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IN December 1914, at the fourth centenary of Vesalius' birthday, anatomists and historians from all parts of the world were expected to gather in Brussels, where a solemn celebration of the anniversary had been prepared. But at that time the invader occupied Belgium, the University of Louvain, where he had studied, had been destroyed and the international homage to the founder of modern anatomy could not take place. Nor, for the same reason, is this possible this year, at the fourth centenary of the publication of the *Fabrica.* Free scientific activity is suspended or hampered all over continental Europe and international meetings are no longer possible. It seems to have been fate that, during Vesalius' life and even after his death unanimous recognition of his greatness always met with some obstacles. In this country, however, where the appreciation of his merits found eloquent expression in many studies of prominent scholars such as William Osler, Harvey Cushing, Edward Clark Streeter, Fielding Garrison, Henry Sigerist and others—in this Academy of Medicine under the auspices of which a magnificent reproduction of the Fabrica's engravings from the old blocks was published, the great historical event had to be remembered. I have taught for many years at the same University and in the same place where four hundred years ago students coming from everywhere listened to the words of Vesalius and I will try to outline his wonderful activity at the school with which his name is indissolubly connected.

On the morning of the fifth day of December, 1537, a solemn assembly was gathered in the sumptuous hall of the bishop's palace at Padua. The vicar of the Pope, the professors and members of the College of Doctors in their gorgeous gowns were present, and Francesco Frigimelica, prior of the College, after stressing in a flourishing, Latin dis-

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course the merits of Andreas Vesalius, of Brussels, who in previous examinations had furnished ample proof of his proficiency in medicine, conferred upon him the degree of Laureate Doctor of Medicine. The professors who placed their signatures on the elaborate document knew very well that the young man was already destined to an important place among them; the following day he was nominated "by the illustrious Senate of Venice, which is by far the most liberal in the endowment of the higher branches of learning, Professor of Surgical Anatomy," and he immediately began his teaching and dissecting. The fact that the official appointment came on the day after the graduation suggests that the Senate and the professors evidently had had ample opportunity of knowing the man whose academic career began in such an unusual way.

Padua, as the center of the scientific Renaissance, was at that time at the peak of its glory. While religious wars were raging all over Europe, hundreds of foreign students were grouped in the "nations," which offered hospitality to the newcomers and were organized with perfect discipline, as centers of friendship and of learning. To mention only one figure: in the second half of the 16th century, the German "nation," which comprised the Flemish students, had an enrollment of 977 members, who attended the medical school. In occasional fierce competitions with other universities, of which we possess many records, the Venetian Senate tried to engage the most famous teachers for the school, and according to the new trend of medical doctrines, anatomy was evidently designed to be the center of medical studies. Padua had played in this field a remarkable role. Alessandro Benedetti had taught anatomy at the end of the 15th century, with great success, and had published a work on anatomy, dedicated to the Emperor Maximilian I, stressing the need for anatomical dissections, giving an exact account of their performance, and a description of the anatomical theater. The fact that Benedetti insisted upon the need for a permanent theater, instead of the temporary ones which were then in use, proves that regular and frequent dissections were part of his program. In the first part of the 16th century, in the flowering of the Renaissance in art, an impetuous desire for knowledge and inquiry into all problems of Nature, was manifest, and anatomical studies were initiated everywhere in Italy. In Bologna, Antonio Benivieni, the greatest of pre-Vesalian anatomists, had published, in 1502, his book on anatomy, and Berengario da Carpi,

commenting on Mundinus, had begun to doubt the teachings of the classics. Alexander Achillini, called *Magnus Alexander*, Professor in Padua, later in Bologna, had published, in 1524, a book with many corrections of Galenic anatomy, with the first correct description of the cecum, the bile duct, and the suspensory ligament of the liver. In Padua, and later in Pavia, where he died as a young man, Marcantonio della Torre, anatomist and friend of Leonardo, had first stressed the necessity for drawing directly from nature as a help to both teachers and students. But these were isolated attempts, public dissections were rarely performed, and outside Italy, in Germany, in France and in the Low Countries, anatomy was taught only from books or from animals. Galen was still considered the authority and a mighty revival of his influence was at hand. Humanism had begun a strong fight against the Arabian authors, and the first move against them was in defense of Galen whose teachings the Arabs were accused of having plagiarized and distorted. The Neo-Galenic Academy of Florence had published, in 1533, a violent attack "against Avicenna and the neotheristic doctors who neglecting Galen accepted barbaric doctrines." Paris was the stronghold of Galenism, and solemnly proclaimed the infallibility of the prince of physicians.

