longata. He noted that the sensory nerves are soft, the motor harder. The olfactory bulb and tract he correctly considered as an extension of the brain, and hence excluded it from his enumeration of the cranial nerves (Marinus?). He knew the ventricles of the brain, the fornix, the corpora quadrigemina, the terms nates and testes applied to the latter being his own. He was acquainted with the membranes of the brain, with the pleura, the pericardium, and the peritoneum. The divisions of the alimentary canal he accurately described. The genital organs of the male and female he considered essentially the same, the ovaries corresponding to the testes and secreting a seminal fluid that is conveyed to the uterus by the Fallopian tubes.

The decline of the Roman empire caused a gradual decay of intellectual culture and a total neglect of all sciences of investigation. It is only occasionally that we find in the writings of some compiler like Oribasius (A.D. 326–403) an indication of a new discovery. He is said to have been the first to describe the membrana tympani and the salivary glands. The cultivation of literature gradually declined and but few, even of the clergy, could read or write. Superstition and vague tradition usurped the place of science. No one thought it necessary to ascertain the structure of the human body when it was universally held that it was controlled by spiritual influences wholly independent of physical or natural laws. Anatomy was forgotten and the treatises of its founders either destroyed or suffered to remain in almost complete oblivion. Almost, not quite, for the torch of science, laid down by the rude hands of the West, was taken up and relighted by the scholars of the East.

The Arabians now began to take an active part in intellectual culture. In imitation of the school of Alexandria they founded great universities at Bagdad, Bassorah, Damascus, Alexandria, Cordova, and Granada. Forbidden by the Koran to dissect the human body, or even to make any representation of it, the physicians of these schools had recourse to Greek authors, particularly to Hippocrates, Aristotle, and Galen. On these they made long commentaries, their remarks often showing perspicacity and judgment. The most important authors of the Arabian school who treated of anatomy are Rhazes (Abu-Bekr-Al-Razi, 850–923 A.D.), Ali Abbas (Ali ben el-Abbas, Haly Abbas, 930–994), and Avicenna (Abu-Ali-Ibn Sina, 980–1037). Their direct contributions to anatomy were not great, but their nomenclature was for a time adopted by European writers. A translation of Ali Abbas' work into Latin, by Constantinus Afer, a Benedictine monk (*circa* 1080), is probably the first work on anatomy in that language (Hyrtl).

The leavening influence of the crusades now began to be felt. The uniting of the scattered peoples of Western Europe into vast armies that made long journeys by land and sea, and came in contact with nations of totally different culture and habits of thought, had great effect in combining the small, warring, feudal factions into larger social units more susceptible of advancement, in opening new avenues of commerce, in diffusing a knowledge of the learning of the East, and in bringing about a revival of intellectual activity. New universities were founded throughout Europe; at Bologna in 1116, at Padua in 1228, at Salamanca in 1239, at the Sorbonne in 1253. Others whose foundations dated back to the Roman period received new accessions. Among the latter were Salerno and Montpellier, at each of which an active medical school was established. At Salerno was seen the first symptom of a revival of practical anatomy, for it is said that the Emperor Frederick II. (1194–1250) made a law that no one should practise surgery without having been previously examined in anatomy, and provided that a dissection of the human body should be made at Salerno once every five years, inviting physicians and surgeons from all parts of the empire to witness it. It has been erroneously stated that the bull of Pope Boniface, *de sepulturis*, issued in 1300, was an interdict against dissection; but it was really intended to prevent the practice of dismembering and boiling dead crusaders for the purpose of more easily transporting their bones to their native land. The Senate of Venice, in 1308, decreed that a human body should be dissected annually. It is uncertain to what extent these dissections were carried, but it is probable that only the larger viscera were examined.

Among the products of the school of Salerno that have survived are the "Anatome Porci" of Copho, and the anonymous "Demonstratio Anatomica." These are both based wholly upon dissection of animals.

