elbow and in the foot first by the elder MOREAU, and at the hip by A. WHITE. The numerous wars of these latter decades have afforded abundant opportunities to practise and improve this method. The indications for resection were accurately laid down and extended in some directions, for instance in relation to orthopædic requirements. Special modifications of this procedure were suited to certain cases as the resection of a wedge of bone in club foot, the so-called temporary resections in which no permanent removal of bone was contemplated, subperiosteal resections, and osteotomies of different kinds.

The treatment of fractures and dislocations was greatly improved by the introduction of stiffening bandages which keep the limb motionless while the cure is proceeding. LARREY for this purpose employed a mixture composed of albumen, white lead and spirits of camphor; SEUTIN invented the starch bandage in 1834, and VEIEL recom-

mended the glue-bandage. The plaster of Paris bandage became the most widely recognized and popular: it had been already known for a long time in the East, and at the beginning of the 19th century was introduced into Europe but did not acquire any great reputation until the plaster-bandages invented by MATHYSEN came into use. Besides these Tripoli powder, guttapercha, plastic felt and paste-board, silicate of soda, paraffin and stearin were made use of for splints of this kind. The art of constructing suitable suspension and extension apparatus and couches for the sick was learnt with results favourable to the process of recovery.

When fractures had united in a faulty position the callus was divided by breaking or cutting so that union might take place afresh. In ununited fracture endeavours were made to unite the bones by suturing them or by artificially inducing inflammation of the fractured ends and by other means. Myotomy and tenotomy for the relief of deformities, as for instance in *caput obstipum* and club foot, were as has been mentioned performed in earlier times: but the sub-cutaneous operation is an invention of the 19th century. DELPECH introduced this operation into surgical practice and the success obtained in it by DUPUYTREN, DIEFFEN-BACH, STROMEYER and others in different affections secured for it a permanent place in operative surgery. The cure of aneurism was attempted by compression, ligature, galvano-puncture and prolonged flexion.

The subject of hernia was advanced by valuable works upon its anatomical relations, upon the causes of strangulation and other matters. In its treatment, after taxis, attention was directed chiefly to the trusses which were brought to great perfection: in the radical cure attempts were made to close the outlet by plastic operations—by drawing in the scrotal integument or by inducing hypertrophy of the tissues artificially. To the methods of lithotomy were added the recto-vesical operation designed by L. J. SANSON and the *sectio vagino-vesicalis* recommended by J. CLÉMOT.

Great services were rendered to lithotrity by GRUITHUISEN, CIVIALE, LEROY D'ETIOLLES, N. HEURTELOUP and others by the invention and improvement of instruments. The cure of stricture of the urethra was attempted by caustic bougies, by gradual or forcible dilatation, or by urethrotomy.

The removal of a kidney by operation was first accomplished by O. SIMON while splenectomy—an operation undertaken as early as in the 16th century,—since the time of QUITTENBAUM has been performed in a methodical manner, all the rules of surgical art being observed.* The long-known operation of gastrotomy led to gastrostomy,—to the establishment of an artificial gastric fistula—a measure introduced by EGEBERG and SÉDILLOT into surgical therapeutics. Resection of the stomach or œsophagus, and extirpation of the larynx have only been ventured upon in our own time.

Rhinoplastic operations in the 17th and 18th centuries had become entirely forgotten. In 1742 the medical faculty of Paris declared the accounts left by TAGLIACOZZI upon the subject to be purely imaginary, and the operative procedure said to have been adopted by him to be impossible. Then English journals in 1794 brought the news that the art of replacing the loss of a nose by means of a plastic operation was practised in India by the natives.† European doctors studied the methods of operating in use, imitated them, and then tried the old Italian procedure: finally they generalized the operation by directing their attention to the replacement of the lips and eyelids, to the closure of abnormal openings, etc. Through the labours of C. F. GRAEFE, DELPECH, DIEFFENBACH, B. LANGENBECK and others, plastic operations reached a high degree of perfection. The transplantation of pieces of skin to replace a loss of substance as after burns, or of periosteum and bone for the purpose of making a firm support, and the attempts

* ADELMANN in the Archiv f. klin. Chirurgie 1887, Bd. 36, H. 2.

† E. ZEIS *op. cit.* S. 208 *et seq.*

to enclose in a healing wound foreign tissues or substances are procedures belonging to the most recent times.

Transfusion of blood after great hæmorrhage was again looked upon with favour at the end of the 18th century and was made the subject of careful investigation by J. BLUNDELL. PRÉVOST, DUMAS and other physiologists who studied the question recommended the transfusion of defibrinated blood; PANUM advised that human blood alone should be used. The subject of transfusion came to be regarded in another light when it was recognized that the beneficial effect of the operation does not depend upon the increase of blood but to the heightened intravascular pressure consequent upon the addition made to the contents of the vessels.*

The satisfactory results achieved by operative surgery at the present day are very largely due to the strictly methodical employment of antiseptic measures which in the two last decades have received universal recognition.† With this a new period began in the history of surgery: how far and how deeply to influence that science can scarcely be calculated precisely.

Special branches of surgery have for the first time met with a scientific treatment in the 19th century and have become separately-taught subjects.

Thus dentistry was by degrees withdrawn from the hands of ignorant barbers and quacks and placed in those of doctors who investigated the relation of diseases of the teeth to the other diseases of the body and established a scientific treatment of the former.

The diagnosis and treatment of diseases of the ear were materially advanced by the improvements in the cathaterization of the Eustachian tube introduced by A. CLELAND. The artificial illumination of the tympanic membrane, the

* E. v. BERGMANN: Die Schicksale der Transfusion im letzten Decennium, Berlin 1883.

† And for which the thanks of mankind at large as well as of the profession are due to Sir JOSEPH LISTER, Bart.—E. H. H.

auscultation of the middle ear, and the air-douche constituted further steps of progress in this department in the establishment of which ITARD, LÉON DELEAU, W. R. WILDE, J. TOYNBEE, as well as W KRAMER and several other German aurists have rendered distinguished services.

Ophthalmology has celebrated great triumphs. A clear insight has been gained into the causes and anatomical changes of most diseases of the eye, the ophthalmoscope has become an aid to diagnosis capable of solving the most difficult questions of pathology, and many new methods of treatment and operative measures have been added to our resources. ADAM SCHMIDT was among the first to draw attention to the relations existing between many diseases of the eye and diseased conditions of other parts of the body: he called eye-disease "the elegant diminishing mirror of diseases of the body." The different forms of conjunctivitis were accurately defined, and thus the real characteristics of the *Ophthalmia Ægyptiaca s. militaris*—a disease terrifying to the people by its rapid spread and malignity—were recognized, iritis and choroiditis were studied, and attention was drawn to the increase of intra-ocular pressure which is the real cause of glaucoma and for which A. v. GRAEFE recommended iridectomy. In opacities of the cornea attempts were made to graft on to the place from which the cicatricial tissue had been excised a piece of glass or part of the cornea of an animal in order that thus the rays of light might be able to pass: or else an artificial pupil was formed. BEER successfully avoided the evil results of the method of iridectomy introduced by WENTZEL, by which affections of the lens or its capsule were frequently induced; this he achieved by ceasing to detach the flap of iris *within* the anterior chamber (as had previously been done) and by introducing the procedure of drawing it out of the corneal wound and cutting it off outside the eye. This method was afterwards improved and is practised to this day, whereas other methods of opera-

tion conceived with the same object in view such as iridodialysis have long since vanished from practice.

In the removal of cataract, the ætiology and anatomical seat of which disease were more closely investigated, extraction was the method chiefly employed as it appeared in most cases to be the best and safest operation: another method in use was couching of the affected lens which SCARPA combined with discission and which BUCHHORN advised should be performed through the cornea. The operation of extraction was materially improved by making the incision towards the upper part of the cornea, a method recommended by F JÄGER though perhaps practised previously by other ophthalmic surgeons and which eventually led to linear extraction. The latter operation which had been previously practised in certain cases, for instance in shrivelled and soft cataracts, was improved and made the common property of the profession by A. V. GRAEFE who made his incision in the upper part of the cornea and performed an iridectomy as part of the same operation.

Operations on the eye were remarkably facilitated when mydriatics came into use. HIMLY drew attention to the dilating effect upon the pupil of hyoscyamus and belladonna. Other drugs with similar properties were afterwards discovered; but the alkaloids and especially atropine were chiefly used.

But there is no doubt that the greatest achievement of ophthalmology in the 19th century was the discovery of the ophthalmoscope. This instrument assumed a definite shape in 1851 though the invention had been led up to by researches upon the luminous fundus of the eyes of certain animals which were in possession of a *tapetum lucidum*, by observations upon the human retina in cases of absence of the iris, and by PURKINJE'S experiments. While HELMHOLTZ, the discoverer of the ophthalmoscope, elaborated nay almost completely perfected its theory, it was chiefly A. VON GRAEFE who recognized and demonstrated its importance

for ophthalmic practice. With the help of the ophthalmoscope it became possible to examine the state of the refractive media and of the fundus oculi. The meaning of amaurosis—which had previously been defined in a jocular way as a disease "where the patient cannot see anything at all—nor the doctor either" was now rendered more intelligible,* and the various diseases of the retina could be differentiated. When the relation of these to certain general diseases, such as BRIGHT'S disease, diabetes mellitus, etc., was established, the ophthalmoscope acquired importance as an aid to diagnosis in general medicine.

Midwifery proceeded on its natural course of development, and by taking into consideration all the physiological and pathological processes which occur in women, became enlarged into gynæcology. The opinion came at last to be held that pregnancy, parturition, and childbed are physiological conditions, the course of which should be left to the management of nature, so long as abnormal circumstances do not call for the interference of the doctor. LUKAS BOËR, who defended these principles, rejected the so-called preliminary treatment, which in most cases acted injuriously, and proved that presentations of the face, breach, knee, and foot do not always require the art of the doctor, but that spontaneous birth frequently occurs through the regulative powers of nature.

The clumsy and complicated instruments of an earlier day were simplified, and operative midwifery was confined to those cases in which it was indispensable. It was discovered how to diagnose a contracted pelvis by methodical measurements, and how to estimate the influence of changes of position and diseases of the uterus upon pregnancy and parturition.

The pathology of the lying-in period was carefully investigated, especially in regard to puerperal fever, a disease upon the pathogenesis of which a startling light was thrown by the observations of the unfortunate SEMMELWEISS.

* A. HIRSCH: Geschichte der Augenheilkunde *op. cit.*, S. 474.

The diseases of the uterus, the ovaries, and the neighbouring parts gave opportunities for operative interference, the methods of which were now for the first time to be discovered. Extirpation of the uterus in malignant affections of that organ was already practised by MONTEGGIA, OSIANDER, and others, and in modern times the operation has been perfected in points of technical detail.

The same is true of ovariotomy, which was for the first time performed by MACDOWELL in 1809, and since then has been much improved as an operation. The operative treatment of prolapse of the uterus and vagina, as also the operation for vesico-vaginal fistula—a condition formerly considered incurable—are also achievements of modern times, and are chiefly due to the labours of JOBERT DE LAMBALLE, MARION SIMS, G. SIMON, and other distinguished gynæcologists of our time.

The progress of medicine in the 19th century was not, however, confined merely to improved methods of treating the individual sufferer, but it brought home to the conscience of the public the important relation borne by sanitation to the State itself. No doubt this was associated with political development, under the influence of which the government of the State was reminded of its duty to protect society, and in every citizen s breast the sentiment was aroused that he, as a member of the commonwealth, had a duty to fulfil towards it, and was interested in its welfare.

And thus forensic medicine, which was established and advanced by A. HENKE, MENDE, CHRISTISON, CASPER, ORFILA, TARDIEU, and others, and State medicine, the foundation of which was the work of PETER FRANK, were added to the list of medical subjects in which instruction was given. What the former became for the Law Courts the latter was intended to be for the Government—the compendium of all the knowledge required by the medical specialist when consulted by the authorities. Sanitary control became expanded into hygiene, or care of the public

health, as the opinion gained ground that not the State alone, but every individual member of it, is called upon to avoid diseases and to assist in the increase and maintenance of sanitation.

The identity of interests which unites the people and the government in questions of hygiene, certainly in a great measure affords an explanation of the fact that during the last few decades the scientific solution of such problems has been prosecuted with extraordinary zeal. The influence of nourishment, clothing, dwellings, soil, climate, temperature, air, occupation, age, and sex have been carefully investigated. Researches into the causes of the rise and spread of epidemics, studies upon the ways most conducive to health of laying out graveyards and constructing hospitals, factories, and buildings of all kinds, the supervision of prostitution, etc., formed other subjects for the public hygienist to consider.

Much assistance in answering these questions was afforded, firstly by the history of medicine, which reported upon the course taken by the great pestilences which swept through countries in times past and upon the result of measures adopted to control them; secondly, by medical geography, which showed that many diseases occur only, or at least chiefly, in certain localities, and which essayed to explain this fact: and thirdly, by medical statistics which attempted to sift the accumulated material by the help of numerical methods, and to draw conclusions from the results obtained. Chemistry, the use of the microscope, and the practice of experiment were all resorted to in research, and valuable information was certainly gained. Meanwhile bacteriology directed attention to the material causes of disease.

The results achieved by hygiene through these means during the last few years and the expectations which are fostered of further manifestations of its power in the future have created for it in a short time a prominent position among the various branches of medical science. The task of warding off diseases appears as great and as beneficent

as that of curing them, and public medicine and private medicine occupy equally honourable positions. The governments, in organizing sanitary administration, in appointing boards of health, and in providing for medical supervision in certain cases, bear testimony to their recognition of the truth of this fact and of its continually increasing significance, and the prophecy of Mr. GLADSTONE that the doctors are to be the leaders of the people is approaching its fulfilment.*

MEDICAL TEACHING AT THE PRESENT TIME.

THE changes and improvements in medical teaching during the last hundred years are not less important than the results which have been achieved in the prosecution of the study of medical science. When we contemplate the institutions and medical schools of our own time richly provided as they are with every kind of appliance to facilitate teaching, with departments excellently arranged for the study of normal and pathological anatomy and physiology, and provided with the necessary apparatus and instruments; their laboratories for physics, chemistry and hygiene; their well stocked museums and numerous departments for clinical teaching; when we look at all these and draw a comparison with the inadequate beginnings which were made in such things in the last century we recognize at once how much has been done since then.

At the present time the above arrangements are

* Wishing to get a corroboration of this rather sweeping prediction at first hand, I ventured to trouble Mr. GLADSTONE with a letter asking him if he could confirm it. I quoted to him the above passage as it stands in the German text. Mr. GLADSTONE honoured me with a reply as follows:—"So far as regards the" "exact words cited in your letter I cannot positively say Aye or No, and I" "rather think that I should in using them have added some qualifying or" "limiting expressions. But it is certainly the fact that, for a very long time," "I have believed the medical profession to be in a state both of absolute" "advance from the progress of its science—this it may be said is mere" "commonplace—and of relative advance from the particular features attaching" "to our civilization in its onward movement."—E. H. H.

considered indispensable for teaching medical students, whereas then at most academies they were entirely absent or at least but very poorly represented, and scarcely ever to be found in anything like the completeness of to-day. The method of teaching has consequently assumed another form: practical demonstrations became by degrees of supreme importance in medical teaching, indeed together with the necessary explanations, constituted the whole of it, while theoretical lectures were pressed into the background and by degrees nearly abandoned. The comprehension of scientific facts and theories is thus extraordinarily facilitated: for what the senses take in is impressed not merely upon the memory but also on the understanding.

It now came about that a division of labour was introduced throughout the teaching of medicine and assumed a definite form. It was arranged that the lecturer should concern himself exclusively with the subject which he represented and might thus be able to attain to the ability and certainty of a virtuoso in it. The perfecting of medical teaching by the establishment of new professorships demanded by the development of medical science, its advance in the direction of specialization, and the introduction and improvement of examinations intended to afford a guarantee that young medical men had acquired the knowledge necessary for their calling, constituted further additions made to medical education during this period.

It is true that the progress on this path differed widely in different countries. The condition of general culture, the state of medical science in particular, the social standing of doctors, historical traditions, and above all the attitude of the State towards the subject of public instruction, exerted an influence quite opposed to uniformity in this matter.

Amongst rude savages, Caffres, Red Indians, native Brazilians, etc., medicine-men and magicians are labouring to this day to drive away diseases by means of prayers and incantations, and medical knowledge but seldom gets

beyond the recognition of the healing powers of certain herbs and roots.*

Even amongst civilized people very different conditions prevail in regard to medical science. The native doctors in the countries of Islam practise still for the most part upon the same principles which were propounded by the representatives of Arabian medicine in the middle ages and the Chinese doctors still believe in the untenable speculations which have received acceptance in their country for thousands of years.† Yet contact with European medicine and the recognition of its advantages have led to attempts being made to introduce it into these lands. At Constantinople and Cairo medical schools have been founded in which European and, by preference, French and German doctors have been installed as teachers. This reform was set in progress in Japan in a much more thorough way and as it appears with greater results: there, during the last few years numerous schools of medicine have arisen, organized entirely after the European model and provided for the most part with a German teaching staff.‡ The lower culture gives way before the higher which everywhere presses forward victoriously and makes mankind happy with the blessings it brings.

In civilized countries the general and special education for the various callings has come to acquire a certain similarity, a fact explained by the easy and rapid way in which literature serves to transmit advances and achievements made in the domain of the intellect. Medical science exhibits the same phenomenon and the educated

* Th. Waitz: Anthropologie der Naturvölker, Leipzig 1859, ii, 412. iii, 225, 419. iv, 473. v, 2, 149, 199. vi, 24 *et seq.*, 394 *et seq.*, 557.—A. Bastian: Der Mensch in der Geschichte, Leipzig 1860, ii, 116 *et seq.*

† P. Dabry: La médecine chez les Chinois, Paris 1863.—D. J. Maccowan in the Med. Rep. Shanghai 1882, No. 22.

‡ Ardouin: Aperçu sur l'histoire de la médecine au Japon, Paris 1884.—Ad. Hofmeister: Die Universität Tokio, ihre Geschichte und Organisation, Ausland, Jahrg. 57, No. 51.—H. Gierke in the Breslauer ärztl. Zeitschr. iv, S. 64 *et seq.*

doctor in France professes the same doctrines as his colleague in Germany, Austria, Italy and other countries.

The science of medicine is the same in all civilized countries; but the amount of knowledge demanded of its representatives in particular states is different and the external forms which are associated with the teaching of students are manifold. In certain places, for instance in America and England, the arrangement still exists of doctors taking pupils and training them up like handicraftsmen to become masters in their art;* but as a general rule medical knowledge is acquired at schools in which its attainment is made the exclusive task and which are either, as medical faculties, joined with schools of other subjects and made universities or else lead an independent existence.

These schools are in many countries conducted or at least supervised by the State while in others they take up an independent position and are either self-administered or managed by private proprietors. These principal differences in the organization of medical teaching have been of great importance in its development, as a review of the existing conditions in the different countries shows us. The state of affairs which has, in this respect, come to exist among the English, French and Germans will deservedly claim our most careful attention, for it shows us types of the various forms exhibited by systems of medical education; while the medical teaching of other nations cannot fail to have been powerfully influenced thereby.

ENGLAND.—NORTH AMERICA.

THE customs of the middle ages in regard to medical teaching have been preserved longest in England.† Here

* This, however, may be said to be exceptional at the present day in England. —E. H. H.

† TH. PUSCHMANN: Das medicinische Unterrichtswesen in England in the Beilage d. Allg. Zeitung, München 1886, No. 7-9. This essay which I wrote under the fresh impression of personal observation formed a preparation for the present work.

it still happens, though far less frequently than it did formerly, that students of medicine begin their studies by becoming pupils of a doctor in practice; they remain with him for a year, in order to get some general idea of what will some day be required of them.* In a method such as this much naturally depends upon the individuality of the pupil and nearly everything upon the personal qualities of the teacher. If the pupil is industrious and intelligent and if the teacher has patience, knowledge, and a pleasure in his work, then this year is to the former one of incalculable advantage for his later studies; otherwise it is lost time and serves at most to provide him with mechanical habits which sometimes approach charlatanism.

The same occurs when the first year is passed in a hospital as is often the case. The students think that there at least they will have opportunities of observing many patients and hope to receive instruction from the resident doctors upon the most important cases. If they are not disappointed in their expectations they may indeed acquire a certain dexterity in their intercourse with patients, which is very useful to them in their later clinical and professional work. But for many other reasons this manner of being introduced to medical studies is one which must raise grave doubts as to its propriety. It tends to make the student a superficial observer, for it accustoms him to touch but lightly upon the real meaning of things, his acquirements and his understanding being insufficient to enable him to grapple with them properly. Moreover the results gained in this way can scarcely compensate for the sacrifice of time and trouble which they entail upon the doctors who play the part of teachers: still less can they justify the inconveniences to which the patients who are under treatment are subjected. In any case, systematic instruction in a medical school is much to be preferred to this groping in the dark. On this account

* Ch. Bell Keetley: The Student's Guide to the Medical Profession, London 1878, p. 16 *et seq.*

it has become more and more usual for students to betake themselves at once to a medical school or a university.

The medical schools of England have been developed out of the form of teaching just described: they are associated with hospitals and arose from the circumstance that the hospital doctors took pupils and gave instruction in medicine. As the demands made upon teaching increased, they apportioned among themselves the representation of the different branches of medical science, and if in certain departments—the theoretical for instance—they did not judge themselves competent to be teachers, they took care that men of the required ability were appointed to teach and that all the necessary appliances and accommodation were provided. Only a very small proportion of medical students entered the universities, for these up to quite modern times were destitute of the arrangements required for the prosecution of medical studies. The English universities were really nothing more than public schools on an extended scale, as J. DÖLLINGER calls them, and their function was not to educate officials and lawyers or to turn out doctors or men of science, but "by means of classical and mathematical studies together with logic and moral philosophy and with the help of college training to provide the State and Society with cultured and independent gentlemen and the State Church with clerics educated less in theology than in classics and literature." The Scottish universities, especially that of Edinburgh, manifested a different disposition: the practice of medicine was at the last mentioned place, even at an early period, made the subject of special instruction.

The various kinds of methods by which medical knowledge was acquired make it very evident that great disparity existed among medical practitioners in regard to their knowledge and skill. It even went so far that they were not obliged to give any serious account of their ability. The State did not concern itself with the question whether the future doctor acquired any aptitude for his calling or if so

where such was obtained: it permitted everyone to practise medicine and left it to the public to distinguish the good practitioners from the bad. Under these circumstances success naturally became the final court of appeal. The quacks mistrusting a judgment which offered them so little security, endeavoured by means of testimonials, in which their medical studies and their professional ability were set forth, to court the popular favour. Various doctors' guilds and medical schools were prepared to give such testimonials upon payment of fees, and held examinations, which, however, were neither arranged on any uniform plan nor supervised by any central authority, and consequently gave no guarantee whatever of the training of the medical practitioner. Many got diplomas in foreign countries or endeavoured to procure them by illegal methods; the Archbishop of Canterbury had * also the right of conferring the degree of Doctor of Medicine. It went so far at last that it was sufficient for anyone to be recognized as a doctor if he were presented as such to the authorities by two members of a medical guild.

Such a state of things must have resulted in serious disadvantages to the patients upon whom these practitioners were "let loose." The imperturbable equanimity of the English people was at length shaken, and Parliament was induced to find a remedy. The result of its deliberations was the Medical Act of 1858, in which it was accurately defined what Corporations should thenceforth have the right to hold examinations and grant certificates which should be recognized as valid. These examinations were rendered subject to the supervision of the General Council of Medical Education and Registration of the United Kingdom, which body has to take care that the examinations are conformable to the end in view. Should this not be the case in any particular instance the General Council has authority to order a change of examiners, or, if the cause of complaint is not removed, to take away the

* This is still a prerogative of the See of Canterbury.—E. H. H.

privilege of holding examinations from the Corporation in question.

The names of persons who have proved their capacity for medical practice before a corporate body entitled to hold examinations are entered in a Register kept by the General Council and published for general information: only legally qualified and registered medical practitioners are entitled to sue for fees in a court of justice or to hold official appointments. The General Council, upon which other duties connected with the polity of the medical profession also devolve, consists now of* 30 members, 20 elected by the various examining bodies, 5 nominated by the Crown, and 5 direct representatives of the profession. The President is chosen by the Council.

By the Medical Act of 1858 a secure foundation was laid for the further development of systematic medical education in England and at least the grossest abuses were abolished. Proposals for reform were evoked by the defects in the system thus shown to exist; proposals, however, which were either not at all or but partially carried out. In 1881 a commission of experts was appointed to consider the question of medical education. On this occasion distinct expression was given to the need of a general scientific preliminary training for medical students, the introduction of State examinations was mooted and it was demanded that only diplomas testifying to the ability of the holders to practise all branches of medicine, and not merely special branches, should be granted. But the majority opposed these suggestions and rejected most resolutely the idea of absolute uniformity in medical education, considering it to be an especial advantage of the English system that within certain limits it allowed freedom of movement and by the number of the schools produced a natural diversity of training.†

* By the Medical Act, 1886.—E. H. H.

† Report of the Royal Commissioners appointed to inquire into the Medical Acts, presented to both Houses of Parliament (Parliamentary Papers for 1882,

At the present time, students of medicine get their technical education chiefly at the medical schools and universities. Of the former there is no scarcity: twelve exist in London alone. They are connected with hospitals and are commonly named after them.

The oldest school is that of St. Bartholomew's Hospital, the eventful history of which is closely bound up with the development of medicine in England. The existence of this institution for the sick dates from 1164 and the earliest records of medical teaching held there, from 1662. To its staff belonged WILLIAM HARVEY, the discoverer of the circulation of the blood, and at a later period the surgeons PERCIVAL POTT and ABERNETHY.*

St. Thomas' Hospital was founded in the 13th century; with it too a school is connected: in the records of this institution an apprentice is mentioned as early as in the year 1551. The present buildings were opened for use in 1871 and by their very convenient arrangements excited the admiration of experts.

So too St. George's, the Middlesex, the London, Charing Cross, Westminster, St. Mary's, and Guy's are hospitals used for medical teaching and have medical schools attached.†

King's College and University College (not identical with London University) are also connected with hospitals; but they differ from the other medical schools in not being isolated from, but in organic connection with, faculties of

Vol. 29). "It would be a mistake to introduce absolute uniformity into medical education. One great merit of the present system, so far as teaching is concerned, lies in the elasticity which is produced by the variety and the numbers of educating bodies."

* N. MOORE in St. Bartholomew's Hospital Rep., Lond. 1882, xviii, p. 333-358.—W. A. DELAMOTTE: The Royal Hospital of St. Bartholomew, London 1846.

† BENJ. GOLDING: Historical account of St. Thomas' Hospital, London 1819.—ERASMUS WILSON: The History of the Middlesex Hospital, London 1845.—W. E. PAGE: St. George's Hospital, London 1866.—B. GOLDING: The origin, plan and operations of the Charing Cross Hospital, London 1867.

law, arts and science, with technical institutions and other establishments.

There exists also in London a medical school for women who intend devoting themselves to the profession.

In other towns of the United Kingdom medical schools are to be found, as at Birmingham, Bristol, Leeds, Liverpool, Sheffield; Dublin, Belfast, Cork, Galway; Edinburgh, Glasgow, etc.; there are also schools which offer instruction in certain departments but not a complete medical education; such are the West London Hospital Preparatory School and COOKE'S School of Anatomy.

In the British colonies, Canada, and British India a number of medical schools are also to be found, arranged after the English pattern: there is a similar establishment at Valetta in the island of Malta.*

The medical schools of England, like the hospitals to which they are attached, are as a rule private undertakings. The State neither pays for their maintenance nor gives any contribution towards it; as little does it exert any influence on their organization and administration or upon the education given at them. Consequently attendance at these schools by no means confers the right to practise. Their teaching staffs have no authority to hold examinations the passing of which confers any public rights, but are compelled to refer their pupils to the medical corporations and examining bodies for this purpose, the certificates and diplomas of which constitute the license to practise. The private character of the medical schools is manifested in their arrangements, in the way in which they are equipped with appliances for teaching according to the taste and choice of the teachers, and in other ways. The decision in these matters rests with the Governors who exercise a supervision over the affairs of the hospital. With them lies the duty of appointing the medical and teaching staff. As these Governors consist chiefly of laymen and have among

* H. B. HARDWICKE: Medical education and practice in all parts of the world, London 1880.

them no experts or next to none, there is imminent danger of patronage and favouritism being shown in filling up appointments, the more so that this is not, as in Germany and Austria, based upon distinguished scientific services rendered by the candidates or, as in other lands, the result of competition.