Vesalius belonged to a family of doctors who had been connected with the Imperial court, the University of Louvain and the Galenic tradition. At the medical schools of Louvain and Paris, two ardent Galenists, Guenther of Andernach, a learned humanist, of whom Vesalius later said that he never had used a knife except at table, and Sylvius, the leader of the Paris faculty, taught anatomy. But the young Vesalius was animated by an unquenchable thirst for learning and researching, personally and independently. He soon recognized that the system of teaching anatomy was wrong. "The detestable procedure now in vogue is that one man has to carry out the dissection of the human body, while another gives a description of the parts. The lecturers are perched up aloft in a pulpit, like jackdaws, and with a notable air of disdain, they drone out information about facts they never approach at first hand, but which they merely commit to memory from the books of others, or of which they have descriptions before their eyes; the dissectors are so ignorant that they are unable to explain the dissections to the onlookers, and botch what ought to be exhibited in accordance with the instruction of the physician, who never applies his hand to the

dissection and steers the ship out of the manual, as the saying goes. Thus, everything is wrongly taught, days are wasted in absurd questions and in the confusion less is offered to the student than a butcher in his stall could teach the doctor."

In Paris, Vesalius had contested for a human skeleton with a pack of hungry dogs in a grave yard; at Louvain, he often waited near the gallows outside the town, trying to procure corpses or bones, and once climbed the gallows in order to take down a skeleton which he brought home in separate parts. The difficulties of dissecting and of teaching brought him to the decision to repair to Padua which he rightly believed to be the one place where his activity could develop freely. How he succeeded in acquiring the confidence of the Senate and of the Paduan professors, we do not know; but it is certain that in Venice, where anatomy was eagerly taught at the College of Physicians, he explained his program and obtained the promise to have the corpses he needed for his lectures.

In Padua the teaching of anatomy was generally committed to the professor of surgery and the dissections were usually done by the surgeons, despised by the learned doctors. Vesalius was appointed professor of surgery primo loco, in first place, on the condition that he had to lecture on anatomy and to perform the dissections. We know that actually he also taught surgery and lectured on tumors and on fractures. But anatomy was the chief object of his lectures; in official documents he is often praised as anatomist and teacher of anatomy with no notice of his lectures on surgery. In a document of 1541 he is nominated lector, dissector and ostensor in anatomy.

In December 1537, Vesalius began his dissections and we know from contemporary sources and from the reports to the Senate, that his success was beyond all expectation. More than 500 students and doctors, and many distinguished and learned men, crowded his classes. The dissections sometimes lasted three weeks, in morning and afternoon sessions. The professor took great care to have a sufficient number of corpses at his disposal, and when these could not be secured, he dissected animals and performed vivisections. He began his teaching by summarizing briefly Galen's description of the part he was going to show, and then he proceeded to the demonstration, dissecting and accurately preparing the part by himself, calling sometimes upon one or another of the students to assist him, with no further reference to the

text. Upon the request of the students, he prepared a delineation of the veins "which proved to be so pleasing to all the physicians and students that they strenuously urged me to supply a description of the arteries and the nerves." He went on drawing sketches for the students, and was so convinced of their usefulness, that, in 1538, he published the *Anatomicae Tabulae*, three of which were designed by himself, three by his countryman, John Stephen Calcar, a pupil of Titian's and a fine artist. The success was so great that immediately the Tables were reproduced and plagiarized in Marburg and Cologne, in Augsburg, Frankfort and Paris.

Everyone who compares these tables, born in the dissection room, with the "*fugitive sheets*" of anatomy, which were widely used at that time, and were derived from old, conventional patterns, is immediately aware of the great progress. These tables, which represent a remarkable achievement, show however, that Vesalius had not yet broken away from classic anatomy. The descriptions of the liver in four lobes, of the sternum in seven parts, of the uterus with horns, correspond not with reality, but with Galenic teaching. Vesalius still accepted the authority of the Ancients, and when in need of a textbook, he did not think to write one himself, but prepared a new edition of his teacher's, Guenther von Andernach's, *Institutiones Anatomicae*, correcting many errors of the original text, which he generously attributed to misprints. When the Venetian printers, Giunta, entrusted him with the editing of the anatomical books of Galen for the complete Latin translation in five volumes, for which no expense was spared,Vesalius eagerly accepted. His vast classical education enabled him to accomplish this difficult task. He had called Galen "the divine teacher, the author of all good things," and had considered galenism unassailable but now, during the assiduous study of Galen's works in the original text, an essential change in his judgment took place. It is once more the characteristic proceeding of the Renaissance, from Humanism and blind reverence of the classic masters, to independent criticism, and from criticism to rebellion against dogmatic authority. In the new edition Vesalius corrected some errors of Galen and Augustinus Gadaldinus, the anatomist, tells that "Vesalius improved Galen's books on anatomy to such an extent as to alter them in many places." The accurate study of the text, the comparison of different sources, and the contemporary control of Galen's assertions by means of his own observations, brought