There is evidence that at this period autopsies were occasionally held to determine the cause of death, whether by poisoning or otherwise. It is also said that the bodies of those who had been hanged were, in Italy, not infrequently given over to physicians for dissection. Occasionally bodies were stolen for anatomical purposes.

It is at about this time that occurred the first attempts at pictorial representations of bodily structure. These are found in a translation of Galen made by Nicholas Regio and published at Dresden in the fourteenth century. Two manuscripts on anatomy by Mondeville and Magister Ricardus that have survived from the school of Montpellier also contain crude drawings of structures.

The credit of first establishing systematic public demonstrations of anatomy belongs undoubtedly to Mundinus (Raimondo da Luzzi, Mondino, 1276–1326), who taught at Bologna. Not content with expounding Galen, Abbas, and Avicenna, he brought the science back to the correct path of ocular investigation. At least three bodies of women were publicly dissected by him, and there is reason to believe that the number was considerably greater. He is the author of a small work known as the "Anathomia Mundini," that was circulated extensively in manuscript before the invention of printing, and afterward ran through at least twenty-three editions. Although very incomplete and containing numerous errors, it was used as a text-book for two hundred years. It is very difficult to read, as much of the nomenclature is borrowed directly from Arabian authors. The abdomen appears as the "myrach," the peritoneum the "cyphach," the omentum the "zirbus," the sternum "the shield of the mouth of the stomach." Some of his appellations are still used, as "nucha" for the nape of the neck, "saphena" for the great superficial vein of the thigh. His anatomy is crude and incomplete rather than positively erroneous. He held that the body has three cavities (ventres): the head, containing animal members; the thorax, spiritual members; the abdomen, natural members. His anatomy of the heart is fairly accurate, and he nearly discovered the lesser circulation, as he says that blood is carried from the heart to the lungs by the pulmonary artery.

In view of the imperfect and incomplete character of this treatise of Mundinus, it is difficult to understand its great influence upon the anatomical instruction of that age. It was, however, the first work since Galen avowedly based upon personal inspection of the human body, and it appealed to the mediæval spirit of curiosity that now began to manifest itself. The same impulses that led Marco Polo to the territories of the Great Khan and impelled the alchemists to new discoveries in their search for the transmutation of metals, animated many physicians of that time in their examination of the body of man. A zeal for anatomical studies arose, first in the Italian, afterward in the French and German universities. At Mundinus' own university of Bologna definite rules for dissection were established. At Montpellier the medical faculty obtained from the Duke of Anjou a regular license to dissect the cadavers of criminals, which was successively continued by the kings of France (Charles VI., 1396; Charles VIII., 1496). In Prague dissection was practised from the very foundation of the university in 1348, and a building was given for that special purpose in 1460. At Vienna dissection was practised as early as 1404, and made a definite part of the medical curriculum in 1433. Pope Sixtus IV. granted special authority for dissections at Tübingen in 1482. The first anatomy act was passed in 1540, allowing the company of barbers and surgeons of London four bodies annually for dissection.

Yet this was nowhere carried on with the care and precision that characterize work in modern schools. The freeing of muscles, vessels, and nerves from the tissues that envelop them seems not to have been understood. Usually the great cavities of the body were opened and the principal viscera therein contained were displayed and demonstrated. Slices were removed from the cadaver by a razor in the hands of an attendant. The modern methods of injection and preservation were, of course, unknown; and a cadaver was soon a mass of disgusting and noxious putrescence. There was as yet no approach to exact and complete anatomical investigation.

That anatomy was but of slight assistance to either medicine or surgery is amply shown by the records of the time. Indeed, it fell into such disrepute that Paracelsus (Theophrastus Bombastus von Hohenheim, 1493–1541) declared it to be useless to know the internal structure of the body, that a knowledge of the shape or situation of the lungs, heart, or stomach was of no value in the diagnosis or treatment of disease. In 1525 he burned the works of Galen and Avicenna before his pupils at Basle, denouncing these teachers as blind guides. Some of the doctrines of Paracelsus reappear at later periods. He considered the body to be a microcosm representing the entire external universe, formed from pre-existing and indestructible germs (Weismann's germ plasm), and governed by astrological influences, the sun affecting the heart, the moon the brain, Mercury the liver, etc., etc. The functions of the body he supposed to be carried on by the *archæus*, a sort of *deus in machina*, that resided in the belly.