The salaries of the teachers are derived from revenue brought in by the fees charged at the medical school: only in special cases, where this, on account of the small number of students, is too little, or when it is considered worth while to secure a celebrated teacher, do the Governors make an extraordinary vote for this purpose. The tuition fees are consequently pretty high. Thus at St. Bartholomew's 9 guineas are demanded for a course of physiology, $6\frac{1}{2}$ guineas for materia medica, 4 guineas for botany or forensic medicine; at St. Thomas' Hospital 4 guineas are paid for a three months' course of dissecting: but it is exceptional for a student to take out a card in only one subject. As a rule he joins all the lectures and demonstrations in the order laid down in the curriculum of the school he is attending and pays a composition-fee smaller or greater according to whether it is paid at once or by instalments, but which is approximately within the limits of £95 and £130 for the whole period of studentship. Special charges are often made in addition for the use of instruments, for "parts" for dissection, etc.

The extent to which the different schools are provided with conveniences for teaching is by no means uniform. Many have lofty and well-ventilated lecture-theatres, convenient dissecting-rooms, well-arranged physiological and chemical laboratories, natural history collections, anatomical and pathological museums, libraries, and all kinds of conveniences for clinical teaching. Others are but poorly provided, and have less to offer in this respect than the smallest medical faculty in Germany. As a general rule, the departments for preparatory and preliminary studies are less complete than those which are more immediately

connected with medical and surgical practice. The utilitarian spirit which animates the English people is, perhaps, nowhere so plainly expressed as in those establishments which aim purely and simply at preparing men for medical examinations. They resemble the institutions in Germany which make it their business to provide the general education demanded of candidates for commissions in the shortest possible time, and which are known under the name of Fähnrichspressen (cramming-places for ensigns).

On the other hand, the English universities look upon it as their highest task to call into existence and to nurture the taste for scientific pursuits. Whoever studies medicine in one of them has in view a thorough and profound education in the preliminary subjects of the natural sciences, and contemplates taking academical degrees. But it costs a man much more to maintain himself at the university than it does at a medical school, and by studying at the university the total period of student-life is prolonged, and much expense is incurred in consequence of associating with rich young men and participating in the amusements in vogue. The doctors who have resided at the university and have proceeded to degrees belong by their learning and their social position to the *élite* of the profession.

The English universities are no more State institutions than are the medical schools. Their expenses are met by the academical fees paid by the students, and by the income derived from their rich estates. They are administered and governed by senates composed of public men in a distinguished position of life, and of academical professors.

Unlike those of the rest of Europe, the English Universities are institutions not devoted merely to teaching, but to general training also. Affiliated to them are numerous colleges and halls—establishments suggestive of monasteries—where the students live together and are boarded and assisted in their studies. Oxford possesses 25, Cambridge 20 of these institutions. Some of them in their origin reach back into the middle ages. They owe their founda-

tion to pious bequests and donations, and are richly provided with pecuniary means. Unfortunately these are not always expended in a suitable or proper way. Instead of serving to advance science and to support poor students, their chief function is to provide profitable sinecures for the Master and Fellows—that is to say, the head and officials of the colleges. If these positions were granted exclusively to persons who devoted their lives to scientific research, and whose efforts in this direction were rich in results, large salaries might, perhaps, be justifiable; but all that is demanded of the candidates for a fellowship is that they must possess an academical degree. Favouritism gives the casting vote in the election to these appointments; that the clergy should get the lion's share is consonant with the conditions of English life, which bestow upon the cleric of the State Church a social power like that which the Catholic priesthood in the Tyrol is vainly attempting to usurp. A member of the Senate of the University of Cambridge complained publicly that the places of authority in the colleges there were held by clergymen, and that the fellowships were given away to people who achieve nothing whatever for science, the university, or their colleges.* E. RENAN says that a small German university, with its awkward professors and its starving private teachers, does more for science than all the pomp and wealth of Oxford.

Most of the colleges at Oxford and Cambridge are ancient buildings and well worth seeing on account of their architecture and their artistic monuments. With their towers and archways, their chapels, colonnades and butteries they call back times long passed away; but the spirit which animates these establishments is that of scholasticism. Although it was a British monk who in the 13th century directed the first powerful assault upon this system it is nevertheless precisely in his native land that the method of contemplating nature characteristic of the middle ages has been preserved to this day. Theological

* A few brief remarks on Cambridge University, London 1870.

dogma dominates the educational system and the whole intellectual life of the English people and has impressed upon them a stamp of piety which suits but badly their freethought in politics and their restless grasping at earthly possessions. The theological character is impressed even upon the external appearance of the professors and students: seeing them as they pass by in their long black gowns and biretta-like caps one would almost imagine oneself transported back to the days when monks conducted the education of youths.

The students are kept subject to strict discipline. They are not treated like young men ripe for a certain amount of freedom and independence but like pupils in need of continual supervision. Among the students are to be found persons of various ages but as a general rule the 16th year constitutes the minimum limit.* They differ no less in respect of their knowledge; while many have hardly surmounted the elementary stages of a general education, others have by their scientific work already attracted the attention of specialists.

The number of professors is proportionately small, reaching at Oxford 55, at Cambridge only 40 in all the faculties together. But there are in addition numerous readers or lecturers and tutors who work in the university or in the separate colleges, give lectures, hold classes, or impart private instruction. At some universities, as members of them assert, teaching lies chiefly in the hands of these persons: probably however only in the departments belonging to general education; in medicine and the natural sciences this can hardly be the case. Medical science however is but partially represented at the English universities.† But a short while ago there were in hardly any, more than one or two medical professors; only in the most recent times have they been increased in number. And

* The 18th and 19th are the usual years for matriculation.—E. H. H.

† There is no doubt that the Medical School of Cambridge is now a great institution and one of which any country might be proud.—E. H. H.

even by these theoretical teaching, especially of anatomy and physiology, was attended to more than anything else. The completion of professional training is effected by practical instruction in the healing art given in the medical schools situated at the same place or in the near neighbourhood, and either incorporated with the university or at least in relation to it. An opportunity for this practical training is afforded at Cambridge by Addenbroke's Hospital, in Oxford by the Radcliffe Infirmary,* at Durham by the Medical School of Newcastle-upon-Tyne, while at Manchester Owen's College forms a part of the university founded there in 1880. The University of Dublin (Trinity College) which has existed since 1591, and the Royal University of Ireland, which since 1880 has taken the place of the Queen's University, are associated in a similar way with the medical schools and hospitals in their vicinity.

The connection between the medical faculties and the universities in Scotland is of a closer nature. The oldest universities of that country at St. Andrew's, Glasgow and Aberdeen arose under the influence of the Catholic clergy, and were governed by them: at St. Andrew's alone there existed a medical school.

The University of Edinburgh began as a college and, as the educational establishment of the city, grew in importance and developed after the pattern of the Academy of Geneva.† When the medical corporation of the town laid out a botanical garden and gave instruction in medicine the obvious course was to associate such teaching with the college itself. Subsequently the town council of Edinburgh in 1685 appointed three professors of medicine: they were doctors of the city, and lecture rooms were placed at their disposal but no salaries were given them. Amongst the first who taught there was ARCHIBALD PIT-

* Oxford and Cambridge men generally attach themselves to London Hospitals for practical work.—E. H. H.

† A. GRANT: The story of the University of Edinburgh, London 1884.

CAIRN. In 1770 there existed already in the medical faculty chairs of anatomy, the "institutes of medicine," the practice of medicine, midwifery, chemistry, botany, materia medica and natural history, as also a department for teaching anatomy, a botanical garden, a chemical laboratory and a clinic. In 1802 a surgical, and in 1825 an obstetric clinic were opened. In 1816 a proposal was made by the town council to appoint a professor of comparative anatomy and veterinary surgery; but this was opposed by the academical senate. In the course of the 19th century the establishments required to satisfy the needs of medical teaching have been provided, as they have also at Glasgow and the other two universities. Besides the medical faculties there are in Edinburgh and Glasgow other special schools of medicine independent of the university.

The University of London is no university at all, but an institution at which examinations are held and academical degrees obtained.

The schools in the trans-oceanic countries under British rule are organized after the English model.

Whoever devotes himself to the study of medicine has to give a proof that he has received a general education of a certain kind. If he is a university man the matriculation examination* suffices for this; if he first attends a medical school he has to pass the examination of one of the numerous bodies commissioned for this purpose, and which are competent to give certificates recognized as sufficient. These do not by any means require an equal degree of knowledge, but a general scheme of subjects lies at the root of all, though the severity of the test varies in degree at different places.

The programme of the London University permits us to form an opinion of the amount of knowledge required, and

* *i.e.*, at the University of London. Oxford and Cambridge men generally take the B.A. degree before attaching themselves to London medical schools.—E. H. H.

this may be taken as the maximum of knowledge demanded from the examinees.* The subjects taken up are as follows:—1. Latin. 2. One of the following languages at the candidate's choice: Greek, French, German, Arabic, or Sanscrit. 3. The English language, history, and modern geography. 4. Mathematics. 5. Natural philosophy (physics). 6. Chemistry of the non-metals and botany. In the Latin examination passages of CÆSAR *de bello Gallico*, of SALLUST, of CICERO'S easier orations, of LIVY, OVID, VIRGIL, and HORACE have to be translated into English; in Greek, XENOPHON, HOMER, and EURIPIDES are the authors set, and questions are added upon the grammar and upon ancient history. The authors and the particular parts of their writings destined to form the subjects of each examination are, however, published a year and a half in advance, so that the candidates may be in a better position to get "coached" in them. Similar arrangements are made with regard to examinations in other languages. The mathematical examination includes decimal fractions, extraction of square roots, and simple equations, and in geometry the earlier books of EUCLID. The knowledge of physics required is of an altogether elementary character, being confined to the simple laws and facts of mechanics, hydrostatics, pneumatics, heat, and optics, with the apparatus and instruments necessary to display them. In the chemical examination it is required that the candidate shall be acquainted with the most important elements and their properties, the commoner chemical processes, and the composition of water, air, and of certain bodies of frequent occurrence.

This is essentially the amount of knowledge which in England forms the foundation of professional study. Even this is, however, encroached upon in many places by the examination in some subjects—languages, for instance (excepting Latin and English), and also physics and chemistry —not being compulsory, but at the will and pleasure of the

* Calendar of the University of London 1883, p. 53 *et seq.*

candidates, and consequently for the most part falling through altogether.

If the general education of the English students is inferior to that of the German, the English training has in another respect a great advantage over theirs, inasmuch as the development of the body has its full importance assigned to it in England. The English schools are not only careful for the education of the intellectual powers of their students, but attend also to the development of their bodies in health and strength. The young men spend a large portion of every day in the parks and gardens surrounding many of the colleges. Bodily exercises of all kinds, cricket and football, wrestling, gymnastics, riding, swimming, rowing, etc., preserve their health and strengthen their bodily powers. As a result of this the English students appear, as a general rule, fresher, healthier, and stronger than their German brethren, who, after having been obliged to sit on school forms at the gymnasium for 32 hours in the week, and having been plagued for the rest of their time with school tasks and private lessons, come to the university tired and weary, and suffering frequently from short-sightedness, weakness of the chest, and other affections.

The curriculum of medical studies upon which the professional education of most English doctors proceeds exhibits many differences at the different seats of training, but shows in every case a marked preference for the so-called practical subjects. Leaving certain universities out of the question, a relatively small amount of time and labour is given to the preliminary and theoretical sciences ancillary to medicine. The extensive subject of physiology which at the German universities occupies six hours a week throughout a whole year is got through in 3-4 lectures a week during six months by the medical schools of England.* Practical work in

* But in addition to the lectures on physiology which the student has to attend during two winter sessions there are also physiological demonstrations, and a course of practical physiology in the summer session: so the subject is really dealt with in a satisfactory manner.—E. H. H.

anatomy or dissection is carried on only to a limited extent, as subjects can only be bought at a high price.* The dealers who used to undertake to supply them had in former times recourse occasionally to the practice common in the middle ages of stealing corpses from the churchyard: some of these resurrection-men even perpetrated crimes, when there was a scarcity of subjects, by compassing the death of people and selling their bodies to the dissecting-room. The trial of the murderers BURKE and HARE at Edinburgh, in which the anatomist ROBERT KNOX was involved, brought some horrible details to light.† It was not till 1832 that the practice of anatomical dissection in England was made subject to legal rules and the conditions defined under which it was to be carried on.

The study of preparations in spirit and of wax models supplements actual dissection. Instruction in the theoretical sciences is limited to the elementary principles and most important facts, especially in respect of their significance and use in professional practice. This keen sense of the practical applicability of acquired knowledge pervades the entire system of teaching at the medical schools. The teachers become reconciled to this demand for utilitarian science and in their lectures always give a prominent place to the relations borne by the subject to points of practice; by this they succeed in arousing and keeping engaged the attention of the students. In England the medical student from the first day of his studentship is accustomed to regard medical practice as the goal which is set before him. Frequently during his first session he attends the visits to the wards made by the doctors in the hospital. The latter sessions are entirely devoted to clinical studies, the students serving in the wards and the different depart-

* The supply, though not so abundant as on the Continent, is adequate.—E. H. H.

† H. LONSDALE: A Sketch of the Life and Writings of ROBERT KNOX, the anatomist, London 1870.

ments of the hospital or attending cases in the neighbourhood, writing diet-sheets and prescriptions, keeping case-books, performing surgical dressings, helping at operations, etc. When they are engaged on the surgical side of the hospital they are called "dressers," when on the medical, "clinical clerks." Whoever is unable to get an appointment of this kind at the hospital adjoining his medical school, has an opportunity of finding what he wants at one of the numerous large country hospitals. Students are only compelled to remain for 2½ years at the medical school; during the rest of the period of studentship they are at liberty to work at a hospital in the way mentioned.

According to the Medical Act of 1858, 19 corporations and societies had the right to hold examinations and to grant permission to practise. These were the Societies of Physicians, Surgeons and Apothecaries in London, Edinburgh, Glasgow and Dublin, and the medical faculties of the universities. The scientific and financial demands imposed upon candidates by these bodies differ as much as do the titles and degrees conferred. How this comes about may be rendered clear by the following examples. The two highest professional Societies of London, the Royal College of Physicians and the Royal College of Surgeons have agreed to hold conjoint examinations, after the satisfactory passing of which the diplomas of the two Corporations are granted.* To be admitted to this examination the candidate must submit proofs that he has received instruction in botany, chemistry, materia medica, and pharmacy, has worked in a chemical laboratory, has dissected for twelve months, has attended a six-months' course of lectures on normal human anatomy, another of the same duration on physiology and histology, and a three-months' practical course on the two last subjects; further, that during six months he has attended lectures on internal medicine and surgery, and, for three months, lectures on midwifery and gynæcology, that he has

* This came into force on Oct. 1st, 1884.—E. H. H.

attended at least 20 labours and has received a systematic introduction to practical medicine in regard to such matters as the various methods of diagnosis, the examination of diseased tissues and of excreta, and the use of apparatus and instruments employed in these investigations; again, that he has attended a three months' course of pathological anatomy, has assisted at post-mortem examinations while engaged in clinical work, has attended lectures on forensic medicine for three months, and that, for nine months, he has been in attendance at the medical and surgical clinics and altogether has spent two years and a half at a hospital: he must have been clinical clerk and dresser each for six months and have acquired practical skill in the performance of vaccination. The candidate's knowledge is tested by many examinations, some of which are passed during the period of studentship. The first examination deals on the one hand with chemistry, physics, materia medica, pharmacy and medical botany, on the other with elementary anatomy and physiology. For the convenience of candidates it may be divided in two portions which are held at different times: but the whole must, if possible, be passed during the first year. Six months later the candidate has to present himself for the second examination, which includes anatomy and physiology, but a more advanced knowledge of these sciences is required than in the first examination. In the third and last examination the subjects are internal medicine, therapeutics, pathological anatomy and general pathology, surgery, surgical anatomy and pathology, midwifery and gynæcology: some questions on the subjects of forensic medicine and public health may be added. This examination, like the first, may be divided and passed at different times. It must however not be entered upon earlier than two years after the second examination. The candidate must be at least 21 years of age. The examinations are partly oral, partly on paper, and partly again of a practical nature, such as involves the demonstration of anatomical preparations, the

examination of patients, the performance of operations on the dead body, etc.

The candidate who passes these three examinations receives the license of the Royal College of Physicians and the membership diploma of the Royal College of Surgeons.* Equipped with these certificates he presents himself to the public as a doctor capable in every respect and equally trained in all branches of his art. Moreover each of these two qualifications may be granted by the corresponding corporation on its own account : † the examination in this case is easier, inasmuch as less importance is attached by the one examining body to anatomy and surgery and by the other to chemistry, physics, physiology and internal medicine.

Other corporations proceed upon the same plan, granting diplomas in conjunction with other examining bodies or independently ; but some boards are satisfied more easily than others. Thus the Royal College of Physicians of Edinburgh only requires that the candidate should have dissected for six months, have attended lectures on physiology for three, the medical clinic for six, and the surgical for three months. The examination consists of two portions ; in the first, anatomy, physiology and chemistry, and in the second, materia medica and pharmacy, general pathology and pathological anatomy, internal medicine, surgery, midwifery, forensic medicine and clinical medicine are the subjects in which the candidate's knowledge is tested.

The Societies of Apothecaries demand of candidates that, in addition to having studied medicine, they shall have devoted special attention to the natural sciences and

* Examining Board in England by the R. College of Phys. of London and the R. C. of Surg. of England, London 1884.

† The diploma of Member of the R. College of Surgeons is not now granted apart from the license of the R. College of Physicians except to students who commenced their professional studies prior to Oct. 1st, 1884. And the same may be said *mutatis mutandis* of the license of the R. College of Physicians.—E. H. H.

to chemistry and pharmacy, and have worked in a dispensary or a pharmaceutical laboratory. The Societies of Apothecaries of London and Dublin constitute medical examining boards.

The apothecaries in England pursue the same course of study as the doctors and have a license to practise. This arrangement has probably developed out of the popular habit—which has existed in all ages—of seeking the first medical assistance at the hands of the apothecaries.*

The candidate has a free choice among the examining boards; he will probably decide upon that one which is nearest his home or the place where he has been pursuing his medical studies, or which makes the most moderate claims on his knowledge and his purse and is respected by the public. The Englishman will therefore in most cases try to get an English diploma, the Scotchman a Scotch, and the Irishman an Irish one: the more of these a man possesses, the greater the tribute paid to his knowledge and the greater the trust reposed in him by his patients. His position is still better if he is received amongst the members of a privileged medical corporation, receiving the title of "Member" or "Fellow" of the same. These titles are granted either after special examinations or are conferred upon suitable candidates after election by the Societies. Thus anyone who wishes to get the title of a Member of the Royal College of Physicians of London must submit to an examination which includes the same subjects as the examination for the license, but goes more deeply into them. From among the Members of this College the Fellows are chosen: the latter conduct the affairs of the College and represent it on public occasions. The Royal College of Surgeons of England† grants the Fellowship to those who have earned a right to it by passing two examinations, of which practical subjects, and especially

* The Society of Apothecaries of London grants a diploma in Medicine, Surgery, and Midwifery registrable under the Medical Act, 1886.—E. H. H.

† Calendar of the Royal College of Surgeons of England, London 1884.

anatomy and surgery, constitute the chief part, and also to those of its members who by their achievements and their character appear worthy of this distinction.* Most of the other medical corporations elect their Members without imposing the condition of an examination: they, in this way, always have it in their power to select none but the ablest and most esteemed representatives of their profession.

The universities alone are entitled to grant academical degrees. The conditions under which these are conferred differ in different places. Yet, as a general rule, the principle holds good that university examining boards attach greater importance to a scientific preliminary training than is the case in most medical corporations. Some universities, like Oxford and Dublin, even require that candidates for medical degrees should already have taken an academical degree in arts.

Whoever wishes to become a Bachelor of Medicine of Oxford (*Baccalaureus medicinæ*) must possess the degree of Bachelor of Arts, which in England has about the same significance as Doctor of Philosophy in Germany. To obtain this degree a course of studies of three years' duration *in literis humanioribus* is required.† The medical

* The Fellowship of the Royal College of Surgeons is however *very* rarely granted as an honorary distinction.—E. H. H.

† To obtain the B.A. degree the candidate must have resided for 12 terms within the university. There are three courses of examinations to choose from—

(i) Responsions (or an Extra-University equivalent), Moderations, Divinity Examination (or an equivalent), and Final Pass Schools in three subjects.

(ii) Responsions, Moderations, Divinity, and Honours in Literæ Humaniores, Mathematics, Theology, Oriental Languages, Modern History, Jurisprudence, or any of the subjects of the Natural Science School, viz., Chemistry, Physics, Animal Morphology, Animal Physiology, Botany.

(iii) Responsions with an additional subject, Divinity, the Preliminary Examinations of either the Jurisprudence or Natural Science Schools and Honours in one of the Honour Schools mentioned in the preceding paragraph.

Vide "British Medical Journal," Sept. 5, 1891, and the "Oxford University Calendar."—E. H. H.

studies follow upon this, and last for four years. The test required of the candidate for the degree of Bachelor of Medicine consists of two examinations, of which the first deals with normal human anatomy, comparative anatomy, physiology, physics, chemistry, and botany; the second with theoretical and practical medicine, the diseases of women and children, materia medica, surgery, midwifery, forensic medicine, and hygiene, and in addition some passages are set for translation from the medical writings of the ancients, as, for example, from the Hippokratic collection, from GALEN, ARETÆUS, or CELSUS, or else from one of these authors and a medical author of modern times. The degree of Bachelor of Medicine gives a right to practise medicine, and only those who possess this degree can proceed to the Doctorate; this, however, is not granted until the candidate has passed three years in medical practice, and has submitted a thesis upon a medical subject.*

In other universities the tests are of a similar nature. The London University, the examinations of which have acquired a great reputation for thoroughness, does not insist upon the candidate for medical degrees possessing a degree in Arts, but only requires that such candidate shall have attained a certain proficiency in the natural sciences. Here the degree of Bachelor of Medicine is granted after the following examinations have been satisfactorily passed:† 1. The Preliminary Scientific Examination, in which physics, inorganic chemistry, botany, and zoology are the subjects; 2. The Intermediate Examination, which follows two years after the last-mentioned, and includes anatomy, physiology with histology, materia medica, pharmaceutical and organic chemistry; 3. The Final Examination at the conclusion of studentship, in which general pathology

* For which a book published within two years of the candidate's application for the degree may be substituted.—E. H. H.

† Assuming that the Matriculation Examination has been already passed.—E. H. H.

and therapeutics, hygiene, surgery, internal medicine, midwifery, and forensic medicine are dealt with.

These examinations, like those carried on by other corporations, are partly oral, partly on paper; practical demonstrations and bedside examinations of patients, etc., are also made use of. Here also, as with the other privileged medical bodies, certificates are required of the candidates testifying that they have attended certain lectures and courses of instruction, clinics, and hospital practice.

The degree of Bachelor of Medicine is the necessary preliminary to the other medical degrees. The doctorate is granted after some years have been passed in practice, and after a further examination in the various branches of medicine. Even the surgical degrees are only conferred on those who have passed the examinations required for the degree of Bachelor of Medicine. The degree of Bachelor of Surgery is obtained by passing an examination which deals principally with surgical anatomy and pathology, operative surgery, and the instruments used. The degree of Master in Surgery is conferred on anyone who being a Bachelor of Surgery has spent two to five years in the practice of surgery, either in a hospital or independently, and who succeeds in passing a further examination in the subjects above-mentioned. In the same way most other university examining bodies in granting surgical degrees impose the condition that the candidate must be legally qualified to practise as a doctor. At the Universities of Durham and St. Andrew's a rule exists enabling doctors who have been in practice for 15 years, and are over forty years of age, to proceed to the degree of Doctor of Medicine by payment of 50 guineas after a comparatively very easy examination.

The statistics of the results of examinations afford some opportunity of forming a judgment upon the importance and activity of the different examining bodies, and upon the localities selected by the majority of English doctors in

which to prosecute their studies. We find that in the five several years, 1876-1880, at the University of Oxford, 6, 10, 5, 6, 7 candidates received the degree of Bachelor of Medicine, and 1, 1, 0, 2, 2 that of Doctor of Medicine; these numbers at Cambridge were, 13, 7, 9, 13, 16 and 5, 2, 6, 9, 7; at Durham, 2, 7, 9, 19, 13 and 2, 3, 1, 11, 10, while 0, 0, 2, 7, 4, took the degree of Master of Surgery; at the University of London the degree of Bachelor of Medicine was conferred on 23, 22, 25, 34, 39, that of Doctor on 11, 8, 6, 12, 18; that of Bachelor of Surgery on 7, 3, 6, 6, 8; and that of Master of Surgery on 1, 1, 0, 0, 1; during these years the Royal College of Physicians of London granted 90, 97, 68, 108, 79 candidates the license to practise, made 25, 23, 20, 14, 18 Members, and 12, 9, 13, 12, 12 Fellows; the Royal College of Surgeons of England conferred the Membership on 406, 393, 361, 420, 404 candidates, and the Fellowship on 29, 36, 21, 18, 30, giving also the license to practise dentistry to 20, 27, 27, 17, 19 candidates; while the Society of Apothecaries licensed 257, 206, 223, 216, 228 to practise medicine. The University of Edinburgh during the same period made 86, 108, 115, 98, 134 Bachelors, 20, 34, 30, 33, 29 Doctors of Medicine, and 80, 100, 106, 98, 129 Masters in Surgery; at the Glasgow University these three categories were represented by 58, 62, 59, 57, 74; 23, 20, 11, 12, 16; 54, 56, 57, 54, 66; at Aberdeen by 41, 34, 57, 51, 48; 32, 46, 30, 25, 35; 41, 34, 55, 48, 48; at St. Andrew's by 1, 2, 1, 0, 3; 10, 10, 10, 10, 11, the first group in this case representing both Bachelors of Medicine and Masters of Surgery. The Royal College of Physicians of Edinburgh gave its license to 114, 99, 114, 145, 137, and in conjunction with the Royal College of Surgeons of Edinburgh to 85, 116, 160, 156, 162, further in conjunction with the Faculty of Physicians and Surgeons of Glasgow to 22, 13, 21, 27, 30, and the same body made 23, 18, 23, 19, 20 Members, and 9, 11, 8, 6, 9 Fellows; the Royal College of Surgeons of Edinburgh elected 27, 31, 30, 41, 44 Fellows;

and the Faculty of Physicians and Surgeons of Glasgow conferred the license on 63, 34, 55, 71, 73, and the Fellowship on 15, 23, 10, 3, 5 candidates. The University of Dublin granted the license in medicine to 3, 2, 0, 2, 4, that in Surgery to 1, 2, 0, 0, 3 candidates, and created 36, 44, 29, 29, 40 Bachelors, and 20, 17, 14, 15, 10 Doctors of Medicine, 20, 18, 23, 23, 28 Bachelors, and 8, 5, 3, 3, 1 Masters of Surgery. The Queen's (now Royal) University of Ireland created 53, 44, 47, 55, 64 Doctors of Medicine, and 47, 35, 35, 34, 44 Masters of Surgery; the King's and Queen's College of Physicians in Ireland gave the license in midwifery to 99, 89, 79, 76, 78, and in medicine to 108, 86, 78, 88, 105, and elected 5, 2, 0, 3, 4 Fellows; the Royal College of Surgeons in Ireland gave the license in midwifery to 11, 8, 10, 9, 10, and in medicine to 97, 99, 106, 122, 103, and made 13, 5, 6, 15, 14 Fellows; the Apothecaries' Hall of Ireland licensed 22, 24, 23, 34, 42 candidates. These figures show that the number of doctors who pass university examinations as compared with the number getting licenses from the medical corporations is in England approximately as 1 to 8, in Scotland as 4 to 3, and in Ireland as 1 to 2.