him finally to the conviction that Galen's mistakes derived from the fact that he had never dissected a human corpse and had believed it to be right to accept the findings on animals as conclusive for human anatomy. Galen, said Vesalius, was "cheated by his monkeys, and in the manifold divergence of the human body from that of the monkeys, had hardly noticed anything except in the fingers and the bend of the knee." The whole study of anatomy had to begin anew.

Starting from this conviction, Vesalius continued his work as teacher calling the attention of his pupils to the differences between the classical texts and the evidence of personal observations and collected accurately the descriptions of his findings and his discoveries. His intense, continuous activity appears wonderful. Encouraged by the students and by many of his friends, among whom he named with deep gratitude J. B. Montanus, the famous professor of medicine, and M. A. Genova, professor of philosophy at Padua, he prepared the two great books, the *De Humani Corporis Fabrica* and the *Epitome*. The Epitome was according to his intentions "the guide, index, and compendium of the Fabrica." It was dedicated to the students as a handbook for dissections and at the same time to physicians and surgeons, who, preparing for an operation, had to recall the position and the form of a bone or of an organ. The *Fabrica* had to be, and in fact was, the first complete and systematic description of the human body as "a fabric, a wonderful structure, according to the work of the Supreme Creator and the Divine Artist, Nature." Anatomy had to be taught as the "history of the human body, with perfect truth and absolute exactness."

The *Fabrica* is therefore more than a classic book of anatomy: it is from the frontispiece to the last page, a declaration of principles, a program of studies and an autobiography, from which the personality of the author emerges fresh and living. The title-page gives us the picture of the anatomical theater, as Vesalius visualized it, the figure of the teacher in the attitude of a challenger who proclaims his beliefs, and is surrounded by an attentive and astonished audience. In the middle of the picture is the corpse, around which the whole scene centers. At the top of the theater, Vesalius' laurelled coat of arms stands as an affirmation of confidence in ultimate victory. In the portrait drawn by Calcar, on the third page of the book, Vesalius appears again examining the muscles of the right arm, in the act of resolving an anatomic problem, with which, we know, he was especially concerned. He does not wear

the traditional gown of the professor, but is clothed in the gorgeous brocade of the patrician. In front of him, on the table, is an open book, not the traditional text of Galen, but the manuscript of a chapter of his *Fabrica.*

The preface, addressed to the Emperor, to whom the book is dedicated, is, like all prefaces of that period and many of later times, redundant in rhetorical phrases. The author correctly foreseeing that his enemies would accuse him of heresy, declares that he respects the doctrine of the classics, and that he only wants anatomy restored to its ancient place of honor. The flatteries of the prince, the protestation of devotion belong to the arsenal of all writers who felt the necessity of finding a sure and mighty protector against the strict censorship of the ecclesiastic authorities, and they often were the label which was expected to cover the contraband.

Vesalius' book first brings to the teaching of anatomy the contribution of objective observation and exact intelligent criticism. Through the penetrating eyes and the agile hand of the young anatomist the Fabric of the human body is revealed and shown in its proper structure, so that we can really speak of numberless discoveries. He lifted the veil which had obscured the real shape of things and therefore he put in his work the foundation of a new system of studying, of teaching, of thinking. In the *Fabrica* the subject is systematically ordered in such a manner that the reader may have a complete and exact knowledge of the human body as a whole and of all its parts, finding for everyone the perfect description of its form and functions. Vesalius is at the same time the anatomist, the surgeon and the physician who conceives medicine as a whole and states that anatomy has to be "the firm foundation of medical art and of its essential doctrines." He states that surgery has to be equal in dignity to medicine, and that all who want to be physicians have to study it diligently. Dealing with Galen, Hippocrates and Celsus, with Aristoteles and Avicenna, whom he often refers to, he pronounces an independent and courageous judgment, showing the way for objective research. He claims the right to perform vivisection on animals, and considers the problems of respiration and circulation with a clear mind. He is above all a teacher, and as a teacher he appears in direct communication with his pupils, never posing as an authority, and constantly inciting them to examine, to experiment, and to judge for themselves.

