

GIOVANNI BATTISTA MORGAGNI, THE FOUNDER OF PATHOLOGIC ANATOMY*

A BIOGRAPHIC SKETCH, ON THE OCCASION OF THE 200TH ANNIVERSARY OF THE PUBLICATION OF HIS *De sedibus et causis morborum per anatomen indagatis*

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The end of the 17th century witnessed a large crop of *spicilegia* (assemblages of necropsy reports), the first blooms of the still-embryonic science of pathologic anatomy. With dissection becoming commonplace, it was inescapable that observations of abnormal conditions should steadily accumulate. Pathologic anatomy was fast eclipsing normal anatomy. The records of these earlier endeavors were, at first, widely scattered¹. Then compilers arose, like Kerckring (1640-1693), Blancardus (1650-1702), and, the greatest of all, Théophile Bonet (1628-1689), who produced his famous *Sepulchretum sive anatomia practica* (1679), a weighty tome of 1,700 pages that was a marvel of industry and perseverance.

The scope and significance of Bonet's mighty collection of nearly 3,000 necropsy protocols is clearly indicated by the author himself in the complete title of the book, translated in Klemperer's article² as follows:

Repository or anatomy practised on corpses deceased of disease, which reports the histories and observations of all alterations of the human body and reveals the hidden causes. Indeed, it (anatomy) deserves to be called the foundation of real pathology and of proper treatment of disease, even the inspiration of old and recent medicine.

As Klemperer² cleverly says, "today, not even the most enthusiastic supporter of pathologic anatomy would concur with this baroque glorification".

Actually, the method pursued by the scouts of this new science was that of descriptive

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anatomy, and, whenever they attempted a correlation between morbid findings and clinical symptoms, they invoked, as a base for speculation, the still-prevailing doctrine of the humors.

Easy interchange of scientific thought was provided by printing with movable type, which led to the publication of one of the first medical periodicals³, the *Acta medica et philosophica hafniensia*, initiated by Thomas Bartholinus (1616-1680). The press also enabled wide dissemination of pictorial representation, which has always been considered the most valuable aid to description. The tradition of beautiful illustrations, as done by Leonardo da Vinci and then, later, by Kalkar, one of Titian's pupils, in *De fabrica humani corporis* of Vesalius, led to the depiction of pathologic anatomy in the 17th century^{4,5,6}.

The material for the study of pathology was at hand. All that was needed was a magician to transform the barren mortuary of *spicilegia* into the meaningful science of pathologic anatomy on which the variable symptoms of disease could be solidly anchored.

All of this could only be provided by a man of great vision. But vision alone was not sufficient to erect an edifice of such dimensions; the need was for a man with an independent mind, rich in experience, and entirely devoted to the cause of mankind. The demand was for a perfectionist, able to produce exactly controlled experiments, and an apostle, able to inspire others with the faith and the conviction that clinicopathologic correlation was the essence of the rationalization of medicine. As Klemperer² said, in the words of *Ecclesiastes*, "To everything there is a time and a time to every purpose under the heaven".

The time had come for the birth of this

new science, and it was only natural that it should spring from the culture and climate of Italy, which had already contributed so much to the rise of pathologic anatomy. Thus, it was not by accident that destiny entrusted Giovanni Battista Morgagni with the task of rebuilding the temple of medical science on the immovable foundation of pathologic anatomy.

When, in 1894, the octogenarian Rudolf Virchow addressed the International Congress at Rome^{7,8}, he selected Morgagni for his subject, considering him as the founder of pathology. In so doing, Virchow honored also a whole tradition of Italian scholars and original investigators — Mondino, Vesalius, Fallopius, Eustachio, Spigelius, Lancisi, and Pacchioni — of whom Morgagni was the most worthy offspring.

When Morgagni entered the field, the basic aims of scientific medicine and the methods by which it should be pursued had been established.

Thomas Bartholinus, in his *De anatome practica ex cadaveribus morborum adornanda consilium* (1674), had already made clear the distinction between the anatomist who limits himself to the exploration of normal structure and the anatomist as a physician who derives information useful for his practice from the bodies of the sick. The Florentine, Antonio Benivieni (?1440-1502), had shown how a practicing physician could blaze this new trail.

If any doubt remained as to how far anatomy could promote the advancement of medicine, it was readily dissipated by the message of Marcello Malpighi⁹ (1628-1694):

Anatomy advances medicine by demonstrating the seat, the origin, and the cause of disease, as well as the mechanisms by which it is produced.