To distinguish the various degrees and qualifications short forms are employed as is the case generally with titles in England. Thus F.R.C.P means Fellow of the Royal College of Physicians; M.R.C.S., Member of the Royal College of Surgeons; L.S.A., Licentiate of the Society of Apothecaries; M.B., Bachelor of Medicine; M.S., Master of Surgery; M.D., Doctor of Medicine; to this is generally added the name of the university from which the degree has been obtained. The English public knows the value and significance of the different kinds of medical diplomas existing in the country, and is reminded upon these points by the differences in the professional fees, which are regulated by custom.*

* Amongst general practitioners the fees are to a large extent regulated by the house rental of patients.—E. H. H.

If England has not always followed the progress made by other countries in regard to systematic medical instruction, she, on the other hand, has rendered the great service of creating the first satisfactory system of sanitary government. By the Public Health Act of 1875, the whole land was divided into sanitary districts presided over by local authorities. These have to take care that drainage, building operations, public and private privies, the cleansing of the streets, the drinking water supply, the food, underground dwelling places, inns, hospitals, graveyards, factories, etc., are conformable to the principles of public health, and they elect sanitary officers to supervise and to take any necessary action in these matters. Whoever desires an appointment of this kind must be legally qualified to practise.

At most universities and examining boards examinations are held and diplomas granted in sanitary science. It is of advantage for anyone desirous of occupying the position of medical officer of health to possess such a certificate of proficiency in sanitary science.

This organization is founded upon the principle of self-government, and may be expected to yield important results in a country the people of which have for centuries been accustomed to manage their own affairs, are in possession of abundant national wealth, and understand the advantage of a rational care for the public health.

[Before being permitted to register the commencement of medical study it is necessary for the student to have passed a preliminary examination in the subjects of general education as specified in the following list :—(1.) English language ; (2.) Latin ; (3.) Arithmetic, algebra, and EUCLID ; (4.) Elementary mechanics ; (5.) Either Greek, French, German, Italian, logic, botany, zoology, or chemistry. For the London student these requirements are satisfied by his passing the matriculation of the University of London, the

examination in arts of the Apothecaries' Society of London or the professional preliminary examination of the College of Preceptors. Examinations of British and Colonial universities are accepted by the General Medical Council if the above-mentioned subjects are shown to have been included. Students who propose to obtain medical degrees in the University of London should pass both the matriculation and the preliminary scientific examinations before commencing their regular medical studies.

The following course of study is recommended at one of the chief Metropolitan schools for a student who enters in October, intending to obtain the double qualification of the "Conjoint Board" (L.R.C.P. Lond. and M.R.C.S. Eng.). It should be premised that the winter session extends from October 1st to March 31st, and the summer session from May 1st to July 31st.

FIRST WINTER SESSION.—*Lectures, etc.:* Anatomy, Physiology, Chemistry, and Physics. Anatomical and Physiological Demonstrations. Dissections. *Examinations:* "Sessional" at Medical School in December and in March. Part III. (Elementary Anatomy and Physiology) of the First Examination of the "Conjoint Board" in March.

FIRST SUMMER SESSION.—*Lectures, etc.:* Materia Medica, Practical Chemistry, and Practical Physiology. *Examinations:* "Sessional" in July, and Parts I. and II. of the "First Conjoint."

SECOND WINTER SESSION.—*Lectures, etc.:* Anatomy and Physiology, with Demonstrations and Dissections. Tutorial Class in Anatomy. Hospital Practice, Medical and Surgical. *Examinations:* "Sessional" in December and in March; "Tests" and "Second Conjoint" in March.

SECOND SUMMER SESSION.—*Lectures, etc.:* Hospital Practice, Medical and Surgical. Midwifery. Practical Surgery. *Examinations:* Sessional in July. The course of instruction in Elementary Clinical Medicine to be attended by Candidates for Out-Patient Clinical Clerkships.

THIRD WINTER SESSION.—*Lectures, etc.:* Hospital Practice, Medical and Surgical. Medicine, Surgery, and Surgical Pathology, Practical Surgery, Practical Course of Pathological Anatomy. *Examinations:* "Sessional" in December and March. Clinical Clerkship (if not held during July, August, and September) and Dressership in the Out-Patient Departments. Maternity cases may be attended at any time after the Lectures on Midwifery of the Second Summer.

THIRD SUMMER SESSION.—*Lectures, etc.:* Hospital Practice, Medical and Surgical, with Clerkship or Dressership. Pathological Anatomy, Forensic Medicine, Ophthalmology. *Examination:* "Sessional" in July.

FOURTH WINTER SESSION.—*Lectures, etc.:* Hospital Practice, Medical and Surgical, the special departments and post-mortem examinations. Clerkship or Dressership in special departments and post-mortem room. Instruction in Vaccination. Practical Course of Pathological Anatomy (if not taken in third winter). Clinical Lectures on Medicine, Surgery, and Diseases of Women. Obstetric Demonstrations. Diseases of Eye.

FOURTH SUMMER SESSION.—*Lectures, etc.:* Hospital Practice, Medical and Surgical, and special departments. Clinical Medicine, Clinical Surgery, Mental Disease, Public Health and Sanitary Science. Tutorial Classes in Surgery, with operations on the dead body. *Examination:* "Final Conjoint" in Medicine, Surgery, and Midwifery. NOTE.—The three subjects may be taken at one examination.*

When to such a scheme of work as this students add, as they often do, such supererogatory labours as are involved in the preparation for the very exacting First Fellowship examination, in the tenure of junior demonstratorships, and in assisting general practitioners in dispensing and book-keeping, it can be easily understood that their time is fully taken up, and that it behoves them to take care that the mental tension is regularly relaxed by appropriate recreation.

* See St. Thomas's Hospital Medical School Prospectus, 1890-91.

Those who desire to get a degree of M.D. have the opportunity of acquiring it at one of eleven universities in the United Kingdom: Oxford, Cambridge, London, Durham, Victoria, Edinburgh, Glasgow, Aberdeen, St. Andrew's, Dublin, Royal. The University College of Medicine, Newcastle-on-Tyne, is affiliated to Durham University. The colleges of the Victoria University are Owen's College, Manchester; University College, Liverpool; and Yorkshire College, Leeds.

The School of Physic of Trinity College is the chief training ground for students of Dublin University; some, however, instead of studying at this their own school, take out their courses at the Carmichael College or the College of Surgeons. The Royal University of Ireland, like the London University, is a purely examining body.

In spite of these numerous universities the conditions of residence and other causes conspire to induce many qualified practitioners to take the more rapidly procurable medical doctorate of the University of Brussels.

However much or little there may be in a name there is no doubt that among the laity in England the letters M.D. form a combination to conjure with. The London student is at a peculiar disadvantage in regard to graduating in medicine inasmuch as the only degree-granting body in London—the London University—has by the duration and severity of the curriculum placed its doctorate out of the reach of the large majority of students.

On the other hand, as may be seen from the figures on a previous page, the Scotch student in his own country has facilities for taking this degree, of which he does not fail to avail himself, and the same may be said, though to a smaller extent, of the Irish student. A medical graduate of Glasgow or of the Royal University of Ireland occupies thus in the eyes of the public a favoured position as compared with a licentiate of the Royal Metropolitan Colleges or of the Apothecaries' Hall out of all proportion to the difference in their professional education.

The Report of the Royal Commission on Higher Education in London gave official sanction to these complaints, declaring that "the demand for degrees attainable in London more easily than at present is a legitimate one, and it is desirable to provide for that want in some proper manner." The Royal Commissioners were of opinion that the doctorate of the London University is an "honours" degree and that it is desirable that there should be in London a "pass" degree attainable, while at the same time they unanimously rejected the application of the Royal Colleges of Physicians and Surgeons for powers to confer degrees.

The London student wants a "pass" degree granted on terms similar to those on which such degrees are given in Scotland and the provinces. It is quite easy to understand that the Convocation of London University objects to any measure which would tend in the slightest degree to depreciate the value of the degrees of which the graduates of that University are justly proud.

How the legitimate grievance of the London student will ultimately be removed is not apparent. A joint request from such powerful Corporations as the College of Physicians, the College of Surgeons, and the Society of Apothecaries, for a Charter empowering them to grant medical degrees could hardly be refused by Government, and would solve the difficulty: this combination, is, however, just what it is difficult to secure. The exclusion of the Society of Apothecaries in any scheme for securing to the London Medical Corporations an extension of privileges in the way of granting degrees is to be deprecated as unjust and impolitic: unjust, as taking no account of the good work done by that Society in the past or of the continually improving character of its examinations; impolitic, for the inevitable result would be the competition, instead of the co-operation, of an examining body entitled to grant licenses in the three chief branches of practice.

The formation of a Teaching University, independent of the University of London (and in which King's and University Colleges would occupy a prominent position), has for long been held to be urgently demanded by many interested in the higher education.

During the present year an important step has been taken towards satisfying these requirements by the foundation in and for London of the Albert University by virtue of her Majesty's prerogative. In it University and King's Colleges are to be colleges of all faculties, and the ten chief medical schools of London, including the London Medical School for Women, are to be colleges of medicine. No medical degree is to be conferred on any person who shall not previously have obtained a qualification for registration under the Medical Acts. The medical schools are to be represented on the Council by one member for each school, while King's and University Colleges are to be each represented on it by three members; the Council is empowered to provide for the representation of the Royal Colleges of Physicians and Surgeons should they signify to the Chancellor their desire to be so represented, and is also at liberty to assign, should it think fit, a place or places to a member or members nominated by the Society of Apothecaries. Periods of residence and study, and examinations at other universities in the Queen's dominions, are to be recognized as equivalent to such periods of study at the Albert University as the Council shall determine from time to time. The growth and development of this youngest member of the academical family cannot fail to influence education in general and medical education particularly.

Certain resolutions were passed by the General Medical Council on June 5th and 6th, 1890, which will become obligatory on every medical student who begins his medical studies after January 1st, 1892. In regard to medical education they ordain that professional study shall last for five years; the first year may be passed at a university or teaching institution where physics, chemistry, and biology

are taught; the fifth year should be devoted to clinical work, but of it the student may pass six months as pupil to a registered practitioner whose opportunities of imparting practical knowledge are considered satisfactory by the medical authorities. The remaining resolutions are framed with the object of securing for the student a thorough and complete training in practical and clinical work.

In regard to professional examination the resolutions require that the time devoted to the practical part of all examinations should be extended; that the examination in physics, chemistry and biology should be passed before the beginning of the second winter session; that there should be three professional examinations (antecedent to the Final Examination) which should be passed before the final year intended for clinical work; that the Final Examination must not be passed before the close of the fifth year of medical study.

In addition to the twelve Metropolitan Schools having a complete curriculum (in which number is included the London Medical School for Women) there are in London no less than thirty Ancillary Schools of Medicine in which departmental or preparatory subjects are taught. In the provinces, Birmingham, Bristol, Cambridge, Newcastle-on-Tyne, Leeds, Liverpool, Manchester, Oxford and Sheffield contain hospitals and medical schools.

In Scotland there are four University Schools of Medicine —Edinburgh, Glasgow, Aberdeen and St. Andrew's. University College, Dundee, now forms part of St. Andrew's. Clinical instruction is given at the Royal Infirmary, Edinburgh, in medicine and surgery and in the various specialities. Clinical lectures and instruction are also given at the Edinburgh Eye, Ear and Throat Infirmary. At Glasgow the Western Infirmary, the Royal Hospital for Sick Children, the Hospital and Dispensary for Diseases of the Ear, and the Ophthalmic Institution subserve clinical instruction. This is likewise imparted at the Aberdeen Royal Infirmary and the Aberdeen Royal Lunatic

Asylum, in the latter institution during three months in summer.

The School of Edinburgh enjoys present popularity and historic renown and attracts not only Scotch but English and Colonial students in great numbers.

Some of the most prominent members of the staffs of London Hospitals have been trained and have graduated in Scotland and the services rendered by them to clinical instruction in the London schools are of the highest character. The clinical teaching of the late Dr. MURCHISON at St. Thomas's Hospital was of European celebrity and in thorough harmony with the traditions of the Scottish school.

There are several centres of medical education in Ireland. Those in Dublin enjoy great repute and are much frequented, especially the School of Physic of Trinity College and the Ledwich School, at the latter of which night tuition is given. The Rotunda Hospital at Dublin constitutes one of the most important schools of obstetrics and gynæcology in the world. The School of the Royal College of Surgeons and the Carmichael School have recently improved their accommodation for students and their appliances for teaching. At the Mater Misericordiæ Hospital, the largest in Dublin, at Sir Patrick Dun's Hospital, the Adelaide Medical and Surgical Hospitals and other hospitals and dispensaries opportunities are afforded for clinical work and clinical instruction is given.

In the prosperous town of Belfast the Queen's College School of Medicine affords facilities for acquiring a first-rate medical education. Here the courses of instruction are framed with a view to the requirements of those intending to present themselves for degrees at the Royal University of Ireland, but are nevertheless quite fitted for preparation for other qualifications. The social and scenic surroundings are all that could be desired while the cost of education and living is moderate. Cork also possesses a medical school and hospitals affording good opportunities of study,

especially if the student has in view the degrees of the Royal University.

Anyone who is on the Medical Register is entitled to practise as a dentist but it is usual and advantageous to take a special dental diploma and to become L.D.S. or a Licentiate in Dental Surgery. This qualification can be obtained by itself but it is better if the student can see his way to taking the medical and surgical qualification of the conjoint board in addition. The special studies required for the dental diploma are: two courses of dental anatomy and physiology human and comparative; two courses of dental surgery; two courses of dental mechanics; one course of metallurgy; practice of dental surgery in a recognized school for two years; and an apprenticeship in dental mechanics to a competent practitioner.

The conditions of admission into the Army Medical Service are that the candidate should be between the ages of twenty-one and twenty-eight, and in good health, that his parents should be of unmixed European blood, that he should possess the double qualification to practise medicine and surgery, be registered under the Medical Act, and furnish satisfactory certificates as to character. He has then to undergo a competitive examination. The subjects are (i.) Compulsory and (ii.) Voluntary. The former include anatomy and physiology, surgery, medicine with therapeutics and diseases of women and children, chemistry and pharmacy and a practical knowledge of drugs. By this part of the examination the eligibility of the candidate for admission into the service is determined. The voluntary subjects are French, German, comparative anatomy, zoology, natural philosophy, physical geography, and botany.

The conditions of entrance into the Indian Medical Service are similar, with the exception that the age limits are twenty-two and twenty-eight, and it is only required that the candidates should be natural-born subjects of her Majesty. Among the voluntary subjects in the examination for the Indian service Hindustani is included.

The successful candidates now proceed to Netley to go through a four months' course of instruction in military surgery, medicine and hygiene. They then pass a final examination, and their position on the list of those recommended for commissions is determined by the combined results of the competitive and final examinations. The surgeons of the British Medical Service then pass to Aldershot for instruction in ambulance drill and equitation.

A further examination has to be passed on promotion to the rank of surgeon-major: this is with a view of testing the surgeon in such branches of knowledge as are essential to his continued efficiency as a medical officer.

The conditions of admission into the Naval Medical Service resemble those for the army. After passing the competitive examination in London the successful candidate receives a commission as surgeon in the Royal Navy, and undergoes a course of naval hygiene at Haslar Hospital.

A further examination has to be passed on promotion to the rank of staff-surgeon.

The special departments in the London Hospitals are now most ably administered and opportunities are afforded to students of holding minor appointments in them. In addition to clinical teaching in the wards, clinical lectures are given on cases of especial interest by the physicians and surgeons at frequent intervals.

The beautifully exhibited and carefully catalogued pathological specimens in the museums afford unrivalled opportunities for study: while practical research in physiology and bacteriology has of late years become an established feature at many medical schools.

The rapid advance in therapeutics which is a characteristic of the present time, has made it desirable that the qualified practitioner should be placed in a position to acquaint himself with new methods of treatment, and facilities are afforded him for this in the courses of post-graduate lectures which have recently been instituted and

which are delivered by men of eminence in the various specialities.

The addresses given at the Annual Meetings of the British Medical Association—held in different cities and towns of the United Kingdom—as well as the papers read before branch meetings of the same Association help to keep the practising doctor abreast of recent inventions and discoveries bearing upon his work.

The Harveian and Hunterian orations delivered once a year *urbi et orbi* while honouring the illustrious dead are eminently calculated by the high standard of rhetoric and of learning which frequently characterizes them, to inspire and instruct the living.

The advances made in the education of doctors in England within the present century has been accompanied by a continual improvement in the nursing staff of hospitals. The cleanliness and order of a ward in an English hospital are the outcome to a large extent of the high intellectual and moral standard required and found in the superintending and subordinate nurses. How far this happy result has been contributed to by the example and teaching of one devoted lady is a matter well known to her contemporaries and will not be forgotten by posterity. The lessons learnt among the sick and wounded of the Crimean war have borne rich fruit in more peaceful scenes.

Thoroughness and practical efficiency are the distinguishing features of English medical teaching of the present day: every effort is made to make examinations of an objective character and high consideration is given to practical work in all branches. The example set by the metropolitan and provincial schools tends in an ever-increasing degree to be followed by the centres of study in India, by those of Sydney and Melbourne, Quebec and Montreal.

How our hospitals, supported by voluntary contributions, liable to abuses as they undoubtedly are, in common with other human arrangements, impress the foreigner, may be

exemplified by a passage written five years ago by the author of this work. Speaking of the English hospitals, he says, "In the erection and maintenance of these institutions the benevolence of the English people is most strikingly shown, while a brilliant example is set for the imitation of other nations."]

The system of medical instruction prevalent in England has been imitated not only in those parts of the transatlantic continent which are under her rule, but wherever the English language and English culture prevail.

In the United States of America medical teaching is also a matter of private enterprise. Several doctors living in the same locality unite for the purpose of imparting instruction in medicine, and give their pupils testimonials of proficiency. No one makes inquiries as to the qualifications of the teachers, or as to the result of their teaching. These schools consequently differ exceedingly in merit. According to a list made in the year 1882 there were in the United States at that time 114 medical schools and 13,321 students.

Some medical schools enjoy, and justly so, a high reputaon. Such are the New York College of Physicians and Surgeons, founded in 1791, the University Medical College, which has existed since 1841, the Bellevue Hospital College at New York, the Massachusetts Medical College at Boston, and the Rush Medical College at Chicago. Along with these, however, there exist others which occupy a low position both intellectually and morally. The scandalous traffic carried on by many faculties in doctor's diplomas is well known. A newspaper of Philadelphia—where the abuse could be studied at its source—made a few years ago some incredible revelations upon this subject.* It is, there-

* "A Doctor-Factory making full-fledged physicians for seventy-five dollars" in the Philadelphia Record, 28th Feb., 1880.

fore, not a matter for surprise that American degrees in medicine should be regarded with distrust in Europe, and placed in the same category as those amiable but meaningless distinctions which are conferred on people dancing the cotillon.

The education of the American doctors is, as a general rule, inferior to that of their European colleagues. President ELIOT thus expressed himself in a report (1871-2) :— "It is fearful to think of the ignorance and incompetence of most American doctors who have graduated at American schools. They poison, maim, and do men to death in various ways, and are unable to save life or preserve health."* The skilled doctors found in America are in many cases of European origin, or at least have studied in Europe. Yet some departments of medical science, such as gynæcology and dentistry, have been prosecuted with great success in the medical schools of North America. Moreover, a gratifying endeavour is now everywhere being made to do away with the existing disabilities, and to introduce improvements into the system of medical education, following European models.

FRANCE.

WHILE in England and America the principle that the State should not concern itself with things which can be equally well managed without its aid, is generally followed, the very opposite is the case in France. There the ruling powers feel themselves called upon continually to exercise a strict supervision over everything that takes place. Both the system of medical teaching and medical practice have been subjected to minute regulations at the hands of the authorities. Only in the days of the great revolution was this principle departed from : at that time, instead of

* Revue internat. de l'enseignement, Paris 1882, iv, p. 550.

parental protection degenerating at times into a paltry pedantry being extended to the profession, an unlimited freedom was permitted which led in the direction of anarchy.

The doctors took an active part in the mighty political movements of that time.* Seventeen members of the profession belonged to the National Assembly, among them GUILLOTIN—the inventor of the decapitating machine named after him†—a politician of very moderate views, and J. G. GALLOT, P. BLIN, SALLES, BEAUVAIS DE PRÉAUX and others. In the Legislative Body of 1791 there were 22 doctors, among them the celebrated surgeon TENON; in the National Convention of 1792, 39 seats were occupied by medical practitioners of whom BARAILLON, PANVILLIERS, R. ESCHASSÉRIAUX, A. FOURCROY, M. A. BAUDOT, LEVASSEUR the obstetrician, E. LACOSTE and MARAT were the best known. When the Terrorists commenced their ghastly proceedings and celebrated their revolting and sanguinary orgies, the medical profession had to lament the sacrifice of numerous victims; 104 of its members were executed and 328 physicians and 540 surgeons were banished from France. PIERRE DESAULT, while holding his clinic in the Hôtel Dieu, was seized in the midst of his pupils and cast into prison. But thanks to the energy of his friend FOURCROY, who found effective support in the Press, DESAULT was soon again set at liberty.

LAVOISIER, the great chemist, was not so fortunate. He died on the scaffold, although HALLÉ had in touching words reminded his persecutors of the imperishable services rendered by him to science. *Nous n'avons pas besoin de savants*, was the reply of the president of the Court; the sentence of death was carried into effect and thereby France was robbed of one of her greatest men.

Men of learning were not wanted and science was not in

* C. SAUCEROTTE: Les médecins pendant la révolution, Paris 1887.

† Professor PUSCHMANN requests me (Oct. 1891) to correct this statement. He says "this machine was not invented by GUILLOTIN, having been used during the middle ages in Germany, Scotland and Italy; he only advised the French Parliament to make use of it."—E. H. H.

request. The smoky atmosphere of political fanaticism stifled the nobler emotions of humanity, and its devastating flame laid low all higher intellectual aspirations.

The system of medical education was pressingly in need of reform. Of the 18 medical schools possessed by France at the outbreak of the revolution scarcely one-half of them were known outside the towns in which they were situated and only those of Paris and Montpellier enjoyed any great reputation. The arrangements of the French medical faculties were inferior to those of other countries, and the French hospitals were on account of their unsanitary condition positively a by-word of reproach. The legislature interested itself in these questions.* A Bill introduced in 1790 contained many admirable suggestions for a reorganization of medical teaching; thus it was demanded that both in teaching and in the examinations the French tongue should be exclusively used, that there should be perfect freedom given to the professors in teaching their subjects, that the lectures should be gratis, that there should no longer be any fixed duration of studentship, that the professors should be appointed by competition, etc. Instead of the 18 medical schools there were to be only four medical faculties, in Paris, Montpellier, Bordeaux, and Strassburg, but each of these was to be provided with at least 12 professorial chairs, and, in addition, in every department there was to be a lower order of medical school associated with a hospital.† Unfortunately these proposals never came to be the subject of debate.

When radicalism came to be the dominant influence in the State men were no longer satisfied with improving the existing arrangements, but demanded their complete abolition. The place previously occupied by reform was now taken by revolution, *qui vint tout renverser depuis le trône du roi de France jusqu' à l'humble chaire du pro-*

* L. Liard in the Revue internat. de l'enseignement, Paris 1887, T. xiv, p. 409 *et seq.*

† Dreifus-Brisac in the Revue internationale de l'enseignement, Paris 1881, ii, 555 *et seq.*

fesseur et la banquette de l'étudiant, as SABATIER says. By the law of the 18th August, 1792, all universities, faculties, and medical schools were abolished; and for this act next to no compensation was given. In medicine as in theology, morals, and other things a desire was shown to retrograde to the primitive condition of mankind. It was hoped thus to reintroduce the conditions which obtained in the times of the ancient Greek philosophers; all that was really done was to open the gates to superstition and impudent quackery. The mistakes and deficiencies of scientific medicine were ridiculously exaggerated and were made use of for drawing up a heavy indictment against its representatives. In the National Convention a speaker rose to the sublime height of declaring that doctors should be dealt with like priests—both alike being mere jugglers.* The wars carried on by the Republic soon, however, became the means of demonstrating how necessary and useful doctors are. When it was communicated to the National Convention that the army had lost about 600 doctors within 18 months, and that the troops in the Eastern Pyrenees were almost entirely devoid of medical assistance, it was decided to reopen some of the medical schools. By a law of the 14th of Frimaire, year III. (4th December, 1794) three medical schools were established at Paris, Montpellier, and Strassburg; they were called *écoles de santé*. They were at first intended only *à former les officiers de santé pour le service des hôpitaux et spécialement des hôpitaux militaires et de marine*. Every district of the country sent a pupil to these military schools of medicine, and there, at the expense of the State, he studied medicine for three years. At Paris there were 300 students, at Montpellier 150, and at Strassburg 100.

The need of educated medical practitioners, however, soon led to civilian students, not supported by the State, being admitted for the purpose of receiving instruction. In 1796 the medical school at Paris was reorganized and

* P. FRANK, *op. cit.*, vi, 1, Abth., S. 221.

provided with twelve professorships as follows: (1) anatomy and physiology; (2) medical chemistry and pharmacy; (3) medical physics and hygiene; (4) surgical pathology; (5) pathology of internal diseases; (6) natural history in its bearings on medicine; (7) the art of surgical operations; (8) clinical surgery; (9) clinical medicine; (10) clinique de perfectionnement; (11) obstetrics; (12) history of medicine and forensic medicine. In addition the director of the establishment gave lectures "upon the Hippokratic methods of treating acute diseases," and "upon rare cases of disease collected from history and practice," while the librarian gave a course of bibliography and subjected medical literature to a critical review.*

Among the teachers were SABATIER, CHOPART, PINEL, CORVISART, BAUDELOQUE, LASSUS, and P A. O. MAHON, the last of whom held the professorship of the history of medicine. In 1799, it was proposed to create two new professorships, one of pathological anatomy the other of "philosophie médicale;" but this suggestion was not carried into effect. In 1798, an "école pratique" was associated with the institution, and there the students had opportunities of practising dissection. Clinics of various kinds dealt with their education at the bedside in the practical treatment of patients, and for some diseases—sexual disorders for instance—special establishments were founded. Instruction was given gratis, and by a law of the 22nd of Ventôse, year X., was made accessible to everyone; but for the sake of propriety, only medical students were allowed to attend the clinics.†

The medical school of Paris, under these conditions, rose rapidly in reputation, and in 1799 numbered 1,500 students. Examinations in the most important subjects taught ensued upon the conclusion of the period of study: these, however, were by no means compulsory.

* A. DE BEAUCHAMP: Recueil des lois et règlements sur l'enseignement supérieur, Paris 1880-85.

† E. BEAUSSIRE: La liberté d'enseignement et l'université sous la troisième république, Paris 1884.

Besides the regular practitioners who had enjoyed a systematic education at the schools of Paris, Montpellier, and Strassburg, there existed a great multitude of quacks. Everyone might practise medicine; no one had any need of license or diploma. The state of things which was thus developed was sharply criticised by FOURCROY—at that time at the head of all affairs connected with public instruction—in a report drawn up by him, and dated 7th of Germinal, year XI. *"La vie des citoyens,"* said he, *"est entre les mains d'hommes avides autant qu'ignorants. L'empirisme le plus dangereux, le charlatanisme le plus déhonté, abusent partout de la crédulité et de la bonne foi. Aucune preuve de savoir et d'habilité n'est exigée. Les campagnes et les villes sont également infectées de charlatans qui distribuent les poisons et la mort avec une audace que les anciennes lois ne peuvent plus réprimer. Les pratiques les plus meurtrières ont pris la place des principes de l'art des accouchements. Des rebouteurs et des mèges impudents abusent du titre d'officier de santé pour couvrir leur ignorance et leur avidité!"**

The law of the 19th of Ventôse, year XI. (10th March, 1803), abolished these abuses by making the permission to practise medicine dependent upon passing satisfactorily certain examinations which were introduced for this very purpose, and which included anatomy and physiology, pathology and nosology, materia medica, pharmacy and chemistry, hygiene and forensic medicine, midwifery, surgery, and internal medicine. The student's knowledge of anatomy was tested by requiring him to put up a preparation, while the examination in the practice of medicine took place at the bedside. Two different classes of practitioners were established, namely—(i.) Doctors of Medicine and Surgery; and (ii.) Officiers de Santé. Whoever aspired to the diploma of doctor had to pass through the Lycée training before applying himself to the study of medicine, and then to occupy himself with the latter for four years.