The accord between the text and the figures is unprecedented. We know that anatomical illustrations at that time were considered by the Galenists as not only useless, but a hindrance to the understanding of anatomy, and the figures of the *Fabrica* aroused a bitter controversy, led by Sylvius and his school. But Vesalius had correctly understood the importance of the illustrations for his book, and his choice of artist was very fortunate. Stephen van Calcar's name is indissolubly bound to Vesalius' glory. His drawings gave to the book the incomparable worth of both a reliable guide through the paths of anatomy and of an admirable work of art. The large figures appear erect in plastic attitudes. Look at the figure of the skeleton standing in the position which was supposed to have given Shakespeare the inspiration of Hamlet's monologue, regarding pensively the skull which rests on a marble base, which is inscribed: "*Man lives through his genius, all the rest is mortal.*" It gives an eloquent synthesis of this work in which anatomy and art and philosophy are joined into a perfect and harmonious system. These figures have as a background an Italian landscape with flourishing trees and ruins of classic temples, and they appear to us as symbols of the new anatomy which has as a background the new life of the Renaissance and the ruins of classic science. The beautiful initials, conceived and delineated with a fine sense of art, give to the book a picturesque touch. Some years earlier, Gerolamo Fracastoro, a Paduan scholar, had published a magnificent poem in classic Latin verses, devoted to the story and pathology of syphilis, creating a medical text and an admirable work of poetry. Vesalius gave to anatomy its first textbook in a perfect artistic form. Both works are superb monuments of the scientific literature of the Renaissance.

The *Fabrica* was published on May 5, 1543 in a splendid edition which makes it also from the typographical point of view, one of the outstanding books of the 16th century. The question has often been asked why the Paduan professor had his book printed at Basle instead of Venice, where the supervision and the correction of the proofs would have been much easier and more convenient, and where he had already been closely connected with L. A. Giunta. But Venice and its printers and the Giuntas first of all, had at that time the reputation of having contributed to the spread of the Lutheran heresy, and in the year 1541, when the book was ready, the Diet of Regensburg had been convoked in order to stop Lutheranism, and the severe

persecution of the heretics had begun under the direction of the Society of Jesus. From northern Italy, many protestants had taken refuge in Switzerland. Basle was a town where Catholics and Protestants lived in peace. That Vesalius was aware of the danger which threatened him is proved by a passage in his *Epistle on Venesection*, published in 1539. "A very learned man, well satisfied because of his private wealth, was not ashamed to call Manardus, Fuchsius, Curtius and Brissotius, Lutherans in medicine, before a crowded assembly." These four physicians were all very well known to Vesalius and in close relation with him, and were at the same time suspected for their independent teachings.

In considering Vesalius' work, it is impossible not to refer also to Leonardo and his anatomical drawings, which make him appear to the impartial historian as the first anatomist in the modern sense of this word. The problem of the influence exerted by Leonardo on Vesalius has been often discussed, but a definitive solution is impossible. It is not even sure that Vesalius may have seen Leonardo's drawings, which seem to have been very little known at this time. But many facts allow us to admit that the great anatomist may have had at least some knowledge of this work, and of the fact that M. A. della Torre had intended to prepare with Leonardo's help, anatomical tables to improve the anatomical teaching. It is certain that Giorgio Vasari, historian and biographer of the great artists of his time, ascribing to this association the origin of Leonardo's anatomical drawings, told us a fact that was generally known. In any case, the revival of learning, the atmosphere of the Renaissance, the factors which had an impact on Leonardo's work inspired and encouraged the Paduan professor. But this does not diminish in any way the importance and originality of Vesalius' achievement.

Leonardo had started from a general conception of harmony and beauty which included the whole of the universe. He was a solitary thinker, driven to the study of all problems as an artist, a mathematician, and a philosopher. Vesalius, as a professor of surgery and anatomy, started from the real necessity for the physician and foremost for the surgeon, to know the anatomy of the body, and called for the help of an artist to accomplish this task. In the new conception of anatomy, free from the bonds of tradition and scholasticism, Leonardo was the precursor, but the conception expressed in a masterful form in his drawings found the convinced supporter, the systematic interpreter, and first of all, the great teacher, in Andreas Vesalius.