Among those who carried on the work started by Mundinus and somewhat extended the domain of anatomy are:

Gabriele de Zerbi (1468–1505), professor at Padua, Bologna, and Rome, who first separated the organs into systems, described the musculature of the stomach, and the puncta lachrymalia. He knew that the tunica vaginalis testis is derived from the peritoneum.

Achillinus (Alessandro Achillini, 1463–1512), professor at Bologna and Padua, author of a commentary on Mundinus, who discovered the malleus and the incus, the labyrinth of the ear, the patheticus nerve, the ileo-cæcal valve, and the entrance of the bile duct into the duodenum.

Alessandro Benedetti (1460–1525), professor at Padua in 1490, afterward at Venice, who built the first anatomical amphitheatre. His demonstrations were public and he complains of the "numerous populace" that crowded to them. He wrote a work on anatomy that is one of the very best of the period.

Berengarius Carpensis (Jacopo Berengario Carpi, 1470–1530), professor at Pavia and Bologna, author of a commentary on Mundinus. He showed the mythical character of the *rete mirabile* which Galen had described as existing on the internal carotid arteries (as in the herbivora), and was the first to deny that orifices existed in the interventricular septum. He stated that he had dissected more than a hundred cadavers, but does not say that these were all human.

Marcus Antonius (Marc Antonio della Torre, 1481–1512), professor at Padua and Pavia, the pupil of Lionardo da Vinci who is said to have designed plates for his work. Lionardo was himself an anatomist fully equal to any of the pre-Vesalian epoch. He made many dissections and carefully reproduced them in drawings that show a great deal of anatomical knowledge. He seems to have come nearer to the circulation of the blood than any of his contemporaries. "The heart," he says, "is a muscle of great strength, much stronger than the other muscles. The blood that returns when the heart opens again is not the same as that which closes the valves." It should be remembered that both Raphael and Michael Angelo studied anatomy and left anatomical drawings. Concerning Michael Angelo, the slanderous story was circulated that he had practised vivisection on a criminal in order to get the expression that he desired to portray in a picture of the crucifixion.

Vidus Vidius (Guido Guidi, 1545–1569), physician to Francis I., and professor at Paris and Pisa, whose name is retained in the Vidian canal and the Vidian nerve; Guintherus Andernacensis (Günther von Andernach, 1487–1574), professor at Louvain and Paris; and Jacobus Sylvius (Jacques Dubois, 1478–1555), professor at Paris, are all chiefly famous as being the instructors of Vesalius. Günther had both Vesalius and Servetus as prosectors in his laboratory at the same time. His description of the valves of the heart is good, and he appears to have been the first to discover that both air and blood undergo changes in passing through the lungs. Sylvius greatly improved nomenclature, assigning designations to muscles and vessels, distinguishing voluntary from involuntary muscles, and demonstrating more by personal dissection than was done in other schools. He discovered valves in some of the veins, but appears to have had no idea of their function.