* RENÉ ROLAND: Les médecins et la loi du 19 Ventôse, an XI, Paris 1883.

The Officiers de Santé formed an inferior class of practitioners. They were not bound to furnish any proof of having received a general education, and they were permitted to engage in medical practice after only three years study at a medical school. But they also might be excused any such study, and it sufficed if they spent five years' working at a hospital, or six years in the service of a doctor. The examination which they passed dealt with anatomy, the elements of medicine, materia medica, and surgery, and was carried on exclusively in French. The doctors were allowed to settle down anywhere, the Officiers de Santé only in the country and in the department in which they were licensed to practise. They were, moreover, obliged in serious cases of illness and in the greater operations to call a doctor into consultation.

CARRET, the legislator, apologized for the establishment of this class of practitioners in the following words: "*Les habitants des campagnes ayant des mœurs plus pures que celles des villes, ont des maladies plus simples qui exigent par ce motif moins d'instructions et moins d'apprêts.*" The Officiers de Santé were trained chiefly at the hospital schools which came into existence in several towns of France, and received a definite organization under the name of *écoles secondaires*.

The lower class of apothecaries also received the requisite instruction at these establishments, while for the pharmaceutists of the first class three special schools were founded at Paris, Montpellier, and Strassburg which were, in many respects, in close relation with the medical schools at those places. The schools of medicine last mentioned were in 1808 once more promoted to the position of medical faculties, and were incorporated with the University of France.

This creation of Napoleon was not a university in our sense of the word, but, as it were, the headquarters of all the establishments and boards of education throughout the country. It was approximately equivalent to what is now known as a department for the regulation of education. A

Grand Master stood at the head of the University of France. This dignity passed or was changed into that of Minister of Instruction. A council was appointed to assist him, in the capacity of consulting authority in educational matters, while a considerable number of General Inspectors supervised and controlled the particular schools. The whole country was divided into 26 university districts, everyone of which formed the seat of an academy (or higher educational establishment), with a Rector, Academic Council, and Inspectors. This strictly uniform method of organizing instruction had the great advantage of helping to strike a balance among the various educational levels in the different parts of France, and of applying, in educational matters, the principles of order and equity throughout the country.

This arrangement was maintained after the overthrow of the empire, and in the course of time experienced only those improvements suggested by the needs of culture or of the State. Each faculty, from this time forth, conferred three degrees, those, namely, of Bachelor, Licentiate, and Doctor. Only the two last, when acquired in the department of medicine, gave the right to practise. The hospital schools were only allowed to grant the title of Officier de Santé. The professorships were obtained by competition, but in the year 1810 in the case of candidates of known literary and scientific merit the process of subjecting them to the prescribed examination, or of making them compose a thesis, was dispensed with.

The hostile attitude afterwards assumed against LOUIS XVIII. by the medical faculty of Paris, and the riotous scenes which ensued thereupon, led to the doors of the schools being closed in 1822. When thrown open once more in the following year the faculty was reorganized. The staff of teachers consisted of 23 professors in ordinary and 36 *agrégés*, of whom 24 were *en exercise* and 12 *en stage*. In 1824 the Ministry of Public Instruction was established, and to this the medical faculties and schools

were subordinated. During the next 50 years the organization of medical teaching in France was but little changed. Only under the third Republic were endeavours made to render it more extensive and complete.

At the present time France possesses six medical faculties at Paris, Montpellier, Nancy — established in 1872, after the University of Strassburg had, with the province of Alsace, been transferred to Germany—at Lille, Bordeaux, and Lyons (since 1877), where formerly lower class medical schools existed. Besides these, there are 18 medical *écoles préparatoires,* the present designation of what were formerly called *écoles secondaires.* They are situated at Marseilles, Nantes, Toulouse, Amiens, Angers, Arras, Besançon, Caen, Clermont, Dijon, Grenoble, Limoges, Poitiers, Rheims, Rennes, Rouen, Tours and Algiers, and are partly *de plein exercise,* that is, with opportunities for a complete course of medical study and in part merely preparatory schools. They are differently equipped in regard to appliances for study and in the constitution of the teaching staff. The *écoles de plein exercise* have at least 17, the others 12, professors in ordinary. Between the former class and the medical faculties the only essential difference consists in the fact that they have not—like the faculties—the power of conferring the degree of doctor of medicine. But besides this the faculties are State institutions, whereas the other medical schools bear a municipal character.

The students of medicine who desire to get legally qualified to practise attend the faculties or the *écoles de plein exercise,* but are also permitted to pass a portion of the period of studentship at the *écoles préparatoires;* in like manner the candidates for the position of Officier de Santé are admitted as students at the faculties, or at the other medical schools; but while the diploma of Doctor can be obtained at the faculties only, the qualification of an Officier de Santé can be got at any medical school. There is a comparatively small attendance at the *écoles*

préparatoires. Of the 21 establishments of this kind which existed in 1845, 18 had less than 40 students, six less than 25, and the school at Rheims only 15. A similar state of affairs exists in the provincial medical faculties; for Paris monopolizes almost all the higher teaching.

In 1877 there were in France 4,447 medical students, of whom 3,835 pursued their studies in Paris, while all the other medical faculties together numbered no more than 612 students. By the promotion of several preparatory schools to medical faculties which has been effected in the last few years this proportion has been to some extent changed. In 1881-82 Paris had 2,413, Bordeaux 155, Lyons 165, Montpellier 154, Nancy 83, and Lille 54 medical students. In addition, 756 candidates for the qualification of Officier de Santé attended lectures of the various medical faculties. At the remaining educational establishments there were in all 632 students, of whom 306 were preparing themselves for the doctorate and 326 for the qualification of Officier de Santé. Thus the total number of students of medicine of both categories reached at that time 4,412, of whom 3,330 had in view the diploma of Doctor, 1,082 wished to become Officiers de Santé.

As early as 1826 a proposal was made to the legislative assembly to abolish the lower class of practitioners, but without result. In 1847, again, the doctors of medicine presented a petition begging that the Officiers de Santé (who at the same time applied for an extension of their privileges) should cease to form a recognized class of medical men.

Once more, in 1864, an attempt was made to do away with the institution of Officiers de Santé; but they found an advocate in BONJEAN, who declared "*A des malades simples et pauvres il faut un médecin pauvre et simple comme eux, qui puisse comprendre le langage, le besoin de ses modestes clients, qui, né dans une condition peu élevée, habitué dès son enfance à la vie sobre des chaumières, ayant conquis son grade à peu de frais, puisse se contenter*

d'une modique rétribution. L'officier de santé est dans les meilleures conditions pour remplir cette mission de modeste dévouement; il se fera d'autant plus aisément le confident, le conseiller, le consolateur du pauvre, qu'il en est presque le compagnon."

For all that, the number of Officiers de Santé in France diminished year by year. In 1847 there were 7,456 of them, in 1872 only 4,653, while the number of Doctors rose between the same years from 10,643 to 10,766. The disappearance of this grade of practitioners appears, therefore, to be only a question of time.

The medical faculty of Paris stands at the head of all the medical schools; it has the most abundant supply of material and appliances for teaching, and the best arrangement of studies. Its teaching staff consists at the present time of 33 professors in ordinary (*titulaires*) and a great number of *agrégés*, who correspond nearly to the Austrian professors extraordinary.

Of the professors in ordinary, 1 represents anatomy, 1 histology, 1 physiology, 1 medical chemistry, 1 natural history in its bearing on medicine, 1 medical physics, 1 pharmacology, 1 general pathology and therapeutics, 1 materia medica, 1 internal and 2 external pathology, 1 pathological anatomy, 1 comparative and experimental pathology, 1 midwifery and gynæcology, 1 operative surgery, 1 hygiene, 1 forensic medicine, and 1 the history of medicine, while 4 conduct the surgical clinic, 4 the medical clinic, 1 the gynæcological clinic, 1 the clinic for diseases of children, 1 that for diseases of the sexual organs, 1 the clinic for diseases of the eye, 1 that for mental diseases, and 1 that for diseases of the nervous system. They draw yearly salaries of 15,000 francs, and are nominated, on being proposed by the faculty, from among the number of the *agrégés*.

The latter assist and represent the professors in ordinary in teaching and during the examinations, and, when they are commissioned to lecture, receive the pay of 6,000fr. a

year. They are divided into three classes—the *agrégés* "*stagiaires*," "*en exercise*," and "*libres*." For the first three years after their election they have neither rights nor duties, and are called *stagiaires*. They then are promoted into the list of active *agrégés*, corresponding in number to the professors in ordinary; as *agrégés en exercise* their duties are to give lectures and to act as examiners, and they are in receipt of pay. After they have been actively engaged in these duties for six years or even longer they become *agrégés libres*, and are no longer obliged to give lectures or to perform any other services, they receive no pay, and only enjoy the privilege that they are qualified like the other *agrégés* for nomination to the position of Professor in Ordinary.

Preferment to the position of *agrégé* is the result of competition between numerous candidates, which, however, takes place only in Paris. This was formerly usual also in appointments to professorships in ordinary; since 1852, however, it has been limited to the election of *agrégés* and of officials of a similar kind. Every legally qualified doctor who belongs to the French nation and has completed his twenty-fifth year is at liberty to take part in this competition. The competitor hands over his scientific compositions to a Commission, the members of which are professors and other learned men; he also, being left entirely to himself and without any aid from books, writes an essay on a question which has been set him, and, finally, he delivers a lecture upon a subject which has been suggested to him three hours previously. The Commission then makes a selection from among the candidates in accordance with their performances, so that the number of those selected shall not exceed three for each vacant appointment. These have once more to undergo an examination, which consists of practical research, the delivery of a lecture, and the composition of a treatise on a given subject, which has to be prepared within a stated time.

The candidature for the position of *agrégé* is never

undertaken with a view to the representation of one special department of medical science, but a definite number of branches are grouped together. The *agrégés*, conformably to this arrangement, are separated into four divisions: of these the first includes anatomy and physiology; the second the natural sciences, physics, chemistry, and pharmacology; the third pathology and therapeutics, internal medicine, and State-medicine; and the fourth the surgical departments with midwifery.

In 1884 the teaching staff of the medical faculty of Paris consisted of 120 professors; at Lyons there were 64; at Bordeaux, 50; at Douai-Lille, 45; at Montpellier, 43; and at Nancy, 41. The faculty of Lyons had no less than 25 professors in ordinary.

From all this it is evident that the medical schools of France are richly supplied with teachers, and that the Government spares no expense in providing them. In Paris the salaries of the professors of the medical faculty amount in the aggregate to nearly 700,000fr. a year, a sum far in advance of that expended on the medical faculties in many other countries. The same admirable care is shown in furnishing the medical faculties with appliances and aids for teaching. The medical schools of Paris and Lyons, which I can speak of from personal experience, are arranged in a most exemplary manner.

Teaching is carried on in Paris partly at the École de Médecine, where the theoretical lectures of the professors are delivered, partly at the École Pratique, at which the establishments for practical work have been centred, and partly in the various hospitals in which the clinics are held.

The large airy dissecting rooms, well supplied with water, good light, and in every respect answering the hygienic requirements of the present day, contain 682 work-places. Besides the Director, who is at the same time a Professor of Anatomy, eight prosectors and twenty-four assistants are at work there, introducing the students to the art of

dissecting and watching over their progress. Moreover, each of the prosectors gives three lectures a week, and each of the assistants one lecture, the subjects of which are chosen in accordance with a plan sketched out by the Director. These lectures of the prosectors and assistants are in close connection with one another, and together serve to review the whole of the science of anatomy; they form the most important part of the teaching of anatomy. The posts of prosector and assistant are filled by competitive examination. Whoever aspires to become a prosector must be a legally qualified practitioner, and must undergo a written and oral examination on anatomy, histology, physiology, and operative surgery, must put up an anatomical and a histological preparation, and must perform two surgical operations upon the dead body. The assistantships are also conferred after competition, and are entrusted to older students who show ability. The students are bound to appear regularly at the anatomical lectures of the prosectors and assistants, and also to practise dissection methodically for three hours daily, and they subject themselves to much unpleasantness if they neglect these observances.

The practical work in the school of anatomy claims three winters. During the first two, normal human anatomy is studied, during the last winter operative surgery on the dead body. For this the student pays a fee of 100 francs.

The abundant supply of material for instruction, the strict manner in which the attendance and work of the students are looked after, the close connection between theory and practice, the application of anatomical facts to practical medical science and especially to surgery, and the continual personal instruction given by the teachers lead to remarkable results. The medical students of Paris acquire as a rule a thorough knowledge of anatomy which has inestimable advantages in regard both to their further technical training and to their success afterwards in the practice of their profession.

There exists in Paris a special Anatomical Institute for

the professors, the hospital doctors and their assistants: this has no connection with the École Pratique intended for students but is conducted by a professor of anatomy and his assistants and is used for making post-mortem examinations, for practising operative surgery, and for scientific research. There are laboratories, museums and work-rooms for teaching physiology, histology, physics, chemistry and the natural sciences: the natural history museum and the botanical garden are made to serve the same purpose.

There are also professorships of physiology and the natural sciences at the Collége de France and at the École Normale — an educational establishment for teachers of advanced subjects: the professors give lectures, and facilities are extended to the students of the medical faculty to attend them.

The 14 clinics, which are under the direction of the professors in ordinary and are thus an essential feature of the official course of instruction, are not centred in one hospital but are divided amongst the Hôtel Dieu, the Charité, the Pitié, the Clinique d'Accouchements, the Hôpital des Enfants Malades, the Necker, Cochin, and Salpétrière Hospitals, and the Hôpital du Midi. Every medical student is bound to take part, during the last two years of his studentship, in the medical visits to one hospital and to perform the small services which are there assigned to him.

The directors of the assistance publique assign the doctors who give in their names to them for this service to the various hospitals of Paris.

The arrangements at the other medical faculties and schools of France are of a similar character to those existing in Paris.

The student of medicine must on beginning his technical studies show that he has received a satisfactory general education. He is on this account required to possess the diploma of Bachélier ès Lettres which nearly corresponds to the "Leaving-Certificate" (Abiturienten-Zeugniss) of the

German gymnasiums, and in respect of his knowledge of mathematics and the natural sciences to have taken the degree of Bachélier ès Sciences.*

The period of studentship extends over four years; it is not divided into semesters but into courses of two or three months' duration which are attended in a prescribed order. The student is obliged to work practically at physics, chemistry, and the natural sciences in his first year; at anatomy, histology, and physiology in the second and third years; and at pathological anatomy, operative surgery, and clinical and hospital work in the fourth year. This period of study at the hospitals is termed *stage*.

The examinations in the various subjects formerly took place at the end of each year. This arrangement was however abolished in 1878 and another adopted in its place, according to which five examinations have to be passed.

The first includes physics, chemistry, and natural history and takes place at the end of the first year; the second embraces anatomy, histology, and physiology and follows partly in the course of the third year, partly at its conclusion. The third examination deals with surgical pathology, midwifery, and operative surgery, and also with general pathology and the pathology of internal diseases; the fourth, with hygiene, forensic medicine, therapeutics, materia medica and pharmacology: and the fifth involves the examination of cases in the surgical, medical and obstetric clinics with their treatment and the performance of a post-mortem examination. The candidate must also show his knowledge of normal anatomy by putting up a preparation, and his surgical skill by the performance of an operation on the dead body. Finally he is obliged to write a thesis upon a subject chosen by himself and to submit it to the Faculty. He is then advanced to the degree of Doctor of Medicine.

The aspirant to the position of Officier de Santé requires a less advanced general education: he is required to write

* Programme de l'examen baccalauréat ès sciences, Paris 1885.

a treatise in French without mistakes of spelling and to answer questions upon the most important facts in natural science, physics and chemistry. The period of studentship for Officiers de Santé likewise extends over four years. The curriculum is nearly the same as for the future doctors of medicine except that less stress is laid upon the theoretical side of studies especially in histology, physiology and pathological anatomy. The examinations are of a corresponding character, and are limited to the main points and principles of subjects.*

The French military doctors were formerly educated at Strassburg, and attended the lectures of the medical faculty there. In 1872 a rule was made that the military medical students should be distributed among 11 medical schools and should receive instruction there with the other medical students; but in 1883 in place of this two *écoles préparatoires du service de santé* were founded at Bordeaux and Nancy for the education of doctors for the army. The students of these schools participate in the teaching given by the medical faculties at the places mentioned; they are obliged to spend five years in study, and are looked after and helped in their work by older military medical officers who act as tutors in the various subjects of study. When they have finished their studies and have obtained the degree of doctor they are transferred for the completion of their professional training to the *école d'application* connected with the great military hospital of Val de Grâce, where they serve in the wards for eight months and lay in a stock of experience in practical medicine.

The system of medical education in France possesses along with many advantages, among which the excellent anatomical and clinical training of students must be especially mentioned, also certain lamentable defects. Thus it seems strange that, according to the curriculum of study, the first year of studentship should be devoted entirely to

* Indications sommaires des conditions à remplir pour l'obtention des grades de docteur en médécine, d' officier de santé, etc., Paris 1884.

the sciences ancillary to medicine and that attendance upon lectures on anatomy should not be commenced until the second year. In this way the study of medical science itself is confined to three years, a period within which it does not seem possible to digest and assimilate such rich intellectual food as is contained in the matter taught during that time. Then, as the second examination which deals with anatomy and physiology falls at the end of the third year, and the student has been till then chiefly occupied in preparing for it, there remains not much more than one year for training in practical medicine.

A prolongation of the period sanctioned by law is the natural result of this, and is indeed rendered necessary by the three last examinations.

A more serious flaw in the system of medical teaching in France lies in the way in which the teaching staff of a medical school is selected and made up. Competition, the form of candidature where all have equal chances, no doubt affords a better guarantee than do other methods of appointment to vacant offices, against the evils of favouritism, patronage, and nepotism: moreover in cases where it is a question of obtaining the position of *agrégé,* or the office of prosector or assistant, in short an admission to the active list of university teachers, it is as a general rule quite justifiable and indeed an excellent way of finding out and estimating the ability and knowledge of the individual candidates. But to select only a specified number of candidates to compete seems to be a method not calculated to promote the end in view, for it is not possible to make distinctions quite in harmony with the demands of justice and equity between numerous candidates of nearly similar qualifications, and the scientific capacity of the selected candidates shows marked differences in different years.

As little is it possible to justify the division of those aspiring to the position of *agrégé* into four groups corresponding to the different branches of learning as is the case at the present day: for many subjects, as for instance the

history of medicine, hygiene, and state-medicine, can with equal justice be put into one or another division. By the present arrangement a scientific man who has distinguished himself in his speciality may fail to get on the active list of university teachers.

The regulation that the competitive examinations for the position of *professeurs agrégés* to all the medical faculties and schools of France must be held in Paris is especially bad. For by this arrangement the candidates who are trying for the position of teachers in the provinces are obliged to make a lengthened stay in Paris, and are subjected to unnecessary expense; all the medical faculties and schools, except that of Paris, suffer in their dignity and interests, inasmuch as the decision upon weighty questions of appointment is committed into the hands of persons who are ignorant of the local needs, and finally the heavy burden of these competitive examinations is thrown upon the Paris faculty, and is felt to be the more oppressive inasmuch as that body has already too many claims upon its resources in the examination of the crowds of students resident in the capital. On these grounds it has already for some time been wished that the competitive examinations should be held not in Paris only but at every medical faculty, that the teaching staff of every medical school should have the right of making suggestions as to the filling up of vacancies in their own body, and that candidates who in the competition satisfy the examiners should be qualified for admission not merely to one faculty but to any medical school in the capacity of teachers, and should not be obliged to undergo another examination.*

In appointing professors in ordinary competition has rightly been abolished, for here it is not a question of persons whose fitness as teachers and investigators it is necessary to examine into, but of men of learning whose scientific performances are things well known in profes-

* Revue internationale de l'enseignement, Paris 1882, T. iii, p. 126, 533.— Dreifus-Brissac: Rev. int., Paris 1887, T. xiv, p. 469 *et seq.*

sional circles. Each medical school must see that it gets the best ability available to fill these positions. It is, therefore, inadvisable that the teaching staff should, in the proposals which for this purpose they submit to the minister, be limited to the *professeurs agrégés* who are in office at their own faculty. Such a rule leads to a local exclusiveness in the particular medical school, and to the danger that an intellectual congelation may supervene in it. It is just the change of theory and doctrine, produced and favoured by the free interchange of professors, which keeps intellectual life fresh and sensitive to every movement which promises to lead to some desirable end. On the other hand it may not unfrequently happen in consequence of the present arrangement that a man of remarkable attainments, working at a small academy in France, is deprived of the opportunity of exercising his talents in a larger sphere of activity, where he might accomplish great things for science and for his country.

It therefore appears highly desirable that the faculties should, in regard to this matter, be freed from these limitations, and that in proposing men to fill vacancies in the professorships in ordinary, they should be at liberty to take into consideration, with a view to election, the ordinary professors and *agrégés* of all the medical faculties and schools. In this case, should a man, hitherto not engaged in academic teaching, appear in any special circumstances to be the most suitable candidate for a professorship, the nomination of such person for the office would be permitted.

This course has exceptionally been adopted, for example, when the professorship of the History of Medicine, founded at Paris in 1870, was conferred upon C. DAREMBERG, distinguished for his profound knowledge of the medical science of the Greeks.

The French should study the arrangements which exist in regard to these questions in Germany and Austria, and when these appear worthy of imitation they should introduce them into their own country.

AUSTRIA-HUNGARY.

It was not until the 18th century that the system of medical education in Austria got rid of those features characteristic of the middle ages, which had exercised a restricting and narrowing influence upon its development. It had up to that time rested exclusively in the hands of the doctors' guild—the union which included all medical men entitled to practise, and which was designated as the Faculty. From amongst the members of this society the professors were chosen, and their election was confirmed by the University Consistory. The latter, which corresponded nearly to the University Senate of the present day, had been dominated by the power of the clergy ever since the Order of Jesuits had, by the Pragmatic Sanction of 1623, acquired a preponderating influence in all questions of education.

The professors of medicine drew but miserable salaries, and were therefore obliged to support themselves by medical practice. At the same time their scientific work, except in the case of a few, was of an insignificant character.

In a report upon the University of Vienna, laid before the Government in 1688, it is remarked "that in this University of Vienna for so many years hardly anything has been heard from its professors of law and medicine, who have neglected to bring forward or publish any subject connected with their sciences. The University of Vienna might as well be asleep, or no such seat of learning exist in Vienna at all. On the other hand, it is notorious how indefatigable and industrious the professors at other high schools in Germany are, what fine books they write, and what useful works they get printed and published."*

There was a complete lack of the appliances and establishments required for the study of medicine, and even the

* Kink: Geschichte der Universität zu Wien, Wien 1854, i, 398.

lectures were given so irregularly that the teachers of medicine were in 1689 and 1727 reproved by the Government for their idleness. Various attempts made to remedy this unsatisfactory state of affairs in 1629, 1687, and 1726 did not meet with success. In 1718, the medical faculty of Vienna proposed to adopt practical instruction, at the bedside, at post-mortem examinations, and in the regular practice of dissection, to erect a *collegium chymicum* and lay out a botanic garden, to appoint assistants in the hospitals, to raise the salaries of the professors, and to summon distinguished teachers from abroad.* But the horror with which a change of system was regarded by the ruling classes, and the want of sufficient money to pay for the necessary arrangements prevented the completion of these designs.

The great Empress, MARIA THERESA, who amid the grievous embarrassments and wars which shook her throne, found time and energy to take thought for improvements in law and administration, directed her attention to these matters. She commissioned her private physician, GERHARD VAN SWIETEN, who enjoyed her complete confidence, to investigate the defects in teaching at the Vienna University.

In a report which he drew up on this subject he referred to the cause of the existing evils, which he considered to lie in the dependence of the university upon the Church and the Guild. He demanded that the State should be complete master in its own house and should direct and watch over medical education. The proposals which he submitted to the Empress met with her approval, although in giving it she had doubtless to sacrifice some convictions which had become endeared to her by tradition and training.

In the Edict of Reform, of February 7th, 1749, it was decreed that thenceforth the professors of medicine should no longer be appointed by the University Consistory, but

* ROSAS: Geschichte der Wiener Hochschule, Wien 1843, ii, 232.

by the Empress, that their salaries should be increased to a reasonable amount, and paid out of the Imperial treasury, and that their duties and teaching as a whole should be under the control of a director representing the Government.

G. VAN SWIETEN himself undertook this important office in Vienna; in other faculties it was entrusted to high officers of State. They presided also at meetings of the Guild Colleges, and at the examinations of doctors, surgeons, apothecaries, and other practitioners. At the same time the medical faculties were equipped with the necessary appliances for teaching. At Vienna a botanic garden and chemical laboratory were established, and the regular practice of dissection and clinical teaching was introduced. The ceremonies connected with taking a degree, which on account of the ecclesiastical observances associated with them, had led to the necessity of expending the considerable sum of 1,000 gulden, and had consequently compelled many students to take their doctor's degree in foreign countries, were now simplified and confined to special occasions, and the whole system of examination was subjected to closely prescribed regulations. The other medical faculties of the Empire were soon after this reorganized after the pattern of the Vienna school, and provided with professorships and the necessary establishments. G. VAN SWIETEN advanced to the head of the entire system of medical education, and acquired an influence which extended itself over the administration of teaching in all its branches.

When the Emperor JOSEPH II. ascended the throne there commenced a period of innovations in these matters succeeding one another with great rapidity, occasionally even pressing too quickly upon each other's footsteps. All limitations which had rendered it difficult for non-Catholics to take academical degrees, were abolished, and the degrees themselves were deprived of their religious character, the salaries and pensions of the professors were brought into

conformity with those of other officials, special academical jurisdiction was done away with, and members of the university were made amenable to the ordinary law, and instead of lecture fees, which were discarded, a system of paying a definite amount every month was introduced into the universities. All the universities of the monarchy were made equal in rank, and the same rights and privileges were accorded to the diplomas and certificates of them all: a law which, however, a few years later was modified to the extent of limiting practice in Vienna to those doctors and advocates who had passed examinations at the University of Vienna.

The Emperor devoted himself with great zeal to the improvement of medical teaching and of the educational establishments connected with it. He lamented the neglect shown to the study of surgery by the doctors, and the unsatisfactory training of surgeons, and he recognized what a great mistake it was to rigidly separate surgery from internal medicine. He discerned that the best means of removing the defects of medical teaching lay in the reunion of these two branches of the general science, and in the blending together of physicians and surgeons. With this object he caused to be carefully drawn up a plan of studies for these two classes of students, which fixed the period of study at four years, and, with slight modifications in the two cases, required from both a knowledge of all branches of medicine.

The promotion of the school for military doctors—the Josefinum—to a medico-chirurgical faculty with the rights and rank of a university and its association with a surgical academy contributed very much to raise the surgical profession, both scientifically and socially.

There arose at the same time a class of inferior country practitioners, bound only to a two years' course of study; these with the name of surgeons accepted also the social position hitherto held by that class.

In this manner a complete metamorphosis was brought

about in the system of medical education and in the social relations of the medical profession, the main features of which have been preserved until modern times. Several other measures, such as the abolition of the degree of bachelor and of the inaugural dissertation—for the latter a practical examination at the bedside being substituted—formed very appropriate improvements in medical education. The erection of the General Hospital at Vienna—the abundant material for instruction afforded by it being made available for clinical teaching—and the foundation of the Military Hospital which was devoted to the same purpose as the Josefinum, rendered possible the splendid successes which the Vienna school of medicine has since achieved. JOSEPH II. also established the Deaf and Dumb Institute, the Foundling Hospital and the Veterinary Hospital in Vienna, and caused hospitals to be erected in Prague, Graz, and other large towns of the empire and to be made use of for the education of doctors. He also built permanent military hospitals in Milan, Mantua, Prague, Brünn, Olmütz, Pesth, Königgrätz, Lemberg, Hermannstadt and other places. "Whatever can be devised to cure sick and wounded humanity, to alleviate suffering and to preserve life has been a subject never neglected by me; every individual man has been precious to me," were his words on taking leave of the army a few days before his death.