Leonardo's anatomical work was quite unknown to the scientific world, whereas the *Fabrica* caused an immense sensation, and the authority of Vesalius grew rapidly. He was invited to perform dissections at Pisa, where Cosimo, Duke of Florence, extended him a cordial welcome, ordered a corpse to be sent by special boat from Florence for the dissection, and offered Vesalius the chair of anatomy at the University. At Bologna he performed another public dissection and his friend Alvius, professor of anatomy, assisted him. At the same time, however, the learned Galenists understood the danger of this revolutionary trend, and the first alarm came from Paris, where Sylvius took upon himself the defense of Galen. He called upon Vesalius to renounce his heretical statements, to confess his mistakes, and to declare publicly his faults. As Vesalius answered that he had nothing to recant and that he stood for the truth of his assertions, Sylvius attacked his former pupil, declaring that he was not Vesalius but Vaesanus, a madman, and a two-legged ass; and his hatred went so far that as the most authoritative scholar of the Paris faculty, he wrote some years later to the Emperor Charles V, at whose court Vesalius was appointed, asking the Emperor that "Vesalius be heavily punished and in every way restrained, lest by his pestilent breath he poison the rest of Europe." On Vesalius' side stood his pupils, who loved and admired the teacher, but not all of them dared to take his part publicly, and some as Realdo Colombo were harsh in their criticisms. At the same time, a great number of plagiarists or "pirates," as Vesalius called them, in Germany, France, England and Spain, tried to present the work of Vesalius in changed form. Vesalius felt very deeply this animosity against him and especially the hostility of his teacher to whom he answered in a form no less violent than the one he had used. And perhaps he resented still more intensely the fact that the drawings had been copied or badly reproduced, the more as having spent large sums for them, he had nevertheless repeatedly stated that he was ready to put them without any charge at the disposal of any one who might wish to use them.

When finally, in 1544, as a young man of thirty, he decided to leave Padua and his chair, and to follow the apparently easier road, in line with the tradition of his family, accepting the call to become physician to Emperor Charles V, he broke with his past, burned his medical books and some manuscripts still unpublished.

Andreas Vesalius became the celebrated physician of Charles V and

of Philip I, the famous surgeon and consultant, but he never returned to his anatomical studies, to Padua, whence his enemies had driven him, just as the wars had once made living in Paris impossible for him. In all probability it was twenty years later the tyrannical regime of Philip II and his fight against the Low Countries, the independence of which was to be crushed at that time, that made his life at the Court of Madrid intolerable. After his resignation no more original contributions to anatomy, except the corrections to the second edition of the *Fabrica* (1555) were published by him. He well knew that his work as scientist and teacher had come to an end. But we have positive proof that he thought of it with deep nostalgia. In the letter to Gabriel Fallopius, his successor at Padua in answer to some objections raised by him, he wrote (1562): "I remember that very sweet life that was mine while I taught anatomy in Italy, the true nurse of genius. . . . No opportunity of a dissection can occur here, where I cannot have even a skull, but I still promise myself that on some favorable occasion I will thoroughly examine that true book of the human body, that is, man himself, and I will impart to you, in order to complete the art, any additional aspect which it will exhibit by virtue of its great abundance and of the singular skill of its Creator." And in another place: "I feel that the ornament of our art originates in that arena from which as a young man I was diverted to the mechanical practice of medicine, to numerous wars, to continuous travels. May you continue to embellish our common school the memory of which is always most dear to me."

The letter was published under the title *Anatomicarum observationum Gabrielis Fallopii Examen* in 1564, but this last work of Vesalius had a strange fate. Fallopio, to whom it was addressed and sent through the Venetian ambassador in Madrid, never received it, having died before its arrival. Vesalius, who arranged with the Venetian printer for its publication, never saw the volume, which was published at the time of his death.

But from the preface written by the publisher we learn that "before leaving for Jerusalem, Vesalius was greeted in the bookshop by Augustinue Gadaldinus, one of his warm friends and supporters, Andreas Marinus [the learned commentator of Rhazes] and some other prominent physicians," and that on the occasion the arrangements for the publication of the *Examen* were completed.

It may be that at that time the possibility of Vesalius' return to

the chair of Padua, had been taken into consideration, but we don't know anything about a formal offer of the Senate which, however, seems to have been likely, the chair having been vacant after Fallopio's death until 1565, when, after the news of Vesalius' death had reached Venice, Fabrizio d'Acquapendents, who was later Harvey's teacher, was appointed. Vesalius never returned from his unfortunate journey. But his great book shows him in the memorable aspect of the founder of anatomy as a science, as the professor at the medical school of Padua, the office he cherished most.

The creative activity of his life, his courageous fight against dogmatism, his great discoveries in the field of anatomy, the preparation of his books and the foundation of a new trend of medical thought evolved during the years of his teaching in Padua, the cradle of scientific Renaissance. In the history of the school of Fracastoro and Copernicus, of Galileo and of Harvey, Andreas Vesalius wrote one of the most glorious pages.