Unequivocally, Malpighi did anticipate Morgagni's vision and he found many hands extended eagerly to grasp his message.

Pathologic anatomy soon started to grow on its own as an independent discipline. Giovanni Riva (1627-1677), the mentor of Lancisi, established a pathology society, as well as a pathology museum, in Rome at the Ospedale della Consolazione.

But far more important was the unreserved

acceptance of the mechanistic explanation of vital phenomena by two of Malpighi's pupils, Albertini (1662-1728) and Valsalva (1666-1723). The thinking of these two men was to vitally influence Morgagni's vision of the priceless value of clinical and pathologic correlation.

Mechanical factors, Albertini¹⁰ said, rather than a "serous constitution" of the blood, are responsible for the occurrence of pulmonary edema, and he explained the dyspnea of the cardiac patient on the basis of venous congestion, hydrothorax, and pulmonary edema.

Of the same period is Valsalva's discovery of the contralaterality of symptoms and cerebral lesions in apoplexy. These fragmentary references mirror the perspicacity and maturity of thinking of the two men from whom Morgagni was to acquire, by word of mouth and example, the rationale of correlating the alterations in function with the alterations in structure.

Naturally appreciative, Morgagni never failed to pay homage to his mentors. Had it been in his power, he would have declined the title, "founder of pathologic anatomy", nobly conferred by Richardson¹¹ and attested to by Virchow^{7,8}, and bestowed it on the humble Albertini or on the highly praised Valsalva, or, even better, on Marcello Malpighi, the forefather of this lofty lineage.

Giovanni Battista Morgagni was born on February 25, 1682¹². His birthplace was Forlì, the capital of a papal province in northern Italy called Romagna, from the ancient *Romandiola*, the military artery of the Roman legions extending from the shores of the Adriatic Sea to the feet of the Apennines. At the end of the 17th century, Forlì was a small town, but of high cultural standards and artistic beauty, including a manor built after designs made by Michelangelo. While Giambattista was still a child, his father died, which explains the great devotion that he always felt for his mother, Maria Tornielli, a woman of rare intellect who devoted all her talents to the education of her gifted son.

After attending *l'Accademia de' Filergiti* ("amatori dell'operare")¹³, a preparatory school in his native town, Morgagni enrolled, at fifteen years of age, in the Medical School

of the University of Bologna, which at that time was in its waning glory.

It was here that Morgagni came in contact with two scholars of unusual distinction — Albertini, a most celebrated professor of the time, although now more or less forgotten, and Valsalva, who was to become his mentor and his friend. Valsalva, skillful in recognizing talent and ready to instill confidence in one whom he believed to be possessed of an imaginative mind, immediately noted the potentialities of this inquiring youth of fifteen and made him his personal assistant. Not a few of the dissections that Valsalva required for his demonstrations in the amphitheater, for the illustrations of his writing, and for his investigations into the organ of hearing are said to have been made by Morgagni under his master's supervision¹³.

After four years of dedicated study at the University of Bologna, Morgagni received both the degree of Doctor of Medicine and that of Doctor of Philosophy, a happy combination of qualifications that hardly could be required of the graduates in the present day.

After graduation, not yet twenty-one years of age, Morgagni was asked to assume Valsalva's teaching obligations at the University of Bologna while Valsalva was in Parma. Morgagni's infinite enthusiasm for his work made him a leader and a moving spirit among the medical students and young graduates. Thus, he was interested in and became president of^{5,7,8,14,15} the *Accademia inquietorum*, which, literally translated, means "Academy of the Restless". The principle governing the Academy was that scientific truth should be based on analytic observation rather than on empirical theorizing and quotations from the classics.

It was to the "restless" that Morgagni presented his first original essays, soon to be published under the title, *Adversaria anatomica* (1706) — *adversaria* being the Latin name for notebooks. This marked the beginning of his scholarly career. The first collection of anatomical observations was followed by five more, with the last one coming thirteen years later.

The Academy of the Restless did not continue under that title, but became (1714) the

Accademia delle Scienze dell' Istituto di Bologna^{7,8,14,15}.

In 1707 we find Morgagni in a scientific pilgrimage through the major cultural centers of the Republic of Venice. In Venice he became closely associated with Gian Girolamo Zanichelli, a chemist and naturalist of good reputation, and with Giovanni Domenico Santorini, a distinguished anatomist of the Ospedale dei SS. Giovanni e Paolo, to whom, in a letter to Valsalva