The beneficent creations of this Emperor, who even if he did make mistakes was at all times filled with an earnest desire to make his people happy, give him a claim upon the gratitude of mankind. His good deeds have outlasted his plans and performances in the field of politics and to this day bear testimony to the noble prince who lived for his people *non diu sed totus*, as is said on the monument which has been erected to him in his capital.*

The reaction which set in against his political schemes was also directed against the measures he had taken in

* TH. PUSCHMANN: Die Medicin in Wien während der letzten hundert Jahre, Wien 1884, S. 53 *et seq.*

the administration of education. "A commission for the arrangement of studies" was convoked, and was charged with the task of leading educational matters once more back into the old familiar track. Party spirit asserted itself in medicine, and made an attempt to regain the influence which it had once possessed in the education of doctors. A desire was shown to restore the former relations between physicians and surgeons, to relegate the latter to a dependent and subordinate position and once more to sever the bond of union between surgery and internal medicine, which had been accomplished by the curriculum of 1786. It was asserted that these two branches of medical science were too heterogeneous and too extensive for it to be possible for one man to be master of both in an equal degree. In regard to the Josefinum the objection was raised that it was too expensive and was certainly not of equal repute with the medical faculties of the universities.

But its total abolition was not ventured upon: for the country could not afford to dispense with the only institution which concerned itself with the supply of military doctors in the midst of the prolonged wars in which Austria was involved at that period. Moreover, daily experience showed how necessary and important a knowledge of surgery is, and to degrade that science appeared to be an act by no means suited to the spirit of the age. The complaints directed against the Vienna General Hospital had more justification. The improvements which were thus brought about proved to be to the advantage of that establishment. No alteration was made in the medical curriculum, although it was in many respects in need of reform.* On the other hand the professors were given strict instructions as to the way in which they should conduct their teaching and the text-books were mentioned which were to form the basis of their lectures. The directorate of studies was abolished, but being reintroduced a

* Freimüthige Betrachtungen über den medicinischen Unterricht an der hohen Schule zu Wien, 1795.

few years later it formed as before the board of inspection for the affairs of the faculties and conducted the whole system of education.

In 1804 the period of study for students of medicine and of the higher surgery was extended from four to five years and it was decreed that the first three years should be devoted to theoretical training, and the last two principally to attendance at the clinics. At the same time it was notified that no one should be admitted to the study of medicine who had not during three years previously attended lectures on "philosophy" at the university and had acquired a satisfactory general education. Every teacher was obliged to spend at least half-an-hour every week in satisfying himself by questioning his pupils, that the substance of his lectures had been understood and assimilated by them. At the end of every half-year public examinations of the students were held, and it depended upon the result of these whether they should be permitted to attend the regular course of lectures for the following half-year. Moreover, the regulations for the qualifying examination, held at the conclusion of the period of studentship, were made more severe and the examiners were admonished to apply them strictly and conscientiously.

In 1810 a new medical curriculum was arranged in which those subjects which had lately been added to the course of study were included. According to this medical students had to attend classes on the following subjects during the periods specified: 1st year, introductory course on medico-chirurgical study, natural history in its bearings on medicine, botany and systematic anatomy; 2nd year, more advanced anatomy and physiology, general chemistry, pharmacy and animal chemistry; 3rd year, general pathology and therapeutics, ætiology, semeiology, materia medica et chirurgica, dietetics, the art of prescribing, midwifery, general and special surgery, surgical instruments, bandaging and ophthalmology; 4th and 5th years,

special pathology and therapeutics of internal diseases, veterinary science, forensic and state medicine. During the last mentioned period attendance at the clinics was required.

Those who were training for country doctors (*Landärzte*) were obliged during the first year to attend the introductory course on medico-chirurgical study, lectures upon theoretical surgery, anatomy, physiology, general pathology and therapeutics, materia medica et chirurgica, dietetics, the art of prescribing, and bandaging; during the second year they had to attend courses of operative surgery, forensic medicine, midwifery and veterinary science, and to visit the medical and surgical clinics. Their period of studentship was afterwards prolonged by one year. The students were left at liberty to judge for themselves whether they should attend the obstetric clinic or not, and the same was permitted in regard to their attendance upon lectures on several other subjects. On every subject of primary importance it was required that on five days in every week a lecture of one hour's duration should be given; twice that time was devoted to instruction given in the medical and surgical clinics.

Care was also taken that what was taught should be rendered more easily comprehensible by demonstrations and practical work. The students made botanical excursions under the guidance of their teachers, worked in the chemical laboratory, practised dissection of the human body, attended post mortem examinations and performed operations on the dead body. Dissecting rooms were erected where they were wanted: but the students had to bear the expense involved in procuring the necessary subjects for dissection.

Whoever was a candidate for the degree of Doctor of Medicine was obliged, first of all, to submit the history of two cases which he had himself treated in the clinic, then to undergo an examination on the subjects laid down in the curriculum, and finally to compose a dissertation and

to defend by argument a position taken up on a point of medical science.

The examination for the doctorate of surgery differed from this chiefly in the circumstance that instead of internal medicine, surgery formed the chief subject and the candidates had to perform two surgical operations on the dead body.

When a Doctor of Medicine desired to take the degree of Doctor of Surgery or *vice versâ*, he had only to pass a supplementary examination which was concerned with questions which had been too little dwelt upon in the previous examination. The demands made upon those who were satisfied with the title of Master of Surgery were of a less severe character. And the case was the same with the country doctors. A diploma in ophthalmic surgery was also granted, but the class of rupture-curers, so-called, was abolished.

In 1822 the period of studentship at the Josefinum was also lengthened to five years for the greater and to three years for the lesser course, and the curriculum which had been introduced at the medical faculties was made the foundation of the teaching there. The institution consequently received the right of granting all academic degrees. The order of studies for the year 1833 gives evidence of no essential alteration either in the teaching or in the examinations; but ophthalmology received more attention than previously.

In 1845 a commission of experts was appointed and took counsel together upon the faults in the system of medical teaching and made proposals for improvements. But before any final decision was arrived at the year 1848 was reached, and during it a complete revolution was effected in these matters. The professors of the Vienna medical faculty submitted a plan of reform for medical study to the newly created Ministry of Education: in it attention was drawn to the inconvenience of both the College of Teachers and the Associated Doctors of Vienna

being designated as the Medical Faculty, and of the professors being excluded from the most important offices, as from those of Rector, Dean and Director of medical studies, and being almost entirely unrepresented in the University Consistory.

They demanded that the professors in ordinary, as in German universities, should form a college to be in immediate correspondence with, and only subordinate to, the Ministry; that this college should independently deliberate upon questions of teaching and despatch other business; should hold examinations and confer academical degrees; that the professorships should be filled up not by competition, but by invitation; that the appointments of professors should be permanent, and should be forfeited only in consequence of dishonourable conduct or continued neglect of duty; that the ordinary and extraordinary professors who represented subjects laid down in the curriculum should be properly remunerated by the State, "so that being freed from the care of having to earn their own bread they may be able to apply their minds to science, and especially to the advancement of the subjects they represent;" that the scientific establishments should be equipped and endowed in a way suitable to their requirements; that freedom should be granted both in teaching and in learning, the teachers not being bound to follow particular text-books nor the students compelled to attend certain lectures or to get their professional education exclusively in the schools of the country; that the six-monthly examinations should be abolished; that the Dean of the faculty should preside at the medical examinations and the Rector at the conferring of degrees; that the Dean should be chosen from among the number of the professors in ordinary and by them; that the connection between the university and the doctor's guilds should be severed, and the medical corporations cease to have any influence upon professional education.

Baron E. VON FEUCHTERSLEBEN, the author of the well-known "Dietetics of the Mind," who was employed in

teaching psychological medicine at the Vienna University, was requested to undertake the direction of the Ministry of Education; he, however, declined the post of minister, being, as he says in his autobiography, "convinced that in view of the changes of ministry resulting from a representative system, and having regard more particularly to the circumstances of the time, it was of no use for a minister to think that he would be at liberty to prosecute any work without interruption, although such is precisely the indispensable condition of success in undertaking a reform of a broad and sweeping character." He was therefore content to occupy the position of Under-Secretary of State in the Ministry of Education, and during the short period of his official activity brought about a number of important reforms.

Thus he introduced the teaching of natural science into the gymnasia; he prolonged by two years the period of studentship at these establishments, by arranging that the course of philosophy, which hitherto students had gone through at the university, should now be made part of the studies of the gymnasium; he succeeded in establishing freedom for both teachers and students at the universities; he did away with the competitive method of filling up professorships, and took care that the appliances for teaching and the collections of the Josefinum were handed over to the Vienna medical faculty when the former institution was abolished.

In 1849 the law for the organization of the academic authorities was promulgated,* according to which the arrangement of studies was placed under the direction of the professorial staff of the various universities. The staffs are composed of all the ordinary professors and of as many of the extraordinary professors as shall not exceed half the number of the ordinary, together with two representatives of the private lecturers, who, however, possess merely con-

* G. THAA: Sammlung der für die österreichischen Universitäten gültigen Gesetze und Verordnungen, Wien 1871, i, 69 *et seq.*

sultative functions. The Dean, who is elected from among the professors in ordinary, presides at their meetings; he in many respects takes the place of the former Director of Studies, a functionary whose office has been abolished.

In Vienna and Prague some remnants of influence were preserved for the doctors' guilds and medical corporations, inasmuch as they were still regarded as parts of the university and were designated as faculties, and received the privilege of electing a Dean, who had a seat and vote in the assembly of professors, and co-operated with them in the medical examinations. It was not until 1873 that a complete separation was effected between the doctors' guilds on the one hand and the faculties and universities on the other.* The doctors' guilds from this time forth have been nothing but medical clubs, concerning themselves with the management of their property, the granting of pensions, etc., but without any official obligations.

As early as 1848 the abolition of the inferior education given to the country doctors was mentioned in a ministerial decree as a measure desirable on principle.† But many difficulties stood in the way to prevent this being carried out. People could not help being afraid that if the schools intended for the education of the country doctors and inferior class of surgeons were suddenly closed a decided deficiency in the number of practitioners would be brought about, and they consequently wished to provide substitutes in time. Then the courses of instruction which had hitherto been given at the universities of Vienna and Prague for the country doctors were discontinued, while the medico-chirurgical schools at Graz and Innsbruck were shortly afterwards promoted to actual medical faculties, and were incorporated with the universities of those places. The other establishments of this kind which existed at Salzburg, Olmütz, Laibach, Lemberg, and other places were gradually closed. With this the lower class education came to an end.

* Thaa *op. cit.*, S. 615 *et seq.*

† Thaa *op. cit.*, S. 497.

From this time onwards an opportunity for the study of medicine was afforded only at the universities. At the present time medical faculties are possessed by the universities of Vienna, Prague, Graz, and Innsbruck, where the German language is employed for teaching; by the newly-created Czech university at Prague; by the Polish academy at Cracow; and by the two Hungarian universities at Buda Pesth and Klausenburg; none is possessed by the high schools of Lemberg, Agram, or Czernowitz.

The Josefinum after being shut up in 1848, and opened again in 1854, was closed once more in 1870, as it was thought that with the introduction of general compulsory military service there would be no lack of military doctors. This assumption has, however, not been realized, and perhaps some day the re-establishment of a school for military surgeons will become a matter of necessity. A military power of the rank of the Austrian Empire requires a school for its medical officers, as is shown by the examples of France, Prussia, and Russia. Its features and organization may differ from those of the Josefinum, but its existence is a matter in which the country and the army are both interested.

The number of existing medical faculties stands in no satisfactory proportion to the extent and population of the Austro-Hungarian monarchy. The attendance at them is consequently large to an extraordinary degree. Of late years the average number of students at Vienna has been considerably over 2,000. The cause of this lies partly in the good reputation enjoyed by the school and teachers, partly in the circumstance that many poor students think that, in the capital, they will find pecuniary support or opportunities of earning money by giving lectures, etc. PETER FRANK* long ago lamented the very prevalent custom of giving lectures in this way—and it is especially prevalent in Vienna—for by it medical students are withdrawn from their proper tasks and driven into a kind of work which is without any

* P. FRANK *op. cit.*, vi, 1, S. 336.

value to them in advancing their professional education. Unless they are extraordinarily gifted they are apt to suffer shipwreck on these rocks, and never to finish their studies at all.

It can easily be understood that crowded lecture rooms and clinics are not conducive to the study of medicine; for here it is important to see well, and closely to observe, every object and every patient and to follow the course of every experiment intelligently. With a view to remedy the inconvenience resulting from the fact that the space at disposal is insufficient for the number of students, it has been suggested to limit their number,* but the difficulty of fixing upon any proper or suitable limit to the number of students to be admitted and still more the natural dislike to anything like a forcible suppression of the popularity of the University of Vienna have not failed to deter the authorities from trying such an experiment. The medical faculty of Vienna must not be measured by a scale adapted for a provincial university. Its history, its arrangements and its abundant supply of material for teaching have created for it a world-wide reputation. It forms one of the few centres which attract representatives of the various peoples of the monarchy, and by its geographical position it seems designed to be the means of transmitting to the East the scientific medicine of Europe, a task of high import in the history of civilization. The degradation of the medical school of Vienna would be a crime against the State, against science, and against humanity.

If there is a want of the necessary space for teaching, it must be supplied by extending the present premises or by erecting new buildings. Preventive measures may also be necessary to keep unsuitable persons away from the university lest the good corn be choked by weeds. These ends might be secured by raising the lecture fees, which are smaller in Austria than in any other country,—not with a view of increasing the incomes of the professors, but

* Th. Billroth: Aphorismen, Wien 1886.

chiefly to enlarge and improve the schools—by making the examinations more severe, and by other means.

At the same time it is surely desirable that some new medical schools should be erected to relieve the overcrowding of the medical faculties. This might be done, for instance, in Salzburg, once the seat of a university,* where the necessary buildings and appliances for teaching exist already in a measure, or at least could be easily found, and where moreover the enchanting beauty and magnificence of the surrounding country would attract students from far and wide, even from abroad; or again in Brünn or Olmütz, in Lemberg or Czernowitz, in Agram, and in one or two places in Hungary. Some of these towns already possess several faculties, so that they only want the addition of medical faculties to become complete universities.

In 1872 new regulations for medical examinations were published by which separate diplomas for the different branches of medicine were abolished. Up to that time there were Doctors of Medicine, Doctors and Masters of Surgery, accoucheurs, and oculists, but as early as 1843 it was decreed that diplomas in surgery, midwifery, and ophthalmology should be granted only to such candidates as were already Doctors of Medicine, or if they belonged to the lower category of doctors to such as had taken the degree of Master of Surgery. With the abolition of this lower category of practitioners it was resolved for the future to educate only one class of doctors enjoying the same preliminary training, following the same course of studies, examined by the same rules, and advanced finally to the title of Doctors of Medicine, with which was associated the right to practise all branches of their art.

Whoever wishes to be admitted to the study of medicine must have finished his studies at the gymnasium, and have passed the "maturity" examination. The period of student-

* J. Mayr: Die ehemalige Universität Salzburg, 1859.—L. Spatzenegger: Die Salzburger Universität, Salzburg 1872.

ship at the university is five years. The examinations are held partly during that period, partly afterwards. They begin with examinations in natural history, on the subjects of mineralogy, botany, and zoology, which can be passed in the course of the first year. Those only who have satisfactorily passed these can present themselves for the professional examinations proper. The first of these latter includes physics, chemistry, anatomy and physiology. It consists of a thorough theoretical examination in these subjects, and involves the putting up or the demonstration of an anatomical and microscopical preparation, the performance of a chemical analysis, and the explanation of physical and physiological apparatus. This examination must not be entered for before the termination of the second year, while the second and third *rigorosen* cannot be passed until after the conclusion of the period of studentship. The candidate on entering his name is obliged to submit proofs that he has attended the medical and surgical clinics each during four semesters and each during two semesters as assistant, also that he has attended as assistant, for at least one semester each, both the obstetric and the ophthalmic clinics and that he has passed the first *rigorosum* satisfactorily. The second deals with general pathology and therapeutics, pathological anatomy and histology, pharmacology, and internal medicine, and involves a practical examination on pathological anatomy at the dead body or with the aid of preparations; the candidate is also required to examine several patients; and a thorough investigation is made into his theoretical knowledge of the above-mentioned four branches of science. The third *rigorosum* embraces surgery, ophthalmology, gynæcology, and forensic medicine, and is divided into practical examinations at the bedside and in the post-mortem room, that is to say the clinical examination of patients, bandaging, operations on the dead body, experiments with models, etc., together with a theoretical

examination upon the four branches of science forming the subject of the test.

After the candidate has passed these examinations he receives the degree of Doctor and a license to practise his profession.

The professors of the various subjects act as examiners in the three professional examinations: a commissioner, nominated by the Government, who is a doctor of medicine and usually a high official of the sanitary service, is charged with the duty of watching the examinations in the interests of the public. The duration and character of the examinations and the amount of knowledge required to pass them have, however, been thoroughly explained and accurately laid down.*

Doctors who desire to devote themselves to the public sanitary service are obliged to furnish proofs that after taking their degree they have held appointments for at least two years in a public hospital, or have been in general practice for three years, that they have acquired a knowledge of psychological medicine and have learned to vaccinate with skill. They have then to pass an examination in hygiene, sanitary law, forensic medicine, pharmacognosy, toxicology, chemistry and veterinary regulations: this examination is partly written, partly oral, and partly of a practical character.†

Excellent arrangements exist at the Vienna University for the education of skilful surgical operators. In 1807 a regulation was made that six students of medicine who had completed their studies in an exemplary manner should be employed in the surgical clinic for two years and should receive instruction in the performance of surgical operations on the dead and living subject. During this period they drew a yearly stipend of 300 gulden with residence found, and they entered into an engagement to practise their profession in their own country. The rulers of

* Thaa, *op. cit.*, Supplem.-Heft, S. 647 *et seq.*, 690 *et seq.*

† Reichsgesetzblatt 1873, 29th. März, Stück 12.

many of the crown lands founded similar appointments for students who were natives of those places and who wished to settle there again. It was hoped by these means to train up a class of skilled and experienced surgeons who afterwards might be able to do good work as university teachers, as directors and principals of hospitals and surgical wards, as sanitary officials or as private practitioners in the different parts of the empire.

At the same time a similar arrangement was instituted at the Josefinum, so that the army might be supplied with expert operators.

When a second surgical clinic was founded at the Vienna medical faculty a number of students was appropriated to this too for the purpose of being trained as operators.

Since 1870 these appointments have been made only for one year: but on the recommendation of the professors of the surgical clinic they may be extended to two or three years. The candidates must be doctors of medicine and must show in an examination on anatomy and surgery that they have the gifts necessary for the vocation of an operator. To only a proportion of them is any stipend paid: the others study at their own expense. At neither of the two surgical clinics must the number of them exceed eight.

Similar arrangements were in 1882 made in the obstetric clinics of the University of Vienna with the object of insuring the education of skilful operators in the department of midwifery.

Certain considerations, suggested by the Austrian system of medical education, have often given rise to discussions in the Press. In the first place, the lectures and examinations upon the sciences which are used as a preparation for the study of medicine occupy more time than appears justifiable when we consider the curriculum of the gymnasia: for by this so many hours are given up to instruction in the natural sciences that the assumption may fairly be

made that the students when they enter the university bring with them a general preliminary training in the natural sciences which, at least in mineralogy, botany and zoology, is so extensive as to make it superfluous to spend almost the entire first year on these subjects, as is now frequently done.* The arrangement in virtue of which these examinations and also the first *rigorosum* are passed during the period of studentship is attended with certain disadvantages; for many students are induced thereby to spend time in preparing for them which they ought to devote to attending lectures.

The custom, usual until recently, of students performing their military service during the period of their studentship was conducive to still worse results. They were, it is true, made military medical pupils at the garrison hospitals, being thus employed in the sanitary service; but they were really quite destitute of the requisite medical knowledge. They were thus withdrawn from the systematic course of study without any corresponding advantage accruing either to themselves or to the army. By the new military law the students of medicine are bound to serve for six months in the ranks and for six months as doctors in the military medical department. The former period can be got over during studentship—during one summer semester, the latter manifestly only after the completion of study. To avoid the interruption of study caused by the military service in the ranks it is to be wished that this could be undertaken either before the beginning or after the end of the university career. Complaints are made in Vienna that attendance on the lectures is irregular on the part of the students and an effort should be made to remove the causes which lie at the root of this state of affairs. It is conceivable that the system of assistantships now usual at the clinical institutions which are attended by hundreds of students is not of a character calculated to satisfy the

* Betrachtungen über unser medicinisches Unterrichtswesen, Wien 1886, S. 14.

requirements of medical education; some arrangement similar to the *stage* in the medical schools of France and England might be thought of to supply this defect.* Whether, in view of the want of this, the present method of examination in practical medicine, in which no provision is made for the prolonged observation and treatment of patients, is sufficient to enable an examiner to decide upon the fitness of a candidate for medical practice, is a matter which may reasonably be doubted.

If after the last *rigorosum* there were still another final examination embracing the most important subjects which had been taught, it would serve not only as a check upon the previous examinations but would render it possible to make a final summing up of the candidate's knowledge.

The Austrian administration of education, eagerly desirous as it is of improving the system of medical training and of rendering it complete by the erection of new schools and the foundation of new professorships, must extend a benevolent indulgence to these remarks and excuse them on the ground of the author's interest in the subject which is great enough to have evoked them.

THE GREATER AND LESSER GERMAN STATES BEFORE THE FOUNDATION OF THE GERMAN EMPIRE.

THE condition of political dismemberment into which the ancient German Empire had fallen, and the autonomy of the various countries which had composed it led to the foundation of numerous academies, many of which for long dragged on a miserable existence. They lacked both teachers and pupils, and they possessed neither appliances for teaching nor assured incomes to meet indispensable requirements. They were therefore not much missed when

* Even P. FRANK (vi, Abth. 2, S. 266) was anxious that all members of the junior medical staff at the Vienna General Hospital should be authorized to give clinical instruction.

they finally succumbed "partly through the effects of chronic disease, partly as the result of violent suppression which at times took the form of amalgamation with other universities."*

This fate befell the university of Bützow, which in 1789 was united with the academy of Rostock, those of Stuttgart merged with the Tübingen high school in 1794, of Bonn abolished the same year, of Köln, Treves, and Mainz, which came to an end in 1798, of Bamberg, Dillingen, Fulda, and Duisberg, abolished the first in 1803, the last three in 1804.

The following towns lost their universities in the years indicated: Helmstädt, Rinteln, and Altdorf in 1809, Frankfort-on-the-Oder in 1811, Paderborn in 1815, Erfurt in 1816, Wittenberg and Ellwangen in 1817, and Herborn and Münster (where, however, a theological and a philosophical faculty continued to exist) in 1818.

The political revolutions of that period, which introduced frequent changes in the map of Germany and assigned different parts of the country now to this and now to that State, exerted great influence upon the system of medical education. Certain universities, such as those of Salzburg, Innsbruck, Würzburg, and Freiburg, were subjected to continued changes of organization, a circumstance by no means conducive to the development of teaching. These conditions were not improved until peace was obtained, and the organization of States established by its means had begun to assume a permanent form.

Besides the two great powers of Austria and Prussia there existed from this time forth the kingdoms of Bavaria, Würtemberg, and Saxony, the first with its University of Landshut (which till 1802 was situated at Ingolstadt and in 1826 was removed to Munich), and those of Würzburg and of Erlangen, the second with its academy at Tübingen, and the third with high schools at Leipzig and Hanover, together with the University of Göttingen; then there were

* J. v. Döllinger: Die Universitäten sonst und jetzt, München 1867.

the grand duchies of Baden, with universities at Heidelberg and Freiburg, of Mecklenburg with the University of Rostock, of Hesse, with that of Giessen ; also the electorate of Hesse, with the University of Marburg, and the Saxon duchies with the University of Jena, the duchy of Schleswig-Holstein, united with Denmark, with its high school at Kiel, and a great number of States without universities.

The system of medical teaching in the various countries was, in spite of certain local peculiarities, in general of a fairly uniform character. The methods adopted in Austria and Prussia, after the period of French ascendency had been forgotten, served as a model for most of the other States, though from time to time efforts at originality were manifested, and were attended with remarkable results.

Accurate information is afforded concerning the education of doctors in Bavaria at the conclusion of last century by the curricula of medical study drawn up for the University of Ingolstadt for the years 1774, 1776, 1784, and 1799.* According to these students who aspired to the degree of doctor of medicine were required to receive a preliminary education in "philosophy," and then to undergo a three years' course of professional study. They were examined every three months, and the examination immediately preceding the degree lasted for five hours. After 1788 a doctorate of surgery as well as of medicine was granted. But it was not until 1807, after Bavaria had been made a kingdom, that the degrees were no longer conferred *imperiali et pontificia auctoritate*, but *regia auctoritate*.

Under the Montgelas Ministry a new organization was given to the universities of Bavaria which reflected the modes of thought of the Napoleonic age. By a stroke of the pen the ancient historical division of the four faculties was erased, and all subjects of teaching were put into one or other of two classes, the first including all those branches of knowledge which can be held to form part of a general education, the second embracing those subjects which form

* PRANTL *op. cit.* i, 676 *et seq.*

preparatory discipline for a definite vocation in life. Each of these classes was divided into four sections. The first class was made up of (i) philosophy and kindred subjects; (ii) mathematics and the natural sciences; (iii) history; (iv) ancient and modern languages: the second class consisted of (i) knowledge necessary for the education of the religious teachers of the people, *i.e.*, theology; (ii) law; (iii) political economy and finance; (iv) medicine.

The teaching staffs were composed of ordinary and extraordinary professors, and of private tutors "for the purpose of assisting and of being educated to become regular teachers."

Each section elected a member to the Senate which conducted the affairs of the university. This classification corresponded with the earlier one in so far that the first class embraced the subjects represented by the philosophic faculty, and the second was made up of the other faculties. It lasted for a few years and then was by degrees replaced by the older form.

The system of medical education was regulated by the legislative enactment of the 8th of September, 1808. This decreed "that no one is to be admitted to medical practice who has not passed examinations in that department of medicine in which he wishes to work." At the same time a rule was made "that the treatment of wounds should for the future be practised by those persons only who had learnt the medical science," and the universities were ordered "not to grant a degree in surgery to anyone who had not already taken one in medicine."

The period of studentship at the university lasted three years. At the conclusion of every semester, examinations were held on the subjects prescribed in the curriculum. If they were not passed satisfactorily they had to be submitted to again. After the termination of study an examination was held in which several questions had to be answered, if possible, in Latin, the candidate receiving no assistance; and a patient had to be examined and treated in the clinic;

finally the candidate's theoretical knowledge on all the subjects taught was tested. If the candidate aspired to the degree of Doctor of Surgery as well as Doctor of Medicine he had also to perform an operation on the dead body and to apply a bandage. With the composition of an essay and the defence of theses proposed to him, all demands on the candidate's knowledge, which preceded the granting of the degree, were satisfied. This, however, by no means carried with it a legal right to practise, for the young doctor had still to improve himself in practical medicine during two years in the wards of a hospital, or under the guidance of a busy practitioner, and after that to undergo an examination which consisted, firstly, of a qualifying part in which ten questions on internal medicine, surgery, midwifery, veterinary science, and forensic medicine had to be answered on paper under strict rules of isolation, a case of illness to be investigated and questions to be answered orally; and secondly of a competitive part the object of which was to select the ablest candidates with a view to securing them for the service of the State, and which was limited chiefly to paper work under strict rules of isolation, upon subjects connected with practical medicine.

Doctors acquired practical ability as obstetricians in a lying-in establishment.

Besides doctors of medicine there were "country practitioners" and surgeons who were taught in special schools.