The time was now ripe for a new advance. The invention of printing and consequent general diffusion of ancient literature, the discovery of new countries and continents, the progress of invention and the flourishing condition of pictorial and plastic art, created an intellectual activity that would no longer brook the restraints of schools and the unsupported dicta of the ancients. The power of tradition, which had weighed like an incubus upon anatomical teaching for over thirteen hundred years, was now to be rudely shaken. There arose a group of anatomists who were to pursue their work again in the proper spirit of free inquiry and to institute for the first time in the history of the science a careful examination of the human body made with thoroughness and skill. The chief of these was Andrew Wesel, more commonly known by his Latin appellative of Andreas Vesalius, who was born at Brussels, December 31, 1514. He was the son, grandson, and great-grandson of distinguished physicians, a fact of which he was justly proud. He showed a taste for anatomical investigations at an early age, and after an excellent training in Latin, Greek, and perhaps in Arabic, at the university of Louvain, he went to Paris to work in the laboratory conducted by Vidius and afterward by Sylvius at the school founded in 1530 by Francis I. His description of the way in which anatomy was pursued there shows the state of teaching at that time. The demonstrations were mostly upon animals, and upon those rare occasions when the human body was examined it was hurried over in three lessons, the teacher merely opening the great cavities and so hastening over the demonstration that "more anatomy might be learned in the shop of a butcher than in such a dissecting room." Except the eight muscles of the abdomen which were badly mangled and improperly prepared, not a muscle was demonstrated, nor were any bones shown, much less were nerves, veins, and arteries properly dissected and displayed.

At odd times Vesalius haunted the city cemeteries to procure chance bones turned up by the spade of the sexton. He early noted errors in the descriptions of Galen and Mundinus. Returning to Louvain he conducted anatomical demonstrations there, and possessed himself, it is said, of an entire human skeleton by remaining all night beyond the city gates and robbing the gibbet of a body partially destroyed by birds. He afterward went to Italy, and received, in 1537, at twenty-three years of age, the appointment of professor of anatomy at Padua, already famous for its anatomical instruction. Here he at once achieved a striking success. His demonstrations were crowded; the clergy, the laity, even women thronging to hear him. He remained in Italy seven years, delivering courses in Pisa and Bologna as well as at Padua, a proceeding rendered possible by the short duration of each course, viz., seven weeks. While not employed in teaching he gave his time to the composition of his great work, "De Humani Corporis Fabrica, Libri VII.," the first attempt at a complete exposition of the structure of the human body.

In this we find the result of his own personal researches, a careful and generally accurate description of the anatom-

ical features of man made for the first time from actual inspection. As Vesalius himself says, it is an attempt to demonstrate the structure of man upon man himself. Galen's many errors, caused by his almost exclusive study of inferior animals, were unsparingly noted. Excellent plates made from drawings of preparations illustrated the work. These were so good that they were often ascribed to Titian, but they were probably the work of Stephen von Calcar, one of Titian's pupils, with perhaps some aid and advice from the master and an occasional drawing from Vesalius himself, who was skilful with the pencil.

From this epoch-making work modern anatomy may be said to have its birth. It is, however, by no means free from errors, both those due to hasty preparation, and those arising from the preconceptions then current. Vesalius still supposed that mucus passed through the holes in the cribriform plate, that the tubular nerves distributed animal spirits, etc. Many of his errors were pointed out by his contemporaries.

This new departure should be considered as belonging to the movement of the age. As has been already noted, the world was becoming impatient of traditionary authority and seeking for facts by personal observation and research. Vesalius' great work appeared in 1543, in the same year that Copernicus published his treatise "On the Motions of the Heavenly Bodies"; it was in 1521 that Luther made his memorable appeal before the Diet of Worms, and in 1534 that he completed his translation of the Bible.

The adherents of ancient tradition did not yield without a struggle. Vesalius was denounced by many, his former teacher Sylvius calling him an impious madman whose breath poisoned Europe. The errors of Galen which Vesalius had pointed out were explained in the most grotesque manner, either by supposing a corruption of Galen's text, or by the hypothesis that the human body had changed since Galen's time. The seven pieces of the sternum which Galen had described (from apes) were supposed to indicate how much larger and more developed the thorax was in Galen's time; the curvature of the thigh bones, not seen in modern man, was said to be their natural free condition before they were straightened by the wearing of tight breeches. More important were criticisms directed toward Vesalius' own demonstrations by Eustachius, who pointed out a number of errors, and thoroughly disapproved of the conduct of Sylvius. Vesalius seems to have taken this opposition very much to heart. He had previously resigned his chair, and now he went to Madrid, where, in the gloomy court of Philip II., he found a most uncongenial atmosphere. He was surrounded by enemies who attempted to stop his work by the power of the Inquisition. Philip asked from the University of Salamanca an opinion as to the permissibility of dissection, and the reply of the learned doctors was that since it is useful to man it may be allowed (1556). Restless and ill at ease, Vesalius wished to return to his chair in Italy, now vacant by the death of Fallopius. He was destined never to do this. Making a voyage to Palestine in the fulfilment of some vow,* recalled while there by the Senate of Venice to resume his chair, he was shipwrecked on the island of Zante, and suffered so much from exposure that he died there, October 15, 1564. He was one of the great pioneers and pathmakers of science, worthy to rank with Copernicus and Columbus. Anatomy has never lost the impulsion due to his arduous efforts. He found it a mass of crude speculations based on ancient authority, he left it a recognized science having for its basis actual observation of structure.

Vesalius was by no means alone. Two other great figures stand out at this epoch, Eustachius (Bartolommeo Eustacchi, 1520–1574), professor of anatomy at Rome, and Fallopius (Gabriele Fallopio, 1523–1562), professor at Ferrara, Pisa, and Padua. It is to Eustachius that we owe the first idea of investigating the tissues, also the conception that to understand adult structures we should examine the fetal ones. To correct the current errors in Vesalius and others, he prepared a great illustrated work on the controversies of anatomists, but it was never published, and the plates that he had made for it at great expense were long supposed to be lost, but were finally discovered in the Vatican library and presented by Pope Clement XI. to Lancisi, who published them in 1714. They were the first copper plates used for anatomical illustrations, and show that their author had anticipated many of the discoveries of his successors. The Gasserian ganglion and the pancreatic duct are clearly shown, and the ciliary muscle not only figured but given its modern designation. The name of Eustachius is preserved in the Eustachian tube, said to have been first discovered by Alcmæon, and the Eustachian valve of the fetal heart. He first described the membranous cochlea and the tensor tympani muscle, the origin of the optic nerve, the abducens nerve, the suprarenal capsules, and the ventricles of the larynx.

Fallopius was especially renowned for his exact description of the organs of hearing. He discovered the aqueductus and hiatus Fallopii, the communication of the mastoid cells with the middle ear, the stapes (also claimed by Eustachius), the fenestra ovalis, the chorda tympani, the aqueductus vestibuli, and the lamina spiralis. He gave the membrana tympani its present name and named the Fallopian tubes (previously discovered by Herophilus) the tubæ seminales. Poupart's ligament was first described by him, as also the hymen, the clitoris, the seminal vesicles, and the urineferous tubules. He also described the ileo-cæcal valve, which was, however, probably known to Achillinus. He discussed the development of bones and teeth, and knew the ganglia of the spinal nerves.

In their zeal for knowledge the anatomists of that age are reputed to have not infrequently overstepped the bounds of common humanity. Vesalius, following the example of Herophilus, is said to have vivisected criminals, and the records found in the criminal archives of Florence (1545–1570) show beyond dispute that it was by no means uncommon to send living persons to Pisa "to be made an anatomy." While this language seems to indicate that such subjects were dissected alive, there is, on the other hand, some evidence to show that they were first executed by smothering or otherwise.

Many other almost equally famous men contributed to the anatomical knowledge of the period. Among these are the following:

Servetus (Miguel Serveto, 1509–1553), a Spaniard from Villanova, in Arragon, burned at the stake by Calvin, at Geneva, for heretical opinions. He was the first clearly to describe the pulmonary circulation and the change from venous to arterial blood that occurs in the lung. This description occurs in the rare work "Christianismi Restitutio," published by him at Vienne in 1553. In this he clearly states that air mixed with blood passes from the lungs to the heart. "*A pulmonibus ad cor non simplex aer sed mixtus sanguine mittitur ad arteriam venosam.*" He had, however, no idea of the greater or general circulation.