A new order of studies and examinations for medical students was promulgated on the 30th of May, 1843. In this it was decreed that after a course of two years' study at the university they should pass the "admission" examination, which embraced the subjects of zoology, botany, mineralogy, chemistry, and physics. Then the special medical studies began, which after three years—that is, in all, a five years' course of university study—were terminated by an examination. In anatomy the student

was required to open one of the great cavities of the body and to demonstrate the viscera contained therein, also to describe one preparation dissected by himself, and certain others illustrating the anatomy of the bones, vessels, or nerves: in the other branches the examination was oral. After this followed the *biennium practicum*, a period passed principally in the clinics and great hospitals, and devoted to training in special departments of medicine.

At the conclusion of the *biennium practicum* the final examination took place; this superseded the qualifying and competitive examinations which were abolished. The candidate who presented himself for this had to furnish proofs that he had treated three medical and three surgical cases in the clinic and had attended three confinements, and he was obliged to submit reports of these cases before being admitted to the examination.

This consisted of (*a*) a practical part, viz., performing three surgical operations on the dead body, applying three bandages, and carrying out three obstetric operations on a model; (*b*) an oral examination on (1) anatomy and physiology, (2) pharmacology and dispensing, (3) general pathology and therapeutics, (4) special pathology and therapeutics of internal diseases, (5) surgery, (6) midwifery, (7) veterinary science, and (8) forensic medicine and hygiene; (*c*) some paper work, the questions set being upon the eight subjects above mentioned, and the candidate being isolated. To this were added successively the handing-in of an essay, the defence of theses, and the granting of the degree.

The student was thus obliged to attend the university for seven years before getting the doctor's degree which also gave the right to practise. It was sufficient moreover to entitle him to hold an appointment in the sanitary service, no further examination being required for this. The faculties had complete control over the examinations.

The regulation for examinations dated 22nd June, 1858, substituted for the "admission" examination, one in the

natural sciences which was passed after the first year of studentship and which like the former embraced zoology, botany, mineralogy, chemistry and physics. The second examination, which took place after four years' professional study and consequently after attendance at the university for five years, differed from the earlier form in that, besides on anatomy, the candidate's knowledge was tested practically on internal medicine, surgery, ophthalmology and midwifery, he being called upon to treat two medical, two surgical and one ophthalmic case during eight days, to perform one ophthalmic and two other surgical operations on the dead body, to apply two bandages, to examine two pregnant women, to make two diagnoses, to perform two operations on the obstetric model, and to attend two confinements. In the oral examination anatomy and physiology formed independent subjects ; pathological anatomy was associated with general pathology and the history of medicine with general therapeutics, while veterinary science, forensic medicine, and hygiene were omitted.

The *biennium practicum* was curtailed to one year, which was devoted to attending lectures on forensic medicine, state medicine, the treatment of mental diseases and veterinary science, to training in special departments, and to practical work in the policlinics. Many during this period also served as assistants in a hospital or with an official of the sanitary department. The State examination was held at the end of the "practical year." This took place only in Munich and there only once a year. It was conducted by a Commission composed of professors, medical officials, and practising doctors nominated by the Ministry, and included (1) special pathology and therapeutics, (2) surgery, (3) midwifery, (4) psychological medicine, (5) state medicine, and (6) veterinary science, and was both oral and by writing. On passing this the license to practise was granted.*

* Regierungsblatt f. d. Königreich Bayern 18c8, S. 2189 *et seq.*, 1843, S. 433, 1858, S. 873.

After the foundation of the German empire medical study and examinations were arranged upon a uniform plan in the different states which composed it. These, however, retained the right of making legal regulations for the education of those doctors who were to be employed in the public sanitary service. For this purpose a law was promulgated in Bavaria in the year 1876, which ordained that candidates for the medical appointments in the service of the State must give proof, both orally and by writing, of their knowledge of forensic medicine, public hygiene, sanitary regulations, and psychological medicine. In the kingdom of Würtemberg the students of medicine used formerly to pass their first examination at the conclusion of the course of study. It was both oral and on paper; it took place before the medical faculty of Tübingen, and was divided into three parts: (1) on the natural sciences, including zoology, botany, mineralogy, physics, chemistry, anatomy, and physiology; (2) on medical subjects represented by general and special pathology, pathological anatomy, and therapeutics, and (3) on surgical subjects, dealing with special surgical pathology, operations, and topographical anatomy.* Upon this followed a year of wider practical training, devoted to hospital work or to travelling in pursuit of scientific knowledge, and then the State examination, which was held by the medical college of Stuttgart, and consisted of medical, surgical, and obstetric portions: it was not only conducted orally and on paper, but was also of a practical character, patients being examined and treated, and operations performed on the dead body and on models.

In the Grand Duchy of Baden, also, a license to practise was acquired by passing a State-examination, for the most part theoretical, and conducted by a commission, which was generally composed of members of the medical college. The doctorate was quite independent of this, and was

* V. A. Riecke: Das Medicinalwesen des Königreichs Würtemberg, Stuttgart 1856.

conferred by the medical faculties: it constituted little more than a barren title, and was consequently not sought after by many practitioners.

In the kingdom of Saxony there were formerly, in addition to the doctors who had taken degrees and had been educated at the university of Leipzig, *medicinæ practici*, surgeons, and accoucheurs, who received instruction at the Medico-Chirurgical Academy of Dresden, a society which arose out of the *Collegium Medico-Chirurgicum* in 1815 and endured until 1864. The *medicinæ practici* were an inferior class of doctors for internal diseases, and had a right of settling down only in very closely circumscribed areas. The surgeons were allowed to practise surgery anywhere, but midwifery only if they had passed the prescribed examination. The *medicinæ practici* could get a license to engage in surgical and obstetric practice on passing examinations in these departments of medical science.

Anyone after finishing his studies at the gymnasium and entering the university for the purpose of studying medicine, could after two years present himself for the examination for the degree of Bachelor, which nearly corresponded to the *tentamen physicum* of to-day; he could then at the conclusion of his studies submit to the "approbation" examination held by the medical faculty and leading to the doctor's degree; the latter examination embraced all the most important subjects which had been taught and made pretty high claims upon the candidate's knowledge.

In the Saxon duchies there used formerly to be State-examinations which were held by examination commissioners in the chief towns of the different countries.

It was not until 1862 that Weimar, Coburg-Gotha and Altenburg agreed to hand over all business connected with examinations to the medical faculty of Jena. The qualifying examination embraced the most important branches of medical science, was associated with practical work, clinical demonstrations, etc., and concluded with the con-

ferring of the diploma of Doctor, upon the strength of which the governments of the different States granted a license to practise.

In the kingdom of Hanover the physicians were trained at the University of Göttingen, and the surgeons, who stood on a lower educational footing, at the Surgeons' School at Hanover. The former went up for the examination for the Doctorate after some seven semesters: this dealt with all the chief departments of medicine but did not give a right to practise. This license could only be obtained by passing the State-examination which was held by a commission nominated by the Government.

In Mecklenburg* also there existed formerly in addition to the physicians who were educated, and took degrees, at the University of Rostock, a class of surgeons who received a more or less restricted license to practise their art by passing an examination before the Medical College. The license to practise was granted by the government to the Doctors of Medicine on the strength of their diplomas. This arrangement of examinations was however altered to suit the pattern of the examination arrangements in Prussia even before the German imperial laws were introduced.

In the Grand Duchy of Hesse there was only one class of doctors. The study of medicine was not allowed until after the conclusion of the studies at the gymnasium. The medical examinations consisted of the following:—(i) The examination in natural science; this included mineralogy, botany, zoology, physics, and chemistry; (ii) the examination in anatomy, which was theoretical and practical, and very thorough; (iii) the final examination, which consisted of paper work, clinical work in the wards, and a part held *vivâ voce*, in which all departments of medical science came into consideration, with the exception of anatomy. Then followed writing an essay,

* Dornblüth: Darstellung der medicinischen Polizeigesetzgebung, Schwerin 1834.

taking part in disputations, and finally the doctor's degree, which carried with it the right to practise.

In those German States which did not possess medical schools, such as Oldenburg, Brunswick, Hamburg, Lübeck, etc., there were boards of examiners made up of officials in the sanitary service and doctors of position, and the right to practise was granted by them.

PRUSSIA AND THE PRESENT GERMAN EMPIRE.

THE Brandenburg-Preussen monarchy during the course of the 18th century gained a prominent position as a political and military power. The idea of a strong ruling authority in the State which should be paramount in all departments of administration, and should conduct affairs with a view to the common weal broke upon men's minds at an early date in this country, and was diffused throughout all classes of the population. The system of medical education was not uninfluenced by this tendency.

As early as the year 1725 a State-examination was introduced, and was no doubt necessary on account of the inconsiderate manner in which medical diplomas were at that time granted in many places.* It was, however, limited to anatomy and the description of a case of disease which had been observed by the candidate. To this was afterwards added an oral examination upon the most important parts of medical science. In 1798 the regulation was made that instead of writing out a case two patients should be examined in the presence of the examiner and treated by the candidate for four weeks. The period of studentship was fixed at a minimum of three years.

A complete organization of medical studies and examinations was effected in the year 1825. According to this

* L. v. RÖNNE und H. SIMON: Das Medicinalwesen des Preussischen Staates, Breslau 1844, i, 344 *et seq.*

several categories of practitioners were distinguished; for instance the doctors who had received diplomas and who were entitled either to practise medicine only or medicine in conjunction with surgery, and surgeons of the first and second class, who were also entitled to practise midwifery and ophthalmic surgery if they had passed the necessary examinations.

The doctors with diplomas were educated at the universities. On matriculating it was necessary for the student to furnish a proof that he had completed his course of study at the gymnasium and had passed the "leaving" examination. He had then to devote himself during four years to medical study and during the last year to attendance on the clinics. There were the following examinations: (1) the *tentamen philosophicum* which was introduced in 1826, included logic and psychology, physics, chemistry, mineralogy, botany and zoology, and was held by the professors of the faculty of philosophy in the presence of the dean of the medical faculty; (2) the *tentamen medicum* and *examen rigorosum* which consisted of a written portion, precautions being taken that the candidate received no help, and an oral examination, and which dealt with every subject which had been taught: these, if passed successfully, entitled the candidate to his degree; (3) the State-examination which took place only in Berlin and gave the right to practise.

While the *tentamen medicum* was held before the dean and the *rigorosum* before the professors of the medical faculty, at the State-examination "theoretically and practically educated men of science from all branches of medicine" were employed as examiners. Professors and other university teachers were intended to be excluded on principle from examining, and at most were admitted as examiners only in subjects which they did not teach. No member of this Examination-Commission, which was appointed annually by the Ministry, was at liberty to exercise his functions longer than two years.

The State-examination was composed of several parts,

of which the first dealt with anatomy, the *situs viscerum* being demonstrated by the candidate who had also to make a dissection and to explain preparations which were placed before him; the second part dealt with internal medicine and consisted of the examination and treatment of two patients during 2-3 weeks, to which were added questions upon other cases of disease, and of an inquiry into the candidate's knowledge of the art of prescribing; in the third two cases of surgical interest were examined and treated in the same way; and the fourth, the final *vivâ voce* examination, once more took all subjects taught into consideration and served as it were to control the preceding examinations. Hereupon the license to practise medicine was granted.

Whoever desired to engage in surgical practice also was obliged to submit to another examination in operative surgery which was interpolated between the second and third parts of the State-examination and consisted of the candidate writing a surgical essay, giving proof of his knowledge of instruments and of the art of operating, applying a bandage and performing two operations on the dead body. If the candidate passed this examination with great credit he received the diploma of "operator:" if he did not distinguish himself he received the diploma of medical practitioner and surgeon. The title of "operator" was abolished in 1855.

The "surgeons of the first class" were not obliged to be possessed of such a good general education and had to study for three years at a medical faculty or a medico-chirurgical school; they were however excused one year of studentship if they had previously been employed for two years as surgeons of the inferior category. They received a license to practise internal medicine and surgery after passing the State-examination. The latter was regulated upon the same principles as that for the doctors with university diplomas, and differed from it only in not presupposing a knowledge of the natural sciences and in

making less extensive claims upon professional knowledge. It was conducted in the German language whereas the university doctors sustained a part of their examination in Latin. The "surgeons of the second class" got the knowledge required for their calling partly through the instruction received from a master of their art, partly by serving at the military hospitals and infirmaries or by attending a few lectures at a medical faculty or medico-chirurgical school. At their examination, which was held by the provincial medical colleges, they were required to answer on paper, without assistance, three questions upon general points in physiology, materia medica et chirurgica, and the art of prescribing, upon the means of resuscitating the apparently dead, the assistance to be rendered in sudden accidents, the provisional measures to be taken on the outbreak of epidemics, etc.; they were also asked to give a demonstration of the *situs viscerum*, to make a dissection and to explain preparations placed before them, to perform a small operation on the dead body, to apply a bandage and to diagnose frequently occurring pathological conditions such as inflammation, suppuration, hernia, fractures and sprains, burns, etc.

The right to practise midwifery was granted only to doctors with diplomas and surgeons of the first and second class, to persons in fact who were in one way or another legally qualified to engage in medical practice. Before submitting to the examination they had to pass to get this license it was necessary for them to furnish proofs that they had attended a complete course of instruction in midwifery and had conducted two cases of labour: they had then to write answers to three questions on the subject to show their ability in manual diagnosis on the model and on the pregnant female, to perform version and extraction on the model, and to pass an oral examination in obstetrics.

Every doctor or surgeon who was licensed to practise surgery was entitled to practise ophthalmic surgery. A special examination in ophthalmology was therefore only

made compulsory for those doctors who possessed no surgical diploma. It consisted of answering on paper two or three questions upon the anatomy and physiology of the eye, performing some ophthalmic operations upon the dead body, showing a knowledge of the instruments in use and undergoing a *vivâ voce* examination in ophthalmic science.

Only doctors with university diplomas or surgeons of the first class who were authorized to practise all departments of medicine received appointments in the public sanitary service. The former were entitled *physici*, the latter forensic surgeons. Candidates for these appointments had to write four essays on subjects connected with medical jurisprudence, several months being allowed them for the task, to perform a dissection in a medico-legal case, to make a visit of inspection to a druggist's shop, to give practical proof of their diagnostic and therapeutic skill in veterinary science, and to pass an examination in State-medicine. In 1850 a regulation was made that only such doctors as had got their qualification in the State-examination with exceptional merit should be admitted at once to the examination for the position of *physicus*, the others had to wait some years.

This system of examinations, complicated by such a variety of combinations, was attended by many drawbacks. It divided doctors into a number of different groups, rendering disputes difficult to avoid, it degraded the faculties, vexed the university teachers by making them the objects of unjust suspicion, inasmuch as it made a point of excluding them from acting as examiners at the State-examination, while the examining boards which had this duty cast on them were overworked, persons were nominated examiners who were but seldom competent or suitable for the office, and the candidates were obliged to make a long stay in Berlin, and so put to much expense. These causes, combined with the advancing development of medicine, and influenced by the spirit of the age, which demanded equalization of position and rights, led to a

partial change in the system of medical study and examinations.

In the years 1848 and 1849 the medical schools of Breslau, Greifswald, Münster, and Magdeburg, which had up to that time served, together with the medical faculties, as places for the education of surgeons, and had been founded only a few decades before, were closed and done away with, so that for the future no more practitioners of this kind were produced.

The law of the 8th of October, 1852, ordained that from that time forth there should be only one class of doctors, who should be obliged to pass all the examinations, and consequently be entitled to practise all branches of medicine. They were to be educated at the university only, and to pass the *tentamen philosophicum*, the *tentamen medicum*, the *examen rigorosum*, and, finally, the State-Examination. The last consisted of the identical parts which had up till this time composed the examination prescribed for the doctors with university diplomas and the surgeons; but the portion which dealt with clinical surgery was merged with the examination upon operative surgery and the examination on midwifery was made a special part of the State-examination. This consisted therefore of examinations on anatomy, medicine, surgery and midwifery, and a final examination to which only those were admitted who had passed the others creditably. Some changes rendered necessary by the scientific requirements of the times were afterwards introduced into this arrangement of examinations. Thus in 1856 the anatomical examination assumed another form by the subject of physiology being added to it, and consisted of an anatomical part devoted to a practical testing of the candidate's knowledge of osteology and splanchnology (*situs viscerum*) together with the preparation of a dissection to show the course of nerves, and a physiological part including histology

In 1861 the *tentamen philosophicum* was abolished and its place taken by the *tentamen physicum*, in which

anatomy, physiology, physics, chemistry, and the descriptive natural sciences (mineralogy, zoology, and botany) formed the five subjects on which candidates were examined. The examination took place under the direction of the dean of the medical faculty, and was passed after the second year of studentship. In 1860 it was decreed that any candidate entering his name for the State-examination should furnish proofs that he had attended, in the capacity of assistant, both surgical and medical clinics during two semesters each. The *examen rigorosum* continued to exist in an unaltered form as an affair of the faculty and independent of the State-examination.

At the beginning of the present century some of the universities of Prussia appeared superfluous by reason of the inadequate number of students attending them, and the vicinity of other academies more favourably situated. Thus in 1805 the University of Erfurt with 41 teachers numbered only 21 students, and that of Duisburg with 12 teachers the same number of 21 students; somewhat better attended were the universities of Frankfort-on-the-Oder with 21 teachers as against 174 students in the year 1797; of Erlangen with 40 teachers and 202 students; of Königsberg with 26 teachers and 346 students, and of Halle with 48 teachers and 762 students. After the universities of Duisburg and Erfurt had been abolished, and that of Erlangen in Bavaria had ceased to exist, and Wittenberg had been united with Halle and Frankfort-on-the-Oder with Breslau, there remained of the ancient universities only Königsberg, Halle, and Breslau; at the last-mentioned a medical faculty was founded for the first time in 1811. To these were added the University of Greifswald, which came under Prussian rule with Swedish Pomerania, and those of Berlin and Bonn which were newly-founded.

The University of Berlin assumed a definite form in 1810 at a time when the State, as a result of the defeats of Jena and Auerstädt, was reduced in extent to the half of its former dimensions, and was partly occupied by foreign

troops. It was certainly a remarkable phenomenon that at such a period of general overthrow the thought of erecting temples to knowledge should have occurred to men's minds; it shows what courage—what moral and intellectual power—these men possessed, and how firmly and surely they hoped and built upon the hope of the restoration of the State.*

The medical faculty of the University of Berlin was developed out of the *Collegium Medico-Chirurgicum,* at which, in 1806, before the outbreak of the war, there was a teaching staff of eighteen ordinary and two extraordinary professors. The faculty took over a portion of the teaching staff and some of the schools, taking care to improve and complete the educational establishment by summoning to their assistance distinguished and learned men like REIL, HUFELAND, RUDOLPHI, and others, and by making some necessary additions to the schools of science. The establishment for the education of doctors for the army at Berlin, which, at the instigation of GÖRCKE, had been provided in 1795 with an excellent organization,† was associated with the university in such a way that the students of the former attended the lectures at the latter. These students were divided into those who were being educated for medical degrees and those who were passing the course of instruction required for "surgeons of the first class." With the abolition of the latter category of doctors, the training of such for the army came also to an end. The institution serves at the present day as a boarding-house for students under the direction of military medical officers. The students receive from the State lodging and instruction gratis, and even get pecuniary support, to a certain extent, during their studies; and in return they incur the obligation of serving for a certain number of years in the army. The

* RUD. KÖPKE: Die Gründung der Friedrich-Wilhelms-Universität zu Berlin, Berlin 1860.

† J. D. E. PREUSS: Das K. Preuss. medicinisch-chirurgische Friedrich-Wilhelms-Institut zu Berlin, Berlin 1819, S. 28 *et seq.*

supervision of the students is given to military medical officers who are distinguished for talents and ability; they accompany their pupils to the lectures, go over the subjects with them again, and thus get an opportunity of making their own acquirements sounder and more extensive. To this arrangement the science of our day owes many distinguished investigators and university teachers.

The youngest of the Prussian universities is that of Bonn, which was founded in 1818. It was a want much felt by the western provinces, widely separated as they are from the eastern; the former possessed no academy, with the exception of the theologico-philosophical school of Münster. The political events of 1866 brought about an increase in the number of Prussian universities by the addition of those of Göttingen, Kiel, and Marburg, which, with Hanover, Schleswig-Holstein, and the former electorate of Hessen, came under the Prussian administration.

When, after the famous victories of 1870, Elsass (Alsace) was reunited to Germany, the University of Strassburg was reorganized after the pattern of German universities, and included in their number. Equipped with abundant material for teaching and a distinguished staff of teachers, it has soon acquired for itself a prominent place among the high schools of Germany.

With the institution of the North German Confederation, which was, by the adhesion of the South German States in 1871, expanded into the German Empire, there followed a uniform organization in medical studies and examinations. By paragraph 29 of the law regulating trades and professions of June 21st, 1869, it was decreed that only the supreme authorities of those Confederate States which possessed one or more universities should be entitled to grant licenses to practise medicine, and then only to persons who had passed the State-examination.*

This can be passed at any of the universities belonging

* H. Eulenberg: Das Medicinalwesen in Preussen, Berlin 1874, S. 306 *et seq.*

to the German empire. The examining commissioners are nominated annually by the presiding Ministry; among them are found experts in all branches of medicine, the professors and teachers of the different universities being chosen by preference, together with a president who conducts and keeps a watch over the proceedings. The medical colleges and examination commissions, which had up to this time held the State examination in the chief towns of the different Confederate States, ceased to exercise this function, and the State-examination in medicine was simply changed into a university examination supervised by State-officials.

Whoever desires to present himself for this examination must furnish proofs that he has gone through the gymnasium course of study, passed the *tentamen physicum*, acted as assistant at the clinics, and attended four cases of labour. On the other hand he is no longer obliged, as was formerly the case, to undergo the *examen rigorosum* and to take the doctorate. It is true the right of granting this degree, after passing an examination, has been retained by the faculties; but this can now be done as well after as before the State-examination, and is nothing more than an ancient custom — no longer a form prescribed by law.

The State-examination was divided into five parts. The first included anatomy, physiology, and pathological anatomy, and involved the demonstration of an osteological and a splanchnological preparation and the dissection of a "part" to exhibit the nerves; the candidate was required to answer questions set him in histology and physiology, and to put up and describe a histological preparation; he had to perform a post-mortem examination and to make a report of the pathologico-anatomical results arrived at; he had also to make a histological preparation of diseased tissue: the second part dealt with surgery and ophthalmology and involved the treatment of two patients by the candidate during eight days with written reports on the cases; he had to answer questions set him on surgical subjects and perform an operation on the dead body, to

answer questions on fractures and dislocations, to apply a bandage and to examine and treat a case of ophthalmic disease: the third part was concerned with medicine in a similar way and involved the treatment of two cases of disease; the candidate had also to answer numerous questions on materia medica, toxicology, and the art of prescribing: the fourth part dealt with midwifery and gynæcology and involved attendance on a case of labour, the treatment of a woman during the puerperal period, and the performance of an obstetric operation on the model: the fifth part consisted of the final *vivâ voce* examination which embraced general and special pathology, surgery, materia medica and State-medicine or hygiene. The subjects upon which the candidates were required to furnish answers were to some extent decided by lot.

Whoever passed the State-examination satisfactorily was entitled to call himself medical practitioner (Arzt) but not to assume the title of Doctor of Medicine. If anyone desires the latter distinction he has to get it from some medical faculty. The conditions under which this is granted differ in different places. The demands on a candidate's knowledge are represented as a general rule by an oral examination on the most important branches of medical science, by the composition of an essay in German, instead of Latin as was formerly the case, and by the argumentative defence of certain theses.

The regulations of June 2nd, 1883, introduced numerous important alterations into this system of examination. In the first place it was decreed that mineralogy should be omitted from the list of subjects for the *tentamen physicum*, since all governments and faculties were agreed "that mineralogy of all branches of natural science is of least use to the future doctor, and the little it is necessary he should know about it is taught him in the lectures on chemistry and materia medica." The examination in zoology and botany was also curtailed, and it was ordered that only one question should be put upon these two

subjects. This was done from the conviction that it is impossible to assign the same importance in medical study, or to allow the same title to a place in the medical curriculum, to botany and zoology as to physics and chemistry, to say nothing of anatomy and physiology: that moreover it appears unjust to require from a medical student in his fourth semester satisfactory work in the extremely wide field of botany and zoology, in addition to an adequate knowledge of anatomy, physiology, physics and chemistry: and that it is impossible for him to satisfy the demands made upon his knowledge of these two sciences by a professor who makes one or both of them his special study, unless indeed he neglects for their sake branches of knowledge of far higher importance to his future career. On these grounds it was even proposed to exempt medical students from any examination at all in zoology and botany, or else to have any such examination conducted not by professors of these sciences but by a member of the medical faculty.

These considerations led to a resolution to require of the student only that he should possess in zoology a knowledge of the outlines of comparative anatomy and physiology, and in botany a general acquaintance with the system of classification of the vegetable kingdom, having especial regard to officinal plants, together with a knowledge of the outlines of vegetable anatomy and physiology. It need hardly be said that persons who have taken the degree of Doctor in the natural sciences at a German university are excused the examination in these subjects in the *tentamen physicum*. The *tentamen physicum* is an oral examination and does not involve any practical work.

At the same time the conditions for admission to the State-examination were made more severe and another method of subdividing it was introduced. The candidate must now, when he puts his name down for it, furnish proof that he has devoted at least nine semesters to medical study, instead of eight as was formerly the case, and that he has

acted as assistant in the surgical, medical, and obstetric clinics for two semesters in each and one semester in the clinic for diseases of the eye; also that at least four semesters have elapsed since he passed the *tentamen physicum*. In 1887 it became necessary for him to show that he had acquired the requisite skill in the performance of vaccination.

The State-examination is divided into the following parts: (1) normal anatomy; (2) physiology; (3) pathological anatomy and general pathology; (4) surgery and ophthalmology; (5) internal medicine and therapeutics; (6) midwifery and gynæcology; and (7) hygiene. In anatomy, physiology and pathological anatomy the examination is carried on by only one examiner; in the other subjects by two. The examination appears to have been made rather more severe than formerly in certain subjects, such as anatomy, surgery, and midwifery. If a candidate fails in any subject he must present himself for re-examination within a certain fixed time: if he fails to do so, he loses all advantage from having passed in the subjects on which his knowledge had satisfied the examiners.

Some of the regulations in this system of examination cannot fail to provoke our criticism. The first to do so is that fixing the period of studentship at nine semesters, whereas only a few decades previously this period in many of the Confederate States covered ten semesters. Since that time medical science has greatly developed in all directions, and the demands made upon the knowledge of doctors have not on that account become less, but on the contrary have extraordinarily increased. If we wish to settle a precise period for the duration of studentship, ten semesters are the least we can demand.

Again, the semester which at present is given up to military service falls generally in the period of studentship required by law and is reckoned as part of it: this arrangement is unjustifiable for while performing their military duties the students are prevented studying by having other

tasks to execute which monopolize all their bodily and mental powers.

The decree that medical studies must be carried on to their termination exclusively in the universities of the German empire excited surprise. Such a regulation could be easily understood in the case of law students who afterwards become State-officials: but permission should be granted to those who are destined for the medical profession—a calling of an international character—to visit foreign universities to complete their education or to enlarge their intellectual horizon.* It has hitherto been quite characteristic of the German race to accept and assimilate the intellectual achievements of other peoples and by no means to shut their eyes to them.

The doctorate in Germany takes up a singular position in relation to the system of medical examinations. Inasmuch as it neither confers the right to practise nor is a condition upon which admission to the State-examination depends, it appears to be really superfluous. If the object is to satisfy the prejudices of the public by preserving amongst practitioners the title of Doctor it ought to be granted to everyone who has passed the State-examination. If it is intended to be a mark of distinction for remarkable scientific attainments it is desirable that the claims on the knowledge of those who are candidates for it should be distinctly higher than they are.

It is an extraordinarily happy and suitable arrangement to intrust the management of the examinations chiefly to the faculties, the members of which are for the most part without any doubt elected on account of their special personal acquirements, and at the same time to preserve to the authorities of the State a proper amount of that influence which they are empowered and intended to use in the interests of the public.