Columbus (Matteo Realdo Colombo, 1494–1559), the warm friend of Vesalius, and who immediately succeeded him at Padua and afterward taught at Pisa and Rome. He dissected with great assiduity, completing at least fourteen bodies in a year. He also ransacked old charnel houses for bones and compared about half a million of skulls. He was an ardent investigator, demonstrated experimentally the lesser circulation, probably without any knowledge of the prior work of Servetus, and had an accurate idea of the functions of the valves of the heart.

Ingrassias (Giovanni Filipo Ingrassia, 1510–1580), professor at Naples, of high rank as an osteologist, who studied the sphenoid and ethmoid bones.

*The report that he was condemned to death by the Inquisition for opening by accident the body of a living man, and that his sentence was by Philip commuted to a pilgrimage, appears to be wholly without foundation, unsupported by the records of the Inquisition or of the royal archives.

Cananus (Giambattista Canano, 1515–1579), one of the earliest to mention the valves of the veins (1547).

Cæsalpinus (Andreas Cæsalpini, 1517–1603), the first to use the term *circulatio* in speaking of the movement of the blood. He had no clear and definite ideas on the subject, believing that the movement was oscillatory.

Arantius (Giulio Cesare Aranzio, 1530–1589), professor at Bologna, who discovered the ductus arteriosus, the corpora Arantii, named the hippocampus major, carefully described the gravid uterus, which he considered a muscular organ, and first spoke of a separation of the maternal and fetal blood.

Coiterus (Volcher Koyter, 1534–1600), of Gröningen, who investigated the osteology of the fœtus and the development of the bones.

Varolius (Constanzo Varolio, 1543–1575), professor at Rome, who made special researches into the brain and nervous system, describing the base of the brain and the apparent origin of the cranial nerves. His name is preserved in the pons Varolii.

Bauhinus (Caspar Bauhin, 1560–1624), professor at Basle, who made improvements in terminology. (The discovery of the ileo-cæcal valve, ascribed to him, is due to Fallopius.)

Spigelius (Adrian van den Spieghel, 1578–1625), of Brussels, who made a special study of the liver, one of whose lobes still bears his name.

Fabricius ab Aquapendente (Girolamo Fabrizio, 1537–1619, so called to distinguish him from Fabricius Hildanus, a celebrated surgeon of the period), who was the successor of Fallopius at Padua, and worthily maintained the reputation of that celebrated school. He erected at his own expense an anatomical amphitheatre which still remains. It is a small dark pit with seats rising almost perpendicularly about it, excluding the light so that all dissections must have been by candle light! It was here that Harvey learned anatomy and obtained from Fabricius the germs of the knowledge which was to result in the discovery of the circulation of the blood. Fabricius was the first to demonstrate in a complete manner the valves of the veins. The first mention of these is by Stephanus (Charles Étienne) of Paris in 1845, who refers to them as "apophyses membranarum," intended to prevent the regurgitation of the blood. Sylvius (1555) noted them in several veins, Eustachius in the coronary vein (1563). Vesalius seems not to have realized their importance, but figures them in the hepatic veins. Fabricius, however, wrote a complete treatise upon them ("De Venarum Ostiolis," 1603), and states that they prevent the overdistention of vessels when blood passes from the larger to the smaller veins. He also studied the development of the human fœtus and of the embryo chick, the muscular coat of the bladder, the œsophagus, stomach, and intestines, particularly the appendix vermiformis. He was succeeded at Padua by Casserius (Giulio Casserio, 1561–1616), who paid especial attention to the organs of voice and hearing and discovered the stapedius muscle. The musculo-cutaneous nerve of the arm is sometimes called the nervus perforans Casserii.

The zeal for investigation instituted by Vesalius and carried on by his contemporaries and immediate successors was undoubtedly a great advance over the ignorant apathy that preceded it, but it was not so much a new movement as a revival of an old one. The anatomy of that time was, after all, the anatomy of the Greeks, carried to a greater degree of detail, it is true, but marred by the same teleological errors. The spiritualistic theories of Hippocrates, Aristotle, and Galen still prevailed and blinded the eyes of anatomists to the true significance of structure. The doctrine of the tissues, hinted at by Aristotle, and dimly groped after by Eustachius and Fallopius, had borne as yet no fruit. The development of the embryo had been but little studied and its details were imperfectly known. In osteology and arthrology the advances were greatest, the general features of the bones, joints, and ligaments being well described; but their nomenclature was as yet undeveloped, they being designated in each region by numbers. In the vascular system the veins were considered the most important vessels, it being supposed that the blood in them had an oscillatory movement which the valves modified without absolutely controlling its direction. The heart had been fairly well described, but as no one had shown experimentally the impossibility of regurgitation of blood into it from the aorta and the pulmonary artery, it was still supposed to be a sort of mixing reservoir for the blood and animal spirits. The permeability of the interventricular septum was still in dispute, it being held necessary for the mixing of the blood. The powerful muscular character of the heart was still unrecognized, and though the lesser or pulmonary circulation had been mentioned by Servetus and Columbus, it was not generally accepted. The lymphatics, although seen and vaguely mentioned by several ancient authors, were not understood.

The macroscopic anatomy of the brain was not yet well known; the ventricles were supposed to be the reservoirs of the vital spirits, and the nerves to be tubular in character. The distribution of the cranial nerves was not clearly made out.

In splanchnology vague ideas prevailed. The liver and spleen were thought to be potent organs for the elaboration of blood, which was made in them as fast as it was distributed by the heart through the veins and arteries to be poured out into the substance of the organs. The pancreas, although discovered by Galen, was overlooked, as it is evident that Vesalius mistook for that organ the collective mesenteric glands. The ovaries were believed to produce a female semen.

Anatomical instruction was still carried on mainly by demonstrations by the professor. The prosectors usually made dissections in sight of the pupils, the professor sitting opposite and with a little wand pointing out the part described. The muscles were dissected in one day, the contents of the head, chest, and abdomen in a second, the bones and ligaments in a third. It was not usually practicable to extend this time on account of the rapid decay of the body. As, however, the whole day was occupied by each demonstration, the work was not as superficial as might at first appear.

Another great advance was now made in a domain which, although physiological in its scope, yet reacted powerfully upon anatomy by affecting conceptions of bodily structure. This was the careful inductive demonstration (commonly called discovery) of the circulation of the blood made by the renowned William Harvey who was born April 1, 1578. He studied at Cambridge and Padua, graduating from both universities in 1602. In Italy he became acquainted with the views of Fabricius whose pupil he was, as to the wide distribution of the valves of the veins, and those of Columbus regarding the pulmonary circulation. It was not, however, until he had made many vivisections and studied the movements of the heart in many living animals, under varying conditions, that he attained to a correct idea of the double circuit made by the blood.

Harvey began to teach the new doctrine in his lectures at the Royal College of Physicians as early as 1615, but did not publish them until 1628, when appeared, at Frankfort, his "Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus" (An anatomical treatise on the movements of the heart and the blood in animals). In this he frankly breaks with traditional teaching: "I profess to learn and teach anatomy not from books, but from dissections; not from the suppositions of philosophers, but from the fabric of nature."* Showing that the anatomical arrangement of the valves of the veins and of the heart necessarily implies a movement of the blood from the veins toward the heart and from the heart into the arteries, he demonstrated such movement by a compression of veins and arteries and by various other experiments in living animals, making an earnest plea for

*In the possession of the Royal College of Physicians of London are preparations of the blood-vessels, mounted on boards and showing the aortic valves, that are said to have been prepared by Harvey when a student in Italy and used for demonstration to his classes. Hyrtl believes them to be the oldest anatomical preparations extant.