Some particular points in the arrangement of the examinations could no doubt be improved. Thus it may be

* K. Koester: Die Freizügigkeit der Studierenden der Medicin, Bonn 1884.

doubtful whether two examiners are required in the subjects dealing with practical medicine while one examiner is sufficient in each of the other subjects, because by this arrangement too great demands are made upon clinical material but scantily available in many places; again, two equally qualified examiners are hardly ever to be found at the same place; and finally the supervision or control of one examiner by the other does not appear to be more necessary here than in the subjects connected with the theory of medicine. So too the present form of the last part of the State-examination is unsatisfactory. Hygiene has no more claim to be admitted as a subject for examination than have psychological medicine, forensic medicine, veterinary science and other branches of medical study.

On the other hand in spite of these few faults—and the justice of the criticism has perhaps still to be proved—the German system of medical education presents so many advantages that it justly serves as a pattern which other lands are glad to imitate.

ITALY.

THE system of medical teaching in Lombardy and Venetia was organized in former times completely after the Austrian model. The medical faculties of Padua and Pavia stood in intimate relation to the universities of the other countries belonging to the Austrian crown and gained from them both inspiration and assistance on the path of intellectual progress. The princes of the Austrian reigning house, as is remarked by LODER,* directed "their efforts towards good organization and satisfactory maintenance of the public medical institutions."

In the States of the Church, medical study lasted for four years in accordance with a decree of Pope LEO XII. dated

* E. v. LODER: Über ärztliche Verfassung und Unterricht in Italien i. J. 1811, Leipzig 1812.

1824; after this period had elapsed the Doctorate of Medicine could be conferred. Anyone desiring only the degree of Doctor of Surgery studied one year less and occupied himself principally with the subjects required for his future calling. The license to practise was not conferred at the same time as the degree, but the *biennium practicum* had first to be passed and was spent in visiting the clinics and in hospital work.

In Tuscany the custom prevailed that medical students should attend the Universities of Siena or Pisa during four years and then betake themselves to Florence to continue their studies; here, in the institution connected with the Ospedale di S. Maria Nuova, they had an opportunity of getting a more extended and complete education in medicine. The lectures which had to be attended at the university were accurately laid down. Examinations held at the end of every year were the means of deciding whether a student should be admitted to the lectures of the following year. After the conclusion of the period of studentship the State-examination had to be passed in Florence: it consisted of an oral part on theoretical subjects and of a practical clinical part. Then followed the composition and defence of theses, the promotion to the degree of Doctor, and the license to practise.

Similar conditions prevailed in other Italian States. The influence of Austria and France, which made itself felt in many branches of the administration, was noticeable also in the arrangements of medical study.

When the national aspirations of Italy were satisfied and the different parts of that country were united into one political whole, a uniform organization in medical teaching became a possibility. It became a reality on the 16th November, 1859, and was the first stone laid in a great edifice of culture, the advantages of which are becoming every day more apparent.

At present Italy possesses 17 universities maintained by the State, and 4 supported by towns or provinces. The

State universities are divided into those of first and second rank. To the first class belong the academies of Rome, Naples, Turin, Bologna, Padua, Pavia, Pisa, and Palermo; to the second those of Genoa, Modena, Parma, Macerata, Siena, Cagliari, Sassari, Catania, and Messina. The latter are partly incomplete, that is, are not provided with all the faculties, and possess fewer professorships and a smaller number of students than the former. The so-called free universities are at Perugia, Urbino, Camerino and Ferrara. We must also mention the Instituto Superiore of Florence, which is connected with clinical and other medical institutions, and offers facilities for the study of medicine.

There is everywhere an absence of the theological faculty, for the training of the clergy was in 1873 taken away from the universities and handed over to the episcopal seminaries.

Four faculties are recognized, namely, the legal, medical, that representing mathematics and the natural sciences, and the linguistic-historical. The study of medicine is continued over six years. The students must on matriculation give proof of having received a preliminary education. If they have not passed through the gymnasium, and the lyceum, which nearly corresponds to the three upper classes of the gymnasium in Germany, and have received no equivalent education elsewhere they are admitted to attend the lectures, but not to the examinations or to the degree. A plan of studies is recommended to the students, but its adoption is not made compulsory. They are examined only in the most important departments of medical science, and this takes place immediately after the termination of the course of study. The examination is held by the professors who teach the subjects examined upon, two specialists acting as assistants to each professor. After having in the course of the period of studentship passed the different special examinations in the subjects taught, which are both theoretical and also of a practical nature—dealing for example with descriptive and patho-

logical anatomy, surgery, internal medicine and midwifery —they receive a license to practise medicine. In order to get the doctorate the practitioners must compose an essay and support several theses by argument.

The teaching staffs of the medical faculties are composed of ordinary and extraordinary professors, who are distinguished only by the difference in the amount of the stipends which they draw; of incaricati, who are commissioned to teach some special subject; and of private teachers. The appointment to the professorships is ordinarily the result of competition in written and oral examinations, or merely the production by the candidates of any scientific work they may have done. In cases where it is a question of a learned man of acknowledged reputation, candidature is disregarded, and he is summoned to occupy the professorial chair.*

SPAIN AND PORTUGAL.

IN Spain, too, the custom of granting the right to practise particular branches of medicine has been given up. At the present day there exists but one class of doctors, the licenciados en medicina y chirurgia, along with persons of inferior position who render surgical aid, amongst whom may be numbered the practicantes (surgical assistants) and the dentistas. Anyone beginning the study of medicine must furnish proof that he has received a general scientific preliminary education, and must possess the degree of Bachiller en artes. Medical study may be pursued throughout at the universities, but this is not compulsory.

Medical faculties exist at the academies of Madrid, Barcelona, Granada, Salamanca, Santiago de Compostela, Seville, Cadiz, Valencia, Valladolid and Saragossa. The students devote the first year of studentship to the natural

* TOMMASI-CRUDELI in the Riv. Clin. di Bologna, 1876.—Regio decreto No. 2621, Roma 1884.

sciences, physics, and chemistry, and the following six years to medical subjects. After this they are subjected to an examination consisting of three parts, the first being theoretical, and embracing all branches of medicine, and the two others being of a practical character, and held partly at the bed-side, partly in the post-mortem room. The candidate receives on passing this the license to practise, but not the degree of doctor. If he desires the latter he is obliged to study for another year, devoting this time to the completion of his medical education, and to attending lectures on the history of medicine, medical geography, hygiene, biology and many other subjects: finally he has to compose an essay and to support theses by argument. The title of Doctor is only granted to those practitioners who manifest an active interest in the advance of science: it affords no advantage in practice, and is sought for only by those who aspire to professorships or high positions in the public sanitary service.

Portugal has a medical faculty at Coïmbra and two medico-surgical schools at Lisbon and Oporto. They differ from one another in the first being more richly supplied with the means of instruction and with professorships than the two last and alone having the right to grant the title of Doctor. The school of Lisbon, by reason of the great hospital which has been consigned to it for teaching purposes, enjoys the reputation of giving a superior education in practical medicine and more particularly in surgery.

There is now only one class of doctors, since the licenciati minores who had but a limited right to practise have been abolished. No one is admitted to the study of medicine until he has shown in an examination that he has received a certain amount of general education. Attendance on lectures is compulsory. The curriculum demands five years' work. Examinations are held at the end of every year, and upon the result of these promotion into

a higher class depends. The examinations are both theoretical and practical and in some respects very strict: thus the candidate is required to treat 10 patients during 20 days independently. The result being satisfactory the license to practise is granted. The title of Doctor is indicative of a more complete scientific education. It is required in the case of those, for instance, who are desirous of teaching at the medical faculty of Coïmbra. To get it the candidate has to pass an examination and write an essay. The professors are the examiners. The professorships are conferred after competition.*

HOLLAND AND BELGIUM.

VARIOUS classes of doctors were formerly educated in Holland, and were licensed to engage partly in medical, partly in surgical practice, and to settle either in the country only or anywhere they pleased. They acquired their professional knowledge either at the universities or at the medical schools which were in connection with certain hospitals. In 1865 a law was passed ordering that, from that time forth, doctors should not be licensed to practise special branches of the healing art, but should practise medicine as a whole and should possess an unconditional right of settling where they pleased.† At the same time the hospital schools were abolished and the education of doctors handed over to the medical faculties.

At the present time Holland possesses the three universities of Leyden, Utrecht and Groningen which are supported by the State, and the Municipal Academy of Amsterdam which arose out of the Athenæum—a high school the history of which reaches back to 1632,—and which in 1877 was raised into a university.‡

* B. A. SERRA DE MIRABEAU: Memoria historica e commemorativa da faculdade de medicina, Coïmbra 1872.

† Das Medicinalwesen im Königreich der Niederlande, Haag 1870.

‡ Revue internat. de l'enseignement, Paris 1881, i, 77 *et seq.*

Whoever approaches the study of medicine must have completed his course of studies at an advanced grammar school or at the gymnasium, or else must furnish satisfactory evidence that he is in possession of a sufficient preliminary education. The period of studentship lasts generally for six years. The license to practise medicine is only acquired by passing the State-examination which is held by Examination Commissioners, teachers from the different medical faculties being nominated as such. This is preceded by the first and second examination in natural science, the first being devoted to physics, chemistry and botany, the second to anatomy, physiology, histology, materia medica and general pathology.

The State-examination itself is divided into a theoretical part which deals with pathological anatomy, pharmacodynamics, special pathology and therapeutics, hygiene, the theory of surgery and of midwifery, and into a practical part which consists of work at the bedside and in the post-mortem room. Before presenting himself for this the candidate must show that he has received clinical instruction during two years and has attended at least twelve labours, of which two have been completed with the aid of instruments.*

The doctorate of medicine is conferred by the medical faculties independently of the State-examination; the candidates for this are required to have passed the gymnasium course *in literis humanioribus*. The examinations for the doctorate have regard not only to professional skill but also to medical learning; they presuppose a more thorough general education and go more deeply into the natural sciences and into the different departments of medicine itself than the State-examination. On this account the Doctorate of Medicine carries with it a license to practise.†

* Geneeskundige Wetten, Zwolle 1882, Gesetz vom 28. Dez. 1878.

† Wet van d. 28 April 1876, tot regeling van het hooger onderwijs, Zwolle 1884.

The Dutch system of medical teaching differs essentially from that of Belgium which shows many points of resemblance to the French. There are, however, in Belgium no *officiers de santé*, no practitioners of an inferior class, but only one class of doctors educated at the university. Two out of the four universities of the country, those namely of Ghent and Liège,* are supported by the State: the remaining two are not so maintained. The University of Louvain bears a religious character, and is directed and maintained by the clergy: the University of Brussels, which was created by the Liberal party in 1834, owes its maintenance to the city and to certain rich patrons.

As a general rule the gymnasium course precedes medical study which may be completed within seven years. The medical studies begin with the natural sciences, physics, chemistry, and philosophy. The curriculum is for the most part regulated by the examinations, inasmuch as the subjects required for one examination are all taken together. The teaching consequently is so disposed as to form a practical preparation for the examination as in the medical schools of England. The first medical examination deals with descriptive and comparative anatomy, physiology, embryology, histology, and pharmacology, is combined with practical demonstrations, and is called the candidate's examination. Three examinations are required for the Doctorate of Medicine, which carries with it the license to practise; the first deals with general pathology and therapeutics, special medical pathology, and pathological anatomy; the second is upon surgical pathology, hygiene, and forensic medicine; and the third embraces clinical medicine and surgery, diseases of the eye and of the sexual organs, and dermatology, together with practical midwifery and operative surgery, being partly theoretical and partly practical.

The professors of the faculty are now the only examiners, whereas formerly commissions for examining were formed,

* A. LE ROY: L'université de Liège, 1869.

being composed in such a way that half the members of every commission belonged to the local faculty, and the other half were professors of another faculty. The principle here followed was that of associating the teachers of the State University with those of the free academies in one examining board, with the view of securing in this manner a desirable uniformity in the education of doctors. There exists also at Brussels a central examining commission, to which those candidates resort who have no proofs to show of preliminary scientific education; for admission to professional study and to the university is free to every one who can read and write. On a person entering his name for the medical examinations he is only required to show that he has attended the surgical and medical clinics during two years and the obstetric clinic for one year. The teaching staffs consist of ordinary and extraordinary professors and *agrégés spéciaux,* who are nominated for three years, and receive a small stipend; these have taken the place of the former *chargés de cours.*

SWITZERLAND.

FORMERLY every canton had its own laws and regulations controlling the admission to medical practice. Some cantons required a State-examination to be passed, which was held before an examining commission formed of the local doctors; in others a certificate that such had been already passed in another canton or country, or the production of a diploma of Doctor of Medicine sufficed; in some even this was unnecessary, and anyone who asserted that he possessed the requisite ability was permitted to engage in practice.

It was not until 1867 that an agreement, ratified by the Federal Council, was entered into by most of the cantons, by which the medical examinations at the Swiss universities

were recognized as sufficient to confer the right to practise medicine throughout the country.

Nowhere do there exist so many academies and high schools in proportion to the population as in Switzerland. On the one hand there are the universities of Basle, Zürich, and Berne,* where teaching is carried on in German; on the other hand, the university of Geneva and the academies of Lausanne and Neufchatel, in which the lectures are delivered in French. The four universities, and since recently the academy of Lausanne, possess medical faculties. The universities of Zürich, Berne, and Geneva have only been founded during the course of the 19th century, and their medical faculties have been developed out of medical and surgical schools. They are at the present day in the same position in regard to teachers and the appliances for teaching as their sister-institutions in Germany.

The medical examinations are arranged after the German pattern, and are held at Basle, Berne, Zürich, Geneva, and Lausanne. The members of the examination commissions are selected from the professors of the medical faculties and from practitioners of proved ability, and are nominated for the period of four years. The examinations are as follows: (1) in natural science, comprising physics, chemistry, botany, and zoology, with comparative anatomy; (2) the anatomical and physiological, which is at least as severe as in Germany; and (3) the special medical examination, which, like the immediately preceding one, is partly practical, partly oral or on paper, and embraces pathological anatomy, medicine, surgery, midwifery and gynæcology, ophthalmology, forensic medicine and hygiene, materia medica, and mental diseases.† It is noteworthy that the conditions of admission to the medical examinations are stricter than in other countries, for the candidate is required to furnish proof that he has attended lectures on the most important branches of medicine, has taken part in

* Ed. Müller: Die Hochschule Bern von 1834-1884, Bern 1884.

† Verordnung der eidgenöss. Medicinalprüfungen vom 19. Marz 1888.

practical work, and has not only attended the medical, surgical, and obstetric clinics each for two semesters and the clinic for diseases of the eye for one semester, but also that he has worked in the clinic for mental diseases for one semester, and has acted as assistant in the policlinic.

The doctor's degree is not connected with this professional examination, but is conferred by the medical faculties on the candidate passing another examination and writing an essay.

DENMARK, NORWAY, AND SWEDEN.

MEDICAL teaching in Denmark is organized on the same plan as in Germany and Austria. Medical students on entering the university of Copenhagen must produce a certificate of having passed the "maturity" examination of a Danish gymnasium; then they apply themselves to the study of philosophy, the natural sciences, physics and chemistry, and are examined in these subjects. It is only after this that real medical study begins.

The examinations which have to be passed before a license to practise is granted take place before the medical faculty in the presence of censors appointed by the government who deliver judgment upon the candidate's fitness. The examinations consist of a part devoted to paper work, in which the candidate has to write, without assistance of any kind, three essays upon subjects of practical medicine; of a practical portion consisting of a dissection, the examination and treatment of several patients and the performance of an operation on the dead body; and of an oral examination upon the most important departments of medicine.

As a general rule it is only those who desire to engage in academical teaching or to enter the public sanitary service who aspire to the doctor's degree; it is granted after the candidate has written an essay of real scientific value.

Every doctor of medicine is privileged to give lectures at the university. The professorships are filled up after competition.

Very much the same system prevails in Norway. Here, too, it is usual for practitioners to rest satisfied with the license to practise and but seldom to aspire to the degree of Doctor. The country possesses a university at Christiania founded in 1811 and completed in 1815. Matriculation takes place only after the satisfactory completion of the course of study at a gymnasium. The university studies begin in all the faculties with an advanced course upon subjects of general science: from two to three semesters are devoted to this, during which time the student has an opportunity to make up his mind as to the choice of a profession.

The period of medical studentship lasts commonly for seven years and is divided by examinations into three parts. The first is devoted to zoology, botany, physics, chemistry, anatomy and physiology; the second is occupied with the study of pharmacology and toxicology, general and special pathology and pathological anatomy, surgical pathology, ophthalmology and dermatology; during the third the subjects engaging attention are clinical practice, forensic medicine and hygiene; the examinations are oral, on paper, and practical. Anyone passing these satisfactorily is given a license to practise.

The doctor's degree is only granted for extraordinary scientific attainments and is associated with the right of lecturing at the university. In the year 1888 there were in the whole of Norway no more than 14 doctors of medicine.

In Sweden medical instruction is given in the medical faculties of the universities of Upsala and Lund and at the Medical and Surgical Carolina Institute which was founded in 1750 and at the present day is used chiefly for clinical education. A certificate of having passed the "maturity" examination *in literis humanioribus* at the gymnasium is required from the students.

The course of study for medical students is approximately the same as in the German universities; only in consequence of the length of the vacations the lectures upon the various subjects extend over more time. Generally from nine to ten years intervene between leaving the gymnasium and beginning medical practice. The student applies himself in the first place during three semesters to physics, chemistry, botany and zoology, and is examined in these subjects. He now passes from the philosophical to the medical faculty and devotes about four years to the study of anatomy, physiology, medical chemistry, histology, pharmacology and general pathology. He is obliged to dissect and to engage in practical work in the physiological, chemical, histological and pathological laboratories, while he is at liberty to please himself in regard to attendance at the theoretical lectures, which are given gratuitously. The examination which closes this portion of the period of studentship embraces the above-mentioned subjects as well as the history of medicine, and is partly oral, partly practical. The medical candidate, as he is henceforth called, devotes the following semester to attending the clinical institutions — in short to perfecting his education in practical medicine. He is obliged to direct his attention also to various special subjects such as medical psychology, the diseases of children and syphilology, to assist in post-mortem examinations in cases of pathological and forensic interest and to attend the hygienic exercises. The examination upon these subjects, which is not generally passed until from three to four years after the "candidate's" examination, confers, if the result is satisfactory, the right to engage in practice.

The degree of Doctor of Medicine is only required in the case of those practitioners who desire to teach at the university or to get posts in the higher branches of the sanitary service: it is granted on writing a scientific treatise and maintaining, in discussion, the positions taken up in it; it is, however, conferred only by the two universities, not by

the Carolina Institute. On the other hand the last has the right to hold the "candidates'" and "licentiates'" examinations and to grant the ordinary license to practise.

RUSSIA.

So late as last century Russia still drew her doctors for the most part from foreign countries.* There was, however, a school founded in Moscow for the education of surgeons as early as the year 1706, in the time of PETER THE GREAT: this was connected with the hospital there, and possessed an anatomical theatre and a botanical garden. The first university with a medical faculty arose also in Moscow, in the year 1755. On the other hand the university connected with the Academy of Sciences at St. Petersburg did not deserve the name, but was nothing more than a gymnasium, in which some courses of lectures on law were held; indeed the attendance was but small, the number of students under the directorship of the Princess DASCHKOW, in the year 1783 amounting only to two.† During the 19th century the medical faculties of the universities of Kiew, Charkow, and Kasan have been founded, and in these teaching is carried on in Russian; the Polish university of Warsaw has also been Russianized. The most recent addition to the Russian universities is that of Tomsk in Siberia, which was opened for students in September, 1888, and at first possessed only a medical faculty. The university of Helsingfors, in Finland, and that of Dorpat also belong to the Russian Empire; in the former the Swedish, and in the latter the German language prevails.‡

* W. M. v. RICHTER: Geschichte der Medicin in Russland, Moskau 1817, iii, 91 *et seq.*—A. BRÜCKNER: Die Ärzte in Russland bis z. J. 1800, St. Petersburg 1887.—J. TSCHISTOWITSCH: Geschichte der ersten medicinischen Schulen in Russland, St. Petersburg 1883.

† Count D. A. TOLSTOI in his Contributions towards a Knowledge of the Russian Empire, St. Petersburg 1886, p. 217.

‡ Die deutsche Universität Dorpat, Leipzig 1882.

To these must be added the Medical and Surgical Academy at St. Petersburg, where the military medical officers are trained.

Anyone who intends to follow the medical calling must have completed the course of study at a gymnasium before he is admitted to professional study. The period of studentship lasts five years. In addition to the examinations, which are held to test the student's knowledge on the subjects of the lectures they have been attending, there is in the middle of the period of studentship an examination which corresponds to the German *tentamen physicum ;* the examination for the license to practise takes place at the conclusion of the course of study, and embraces the most important departments of medicine, being both oral and of a practical character. Those who, having got the license to practise, aspire to the Doctorate have their knowledge tested more severely.*

GREECE AND THE CHRISTIAN LANDS OF THE BALKAN PENINSULA.

THE University of Athens was founded in 1837, during the reign of King OTHO, and was organized on the German model. A certificate of having passed the "maturity" examination of a Greek gymnasium was required before matriculation. Medical studies generally demand five years, the first of these being devoted to the ancillary sciences. The preliminary examination is held at the conclusion of the first year, and includes physics, chemistry, and natural history. The examination for the degree of Doctor deals with normal anatomy, physiology, general pathology, materia medica, medicine, surgery, midwifery, forensic medicine, and hygiene, but is not associated with practical demonstrations. After the degree there follows a

* Allgem. Statut der K. russ. Universitäten vom 23 August 1884, Petersburg 1884.

year of practical training, and then the practical examination, which consists principally of the treatment of patients, the performance of operations on the dead body, etc., and, if passed satisfactorily, confers the right to practise.

There formerly existed in Roumania only a military medical school, the most gifted pupils of which were sent to foreign universities to complete their studies. At the present day the country possesses the two universities of Bukharest and Jassy, each one of which is provided with a medical faculty.* Connected with the former there is a school of pharmacy. Bukharest also possesses a veterinary college. The completion of the gymnasium course is a necessary preliminary to the study of medicine. The period of studentship at the university lasts five years. The examinations embrace all departments of medicine, are both theoretical and practical, and are conducted by the professors. These concluded satisfactorily, the candidate receives the doctorate, which carries with it a license to practise all branches of medicine.

The Servian University of Belgrade as yet has no medical faculty.

FINAL CONSIDERATIONS.

On looking at the abundant supply of facts which serve to throw light on the systems of medical teaching prevalent at different periods and in various countries the question naturally suggests itself: "Where is medical education now carried on in the best and most appropriate way?" The question, however, as little admits of an answer as does that which asks which is the best form of government, or the best religion. While a republic appears most suited for one nation, and has been preserved by it for centuries, others require a monarchy, perhaps even despotic rule.

The case is similar with the arrangements for medical

* Revue internat. de l'enseignement, Paris, iv, p. 251 *et seq.*

education. The condition of general culture, the historical traditions and the geographical position of the country, together with the state of its finances and the character of its population are here matters of great importance.

It may be permitted, however, to take this opportunity of discussing certain general questions, which, even if the solution of them is unattainable, are fit to engage our attentive and serious consideration.

A principle which is of the utmost consequence in the preliminary education in general knowledge given to those intended for the medical profession, and one which must under all circumstances be firmly maintained, is that such education shall be in no way inferior to that required for the other learned professions, for theology, for law, for philology, etc. The doctor must possess that measure of general knowledge which satisfies the highest demands in the country he lives in. The nature and extent of these demands depend upon the conception formed of general education, and this differs and has differed according to place and time.

Inasmuch as in most civilized countries of the present day this conception has been developed under the influence of the humane letters, it follows that the study of antiquity with the help of the Greek and Latin languages has come to form the real foundation of general education. It is true that this system, which was in high favour during the 16th century, in the 17th and 18th centuries was subjected to considerable limitations. The sudden stimulus given to the study of the natural sciences and the development of national literatures forced men to give consideration to other subjects as elements of education. Wherever these new subjects were not merged into the educational system till then in vogue there appeared, separating the schools devoted to ancient and modern learning respectively, a cleft, which the course of time has enlarged into a chasm.

The advocates of the former declared that the educational value of ancient literature depends chiefly upon the forms

of language in which it is conveyed, the study of which sharpens the intellect and exercises the thinking powers. Assuming the correctness of this assumption, the reflection that eight or nine years of life are devoted to this study must give us pause. The end aimed at stands in no reasonable relation to the time spent in reaching it. At any rate we are at liberty to ask whether the toilsome and tedious journey over the linguistic rocks of Greek and Latin literature is the only path by which the wished-for goal can be reached. There have existed at all times and there exist at the present day numberless remarkably clever people who have never learnt Greek or Latin; and the converse proposition may be stated with equal truth. Why should not other branches of knowledge, especially mathematics, be suitable for developing and sharpening the intellect?

The object of a good system of instruction should be to train the mind and at the same time to pay due attention to the requirements of life. It is well known that the classical gymnasia with their arrangement of studies only partially satisfy this demand.* Most of the objections which have been raised against them depend upon this fact. What above all things is demanded at the present day, is that greater attention should be paid to practical matters in teaching, for this is to the advantage not only of the future doctor and man of science but also of the theologian and lawyer,—of everyone, in fine, whose calling comes into touch with practical life. In most countries these requirements have been taken into account either by modifying the course of the classical gymnasia through the adoption of new subjects of instruction or by enlarging them into schools of a mixed character, with practical classes added and running side by side with the subjects

* Bezold and Esmarch in the Tägl. Rundschau 1885, No. 286, 1886, No. 68. —Th. Puschmann in the Tägl. Rundschau, Berlin 1886, No. 168, 169.—E. Haeckel: Realgymnasium and Formalgymnasium in the Tägl. Rundschau 1887, No. 152.—W. Preyer: Naturforschung und Schule, Stuttgart 1887.

previously taught. With a view to this the *Realschulen* were founded in Germany, some of which have by the extension of their fields of instruction, taken the new form of *Realgymnasien*, and are distinguished from their classical sister-schools chiefly by the fact that in them the Greek language has ceased to be taught and the time thus gained is devoted to the natural sciences, etc.

There is no doubt whatever that the German *Realgymnasium* in its present form affords a better preliminary education for the study of medicine than does the classical gymnasium; and yet the students of the former are at present refused admission to medical study, this privilege being exclusively reserved for those who have satisfactorily finished their course at the classical gymnasium.

There have not been wanting attempts to enable students leaving the *Realgymnasien* to enter forthwith upon the study of medicine. The Prussian Government consulted both the medical faculties and the medical practitioners upon this subject but the answers received proved by a large majority to be unfavourable to the *Realschulen*. Of the nine medical faculties of Prussia which expressed opinions in 1869 on the desirability of admitting students leaving the *Realschulen* to medical study, only four (Göttingen, Greifswald, Kiel and Königsberg) voted in favour of the proposal, four (Berlin, Breslau, Halle and Marburg) voted against it, and one (Bonn) refrained from voting. Of the 163 medical societies of Germany which were requested to pronounce opinions upon this matter in 1879, three only voted for the proposal unconditionally, three with certain limitations, seven others only on the condition that those who had passed the *Realschulen* should have equal access to the other faculties, while the remaining 150 voted against the proposal, 98 of these, however, on the understanding that the classical gymnasia should be reformed.

The cause lying at the root of this expression of opinion was not prejudice in favour of education by means of the ancient classics but regard for the preservation of the social

position of the medical profession. This, it might justly be feared, would be in danger of impairment if it were pronounced that for doctors a preliminary education in science only is necessary, such an education being, according to views very widely prevalent, of a value inferior to that which is found necessary in the case of the other learned professions. Unfortunately in certain places the mistake was made of not treating this as the only objection but, at the same time, of bringing an indictment against the *Realschulen* by alleging that they had no ideal aims, and engendered superficial and narrow views in the minds of their pupils—accusations which naturally met with a sharp denial from the parties concerned.*

The question of admitting students leaving the *Realgymnasien* to the university can only be answered in one way—by throwing open all the faculties to them and by recognizing their general education as equivalent to that given by the classical gymnasia. Justice demands this course, for the curriculum of the *Realgymnasium* is as good as that of the classical sister-institution; it is also a duty owed to those youths who are not naturally fitted for the study of the ancient languages. Can we consider it justifiable in the case of one showing a remarkable gift for natural science and promising to make an excellent doctor, to throw a stumbling-block in his path because he does not possess as much knowledge of the Greek and Latin languages as a philologist considers necessary for his future profession?

A uniform plan of general education is certainly very convenient for systematizing school-teaching, for it serves as a sort of intellectual cathetometer, showing at a glance the height of a student's attainments; necessary or conformable to nature, it certainly is not. The differences of inclinations and of talents shows that there is not one single and only method of intellectual education.

* P. Wossidlo in the Pädagogischen Archiv, Stettin 1880, H. 2.—E. Speck: Die Berechtigung der Realschul-Abiturienten zum Studium der Medicin in the Pädagogischen Archiv 1883, H. 9, 10.

In many countries the dual system has been introduced into schools, and opportunities of entering the university are offered the students of both divisions. In Germany this is still striven against, although in intelligent and unprejudiced circles the fact does not fail to be recognized that uniformity of preliminary education is untenable in the long run. For some time now the classical gymnasium has ceased to form the only preliminary school of the educated classes, for the polytechnic high schools and certain of the higher grades of official appointments have been made accessible to those who have passed through the *Realschulen*, moreover the Cadet Academies intended for the training of officers have renounced the classical form of education and have adopted the curriculum of the *Realgymnasien*. The circumstance of granting to the *Realgymnasien* a position equal to that of the classical schools and of giving equal rights to the students leaving them will not therefore, as is asserted in many quarters, lead to a division among the students, but on the contrary will tend to unite all classes of educated men on the grounds of a preliminary education not identical, it is true, but nevertheless equivalent.

It is manifest that the satisfactory educational results which were formerly achieved by the grammar school and the classical gymnasium were dependent not upon the matter taught but upon the thorough method of teaching it. The more their plans of study were compelled, in consequence of the adoption of new subjects, to fall away from this principle so much the more frequently were complaints heard as to the faulty and unsatisfactory education of the scholars. At the present day these complaints are levelled against the teachings in all subjects, not excepting the ancient tongues. This is most pronounced in the case of the Austrian gymnasia, which, with the object of preserving the uniformity of preliminary education, have endeavoured to associate the teachings of the classical schools with that of the *Realgymnasien*, and in doing so have to

struggle with difficulties arising out of the polyglot character of the country.

Persevering work in a limited field of knowledge produces thoroughness, a quality which must be instilled into the minds of the young. Whether we use the ancient or the modern languages, mathematics, or some other science, for the purpose of attaining this end may perhaps be a matter of indifference, and should be determined by the requirements of the time and in accordance with the inclination and talents of the individual student.

This opportunity may be taken for offering some criticisms upon both the *Realgymnasien* and the classical schools. In the first place the overcrowding of the curriculum with lectures cannot be approved of from the hygienic point of view. To compel boys and young men to sit at their desks for thirty-two hours a week, and perhaps also to spend some hours daily in preparing their school exercises at home, cannot fail to act injuriously upon their bodily development. The increasing short-sightedness, the pale cheeks and narrow chests of the students afford convincing evidence of this. In no class of the gymnasium should the number of lecture hours exceed twenty-four or twenty-six a week if the bodies of the students are to be kept healthy and their minds clear. Boys must be allowed time for recreation, and they must have the opportunity afforded them of developing their individual aptitudes.* And here the wish may be expressed that more time should be devoted to gymnastics and bodily exercise generally at schools than has hitherto been the case: it must be confessed that much has been done in this respect of recent years: but much still remains to be done before the requirements of hygiene are satisfied.

One great mistake in the gymnasia of Germany and the

* Zeitung f. d. höhere Unterrichtswesen Deutschlands, Leipzig 1883, No. 48. —HASEMANN: Die Überbürdung der Schüler, Strassburg 1884.—Centralbl. f. allgem. Gesundheitspflege, her. v. Finkelnburg, Jahrg. iii, H. 7, 8.—*Cf.* P. FRANK *op. cit.* vi, Th. 3, S. 260.

schools of many other countries lies in the neglect of objective teaching. They store the memory, exercise the understanding, and develop the thinking faculties; but they forget to arouse the powers of observation and to sharpen the senses. In so doing they discountenance means most effective in the education of the mind and of the highest importance in many callings—that of the engineer, for example, of the doctor, or of the man of science. It appears therefore desirable that instruction in geography, mathematics and the natural sciences should be combined with practical demonstration, and that the subjects dealt with should, as far as possible, be rendered evident to the senses. Instruction in drawing is here of especial value. Museums should be enlarged by the addition to them of pictures, models, etc., and in this way the senses exercised as well as the understanding.*

In many English educational establishments and in many Swiss and Swedish schools there are workshops for the mechanical arts, in which students can learn how to make use of tools and of their own hands. If these places are properly conducted they are the source of great pleasure and of still greater profit to the pupils, as they are the means of imparting to them a dexterity invaluable in practical life. What a sorry spectacle is afforded by many a man of learning—judge or priest, as the case may be—who can scarcely sharpen his pencil without cutting his fingers! It is noteworthy that such people are almost only to be found in Germany and those countries in which such methods of education for the young are entirely neglected.

Finally, the organization of the gymnasia provokes the question, whether it can be right and expedient, from an educational point of view, to associate boys of ten and young men of nineteen in the same school and to subject

* V. Hueter in the Päd. Arch. 1879, H. 9.—W. Flemming in the Päd. Arch. 1883, No. 7.—J. Rosenthal: Die Vorbildung zum Universitäts-studium in the Päd. Arch. 1885, H. 4.—Lunge in the Zeitschr. des Vereins deutscher Ingenieure, Bd. 29, S. 854 *et seq.*

them to the same discipline and the same laws. In Southern Germany and Austria the gymnasium course used to be divided into two parts, and for each a separate school-building was provided; this is still done in Italy.* The object in view when making the division into an upper and lower gymnasium is that the course of instruction given at each of these institutions shall be complete in itself. This offers the advantage that for those students who have to leave the gymnasium before finishing the whole course of study a natural and easy exit is secured; they are preserved from the anomaly of entering life with a curtailed and quite insufficient training. At the same time a rational halting-place on the educational journey is provided for those who desire to get minor appointments in the official service, to attend a technical school, etc.

The task of giving the pupils a systematic and practical education in general subjects would thus be entrusted to the masters of the *Unter-gymnasium,* by means of a course of five years' training in the use of the mother tongue, for which the study of a second language—Latin—is indispensable, together with elementary mathematics and the most important facts and doctrines of religion, history, geography, and the descriptive natural sciences, drawing lessons being given with the object of strengthening the powers of observation; while the authorities of the *Ober-gymnasium* would be expected to give clear expression to the classical or scientific character (as the case might be) of the instruction afforded by them. The *Ober-gymnasium* might be organized in such a manner that the classical and scientific subjects should run in parallel courses; all the pupils being taught together in most of the subjects, such as the mother-tongue, religion, history and geography, modern languages and drawing, and only divided in order that one division should be taught Latin and Greek and the other mathe-

* An arrangement of this kind was demanded in the Ministerial scheme, which was made the basis of the discussions on the reorganization of the higher schools held in Berlin, April 16th to May 14th, 1849.

matics and the natural sciences.* Arrangements similar to these exist, in the Danish, Swedish, and Norwegian gymnasia. But those who have completed the course of study at either of the two divisions of the *Ober-gymnasium* must be allowed the same privileges, and all the faculties must be accessible to both classes of students alike.

While in most civilized States provision is made by legal enactments that doctors shall have a preliminary education in general knowledge, it seems nowhere to have occurred to legislators how extremely important it is that only sound and healthy men should devote themselves to the medical calling. This is explained by the way in which the education of the body is generally neglected in our modern civilized life. In the Bavarian medical regulations of the year 1808 it was decreed "that only such persons shall be admitted to the study of medicine as have their bodies and senses free from defects." Youths afflicted with chronic lung disease, heart disorder, and other organic affections, or any of whose senses had not been developed or had become defective, were excluded from medical study; for such persons are at a disadvantage in the examination and treatment of the sick and speaking generally in all professional work, they are prone to succumb to the various injurious influences they meet with, and are not in a position to confer the benefits which are expected of them. For the student and for the practitioner a healthy and strong frame is most requisite. Disease sours the disposition and steals away the animal spirits; how necessary are these to the doctor both for himself and for others! The tone of his mind often finds a responsive note in the patients he attends.

The course of studies for medical students has, through custom and the requirements of science, assumed approximately the same form in different countries. It begins with the natural sciences—the so-called ancillary sciences of

* Th. Puschmann in the Deutschen medicinischen Wochenschrift, Berlin 1883, No. 49.—E. Rindfleisch in the Tägl. Rundschau 1887, No. 209.

medicine—and with anatomy and physiology. In other words, the structure and functions of the human organism and its place in Nature form the groundwork of medical study. But the student ought to bring with him from school as much knowledge of the natural sciences as shall render it unnecessary for him to apply himself to the elements of mineralogy, botany, and zoology at the university; he must here confine himself to reviewing these sciences in their relations to medicine. Since physics and chemistry can be only lightly touched upon at the gymnasium, the student of medicine must go deeply into these subjects at the university, because there the abundant material for instruction offers him the best opportunity for study, and a knowledge of these matters is indispensable for the proper understanding of the different branches of medical science.

Anatomy and physiology form as it were the pillars which support the whole structure of medical education. These sciences must be treated with exhaustive thoroughness and be made the permanent intellectual property of the student by means of lectures combined with demonstration and experiment and by giving him opportunities of engaging in practical work. The review of anatomical facts from comparative, topographical, and surgical standpoints gives an opportunity of checking and confirming knowledge acquired in the lectures on systematic anatomy and in actual dissection, while histology completes it in relation to the more delicate structure of the body which is only recognizable by assisted vision. If physiology is taught with reference to its high importance for practical medicine the interest taken by students in the facts of the science is greatly increased. The first part of medical study which deals with the normal relations of the body concludes with the subject of embryology.

In the study of medicine proper it is of primary importance to get an insight into the nature of diseases and morbid states. The lectures on general and special pathology afford

opportunities for this. Pathological anatomy demonstrates on the dead body the changes which have taken place as the result of particular diseases, and experimental pathology teaches us the origin of diseases and their mutual relations. Unfortunately it has come to be thought in many universities that theoretical lectures on internal diseases, on surgery, ophthalmology, midwifery and other parts of practical medicine are unnecessary. It is quite true that highly elaborated discourses going much into detail may be confusing and wearisome to beginners; for such, all that is wanted is a short, concise review of the most important facts; this however is indispensable before the commencement of clinical teaching although it is in the latter course of instruction that the more profound knowledge of any particular subject must be gained.

Lectures on materia medica, pharmaco-dynamics, general therapeutics, dietetics and balneology should also precede the clinical teaching. It is a very suitable arrangement for students to learn to make up prescriptions with their own hands in an apothecary's shop or a pharmaceutical laboratory, as is done at Munich in the Reisingerianum.

The course on diagnosis and the preparatory clinic make the students acquainted with the methods in use in the investigation of disease and show on simple uncomplicated cases how maladies may be recognized and treated. The preparatory clinic fills a gap in the curriculum but is only indispensably necessary in the great medical schools, and indeed only admits of being arranged in places where there is a great mass of clinical material to be dealt with and the number of students makes it desirable to separate the patients into numerous divisions.

The surgical clinic pre-supposes more particularly a knowledge of surgical instruments and skill in applying bandages; a student attending this must have been taught and have himself performed operations on the dead body.

In the clinic for diseases of the eye acquaintance with the use of the ophthalmoscope is requisite; it is also

necessary for the student to have taken part in a course of operations on the eye.

Knowledge of midwifery is gained in the obstetric clinic and by means of operations performed on the model.

Attendance on the special clinics for mental diseases and diseases of the nervous system, for diseases of the skin and of the sexual organs, for laryngeal and aural affections, for diseases of childhood, etc., must be reserved for the last semesters of studentship.

The students of the clinics are divided into beginners whose functions are purely receptive, and into assistants who are more advanced students and co-operate in the examination and treatment of the sick. The latter class get opportunities for prolonged observation of cases of disease and thus get accustomed to performing the minor duties required in the care of the sick.

Policlinical work succeeds to clinical instruction and forms as it were the bridge which leads to medical practice. In giving over a portion of the practice amongst the poor to the policlinical institutions an opportunity is afforded to the assistant of becoming familiar with the claims which are made upon a doctor attending a case and of gaining that certainty of judgment which is necessary for his independent practice.

Lectures dealing with forensic medicine, hygiene, sanitary control, medical legislation, medical statistics, veterinary science and comparative medicine, medical geography and the history of medicine belong also to the close of the student's career.

The two last subjects are at present only taught at a few universities. While lawyers, theologians, philologists, architects, artists, officers, in short all the higher professional classes, apply themselves diligently to the study of the history of their science or art,* most doctors think that

* The veterinary surgeons in Germany have since 1883 been obliged to show a knowledge of the history of their science, but no similar historical education is required from their distinguished colleagues who extend their medical services to mankind.

they have nothing to learn from the history of medicine. They do not know how many discoveries and inventions have been obliged to be remade, because in the course of time they had been forgotten: the history of the plastic operations affords a striking example of this.

But the study of the history of medicine is not only useful and necessary for medical research; it is also of high ethical value in the education of students, for it teaches them reverence and admiration for the intellectual struggles and achievements of our forefathers, and completes the educational edifice by the addition of a high watch-tower from which an extensive survey of facts and events may be made. It is, therefore, the duty of educational authorities to extend a more favourable recognition to the claims of this subject than has hitherto been the case. Only a few decades ago the history of medicine used to be taught at the universities of Berlin, Breslau, Halle, Königsberg, Greifswald, Marburg, Göttingen, Heidelberg, Würzburg, Erlangen, Munich, Strassburg, Berne, Prague, and Vienna, while at the present time there are at most only two or three of these universities at which lectures on this subject are held—or perhaps only announced. Although men like BRÜCKE, DU BOIS-REYMOND, CHARCOT, HELMHOLTZ, HYRTL, VIRCHOW, WUNDERLICH, ZIEMSSEN and others have borne testimony to the value and importance of the history of medicine no attempt is made to direct the attention of students to the subject, and it is looked upon as superfluous to train and appoint professors to teach it. BILLROTH himself, who formerly declared "that the great medical faculties should make it a point of honour to take care that lectures on the history of medicine are not missing in their curricula,"* considers them now merely ornamental appendages, and is opposed to the professor of this subject being a member of the College of Medical Professors in the enjoyment of full rights, because he considers

* TH. BILLROTH: Lehren und Lernen der medicinischen Wissenschaften, Wien 1876, S. 80.—Wiener Klinische Wochenschrift, 1888, No. 36, 6 Dec.

that the work of this department of teaching is less than that of others. But the duties of a German professor are not confined to teaching: he must also work as an investigator for the advancement and extension of his science. A wide and hitherto but little cultivated field of labour is here open to the historian of medicine.

Medical geography, too, a subject which for teaching purposes may be combined with the history of medicine, presents to the teacher and investigator a number of problems which press for solution in view of the increasing intercourse with foreign lands.

It is difficult to decide how much time should be devoted to medical education: this depends upon the natural gifts and the application of students, upon the quantity and quality of the teachers and appliances for teaching, and upon many other circumstances. In subjecting a student to no constraint in his choice of lectures, and leaving him completely at liberty to get his knowledge how and where he pleases, it is assumed that, like a reasonable and prudent man, he will follow the advice which is offered him by persons of special experience in these matters. But if from want of intelligence or from carelessness he is inclined to neglect such advice there is nothing to prevent his doing so. The result is seen in a defective education, the opportunity to remedy which he cannot perhaps find, as the period of his studentship draws to a close. If he does not make good his deficiencies before he enters medical practice the patients who fall into his hands have to suffer accordingly.

Unlimited freedom for the student in choosing what lectures he shall attend nowhere has such bad results as in the study of medicine; for here the health and lives of men are at stake.

In some countries—and among them such as pride themselves upon their liberal institutions—freedom of this kind has been discountenanced, and a curriculum has been laid down for medical students, and is closely adhered to.

Even in Germany and Austria this freedom is at least so far controlled that proof is required from students entering their names for examination, that they have attended the most important clinics during several semesters. It would be well to issue similar regulations for other departments of medical teaching, attendance on which is indispensable for a doctor's education. Can we imagine anyone learning anatomy and physiology without the personal assistance of a teacher? It is highly desirable for students to participate in the instruction given with regularity and attention, and to make the matter taught them their own.* In small universities, where teachers and students are brought more nearly together, this occurs naturally; the danger of students escaping instruction exists chiefly at the great universities. But so many difficulties surround all systems of control that they have had to be abandoned.†

The results of teaching are more surely guaranteed if the students are induced to take a more active part by means of occasional questions asked and answered, as is usual in subjects associated with practical demonstration. Still more is this the case if a disputation is held just after the conclusion of the week's lectures, during which the students, in the presence of the teacher or his assistants, can discuss the subjects which have been lectured upon, rectify any misconceptions, and be enlightened on things which they have not been able to understand. This form of teaching—more suited to the school than to the academy—has been preserved at the military medical schools, and has even been introduced into the universities, where it is practised in the schools of philology, history, and law, and in the scientific clubs and societies. It would serve the same purpose if students at the end of a course of lectures

* Formerly, as is the case now, there was no lack of complaint as to the irregular attendance on lectures. VICQ D'AZYR in his time declared that "students enter their names for, but do not attend, the lectures." GRUNER'S Almanach f. Ärzte, Jena 1791, S. 142.

† G. SCHMOLLER in the Jahrbuch f. Gesetzgebung, Leipzig 1886, H. 2, S. 286 *et seq.*

on any subject, and consequently while the impression is fresh, were permitted to pass an examination held by the teacher or his representative. The certificates given after passing such would bear valuable testimony as to the way the period of studentship had been passed, and would enable the examiners, who have to decide upon the fitness of candidates to engage in practice, to form a preliminary opinion upon their professional education.

The examination for the license to practise ought to extend over all branches of medicine, and to include all the subjects with which it is necessary that a practising doctor should be familiar. If, after the conclusion of the first part of the period of studentship devoted to training in the natural sciences, an examination is held on natural history, physics, chemistry, anatomy, and physiology, it ought to be made a rule that no one shall be admitted to the lectures on actual medical subjects before he has passed such examination; for, failing this, the time he should spend in medical study is devoted to preparing for the examination in science. In the examinations which take place after the conclusion of the period of studentship, and which precede the granting of the license, great weight is justly laid on practical proofs of ability; the candidate is given the opportunity of showing that he understands how to make practical use of the medical knowledge he has acquired by the demonstration of anatomical preparations, attendance at necropsies, the examination and treatment of patients, the performance of surgical and obstetrical operations, etc. The questions which are set perhaps touch lightly upon the candidate's knowledge of other subjects as well; but they depend too much upon contingencies to form a satisfactory or sufficient test of his general professional education. For this purpose a final *vivâ voce* examination is necessary to act as complementary to, and as a check upon, the preceding practical examination, and to pass all departments of medicine in review.

There is no doubt that persons who are teachers of the various subjects of examination are more suited to act as

examiners than persons who are not specially concerned with these branches of knowledge. Those only who are masters of a subject know how to put proper questions upon it and correctly to estimate the value of the answers given.* It is therefore best to entrust the carrying on of examinations to the teaching-staffs of the medical faculties and schools. But the Government of the State claims, even in this department of educational administration, to act as counsel for society watching the proceedings in its interest, and taking care that doctors are educated in such a way as to be equal to the demands of their calling.

The question at once presents itself whether doctors should be educated in institutions conducted by the State or independent of it. The answer is that in every case power of control over studies and examinations should be conceded to the State, to be made use of in the interest of the population. While in the examination for the license to practise, the chief question is to determine whether the candidate possesses the requisite ability for his calling, in granting the degree of Doctor of Medicine severer demands should be made on scientific knowledge, and the candidate for this academical honour should be required to show that his acquirements exceed those of ordinary practitioners. The examination, which affords him this opportunity, should therefore go thoroughly into the various branches of medical science, and should touch upon subjects which, like the history of medicine and medical geography, are disregarded in the examination for the license, being desirable, but not indispensable, subjects of medical education.

In the same way care should be taken that only works of scientific value are accepted as essays for the doctorate. The custom of requiring that they should be written in Latin has been given up nearly everywhere, and rightly so; for, as J. v DÖLLINGER says,† "in the devious by-paths of the

* PRUNELLE: Discours des études de médecine, Paris 1816, p. 21.

† J. v. DÖLLINGER: Die Universitäten sonst und jetzt, München 1867, S. 16.

impoverished modern form of this idiom, confused ideas and barren thoughts find safe concealment; commonplaces intolerable in a German dress appear quite respectable when seen through a veil of Latin."

If the title of Doctor of Medicine is a distinction, conferred for scientific merit and characteristic of the *élite* of the medical profession, it should also be looked upon as an indispensable prerequisite for everyone who aspires to occupy a position of importance in the public sanitary service, in the medical department of the army, or on the staff of a hospital, or who desires to be a teacher at any medical faculty or school. The last-mentioned position should, for the rest, be open to anyone who is able to point to meritorious services in any sphere of knowledge, and who, in virtue of these and of his personal character, gives a guarantee that he will prove to the advantage and honour of the institution at which he desires to labour.

The necessary requirements of a medical school having been satisfied by appointing and paying a staff of teachers, it can prove nothing but desirable and advantageous if men of training and ability come forward to increase its teaching-power of their own free will and without claiming remuneration. The private teacher (*Privat-Docent*) is merely given the right, but must by no means be under an obligation, to teach, so long as he is not specially commissioned to do so and to fill up a gap in the curriculum. His work is a preparation for the professoriate, to which he may be afterwards called if he distinguishes himself as a teacher and investigator. But only a few reach this goal: for intellect, patience, and money are all wanted: and whoever is not provided with these three things had better renounce the idea of undertaking a calling which treacherously entices him with hopes, the fulfilment of which he awaits in vain. It is quite right that in appointments to vacant professorships the claims of the private teachers should be considered in the first place: for thus the danger of appointing men unsuited or unqualified for the position is avoided. It

is a dangerous thing to entrust such a post to anyone who has up to that time had no practice or experience in teaching.

The division of professors into ordinary and extraordinary as is usual in the universities of Germany and other countries is less justifiable. The extraordinary professors are inferior to the ordinary in rank and pay, and beyond the title have scarcely any greater privileges than the private teachers. To this category belong the representatives of the so-called subordinate departments, certain teachers whose duty it is to supplement and complete the instruction in some of the principal departments, and those private teachers who have received the title of professor as a reward for their services. There is no doubt that it is an act of injustice to punish a professor because he devotes his powers to teaching a subject which is not of primary importance to the profession. When men who are counted amongst those who are an honour to science are thus dealt with it is not only cruel but also unreasonable. Their unselfish efforts should be recognized and assisted, not crushed and paralyzed by a mortifying and unjust restraint. Against making the position of the representatives of the subordinate departments equal to that of those who teach the principal subjects, it is urged that the claims upon the teaching-powers of the two sets of professors differ in degree: but such things cannot be estimated in the same way as the work of day-labourers, according to the number of hours put in.

It is above all things difficult to determine what departments of medical science can be considered subordinate in the curriculum. Formerly even midwifery, ophthalmology, and pathological anatomy were so considered. Opinions are divided as to whether many departments of medical science, as for example histology, forensic medicine, dermatology, laryngology, etc., should be considered principal or subordinate subjects. Much will also depend upon the size of the school: for it is clear that

medical faculties like those of Paris, Vienna, or Berlin must not be measured by the same rule that suffices for small medical schools. In the latter many an arrangement must be neglected and many a professorial chair left unoccupied which in the former are necessary, nay, indispensable. The Frankfort Congress and the Reform Society of Jena refused to acknowledge the division of professors into ordinary and extraordinary, and declared that there should, in reason, be only two classes of academical teachers, namely, the professors and the private teachers: the former being commissioned to teach by the school and being paid for it, the latter doing so of their own free will and receiving no indemnification for their services. This by no means prevents certain private teachers being granted the title of professor in recognition of their labours: but they should be promoted to the name only, not to the professorial rank and rights.

The professors form the College of Teachers, having direction and charge of the affairs of the faculty or school. Each member of this college has equal rights in debating and voting, whether he is the representative of a so-called chief department or of some narrowly circumscribed speciality: for in general educational matters every one of them is competent to form an opinion, and in questions which concern a particular department all due weight will be given to the judgment of an expert. The fear that in consequence of the great number of the members of the College of Teachers "the interest in the welfare of the faculty as a whole will be blunted," is entirely unfounded. The transactions of Parliaments, in which hundreds of representatives of the people from all parts of the country co-operate, show that such joint work is possible "without loosening the bonds of a common interest." There is far greater danger that with a numerically small College of Teachers the deliberations will assume a quasi-domestic character and be biassed by personal considerations to such an extent as to be injurious to the general weal.

Differences of opinion are produced among the members of a College of Teachers by the variety of their intellectual gifts, by peculiarities of character, and by the scientific work they may have done: the result of their discussions is thereby beneficially influenced.

Differences in the stipends of the professors are equally natural and just, and are influenced by the services they have rendered to science, the results of their teaching, and the time they have to devote to it. On the other hand it is impossible to approve of the extreme diversity in the income of professors which is produced by the system of lecture-fees; for the number of the audience depends chiefly upon whether the subject of the lecture is or is not one which is of use for examinations, and is but seldom affected by the merit of the lecturer. If he has to deal with a science but little popular, he will find himself surrounded by only a small circle of pupils, even although he possesses splendid gifts of eloquence, a powerful personality, and a world-wide fame. The students are bound in the first instance to apply themselves to those subjects which offer a secure foundation for their future life-work. To reproach them, on this account, with a shallow materialism, would be foolish: for they are, in this, only performing a duty they owe to themselves and to their families. But it is quite as senseless to reward or punish the lecturer for circumstances over which he has no influence, by assigning to him more or less of the money received as lecture fees. This diversity of payment can hardly be justified by any difference in the effort expended, as C. HASSE has pointed out;* for this is much the same whether the audience consists of two or two hundred.

The custom of assigning the lecture-fees to the professors is also objectionable from an ethical point of view. The ideal aspect of a teacher's calling is degraded if the com-

* C. HASSE: Die Mängel deutscher Universitätseinrichtungen und ihre Besserung, Jena 1887, S. 28 *et seq.*

mercial side of it is brought so prominently into view. "These fees are represented to us as being merely the reward which is considered everywhere in society as unquestionably due to a man in the successful exercise of his talents. But it is a reward not honourable but degrading to a teacher."*

It is the duty of the State to put an end to this system. It should require that money received from persons attending educational establishments supported by itself should be spent on the improvement of such establishments. How much could be done in increasing the appliances for teaching, in the support of scientific work, in the augmentation of stipends, in short in curing the serious disease from which, as WALTER PERRY said in the English House of Commons, the German universities suffer—the want of money,—if the income derived from the lecture-fees were so employed! A wise educational policy will attack this problem and carry out the necessary reform while sparing the acquired rights of the individual, thus earning the thanks of the German people who love their universities and are acutely sensitive to every cloud which dims the pure light of their fame.

No human arrangements are free from faults. A strenuous effort to improve and render perfect what already exists constitutes the task of life. Where can such endeavours be more justified or demanded than in dealing with the education of doctors on whose knowledge and ability the health and lives of men are so greatly dependent?

"The most precious capital of states and of society is man. Every individual life represents a definite value. To preserve, to maintain it intact as far as possible, up to the

* H. J. v. WESSENBERG: Die Reform der deutschen Universitäten, 2 Aufl., Würzburg 1886, S. 39.—So also P. FRANK (*op. cit.* vi, Th. 1, S. 290 *et seq.*) enters a protest against lecture-fees. The arguments brought forward in favour of them by the Minister Jos. UNGER in the Austrian House of Representatives on 28 January, 1876, have failed to convince me of the propriety of this arrangement.

unalterable limits of its duration, is not only a precept which humanity teaches; it is the duty of every commonwealth in its own peculiar interest." In these words the Crown Prince RUDOLPH of Austria, unhappy in his early death, struck the key-note of a policy which sounds like the Evangel of times to come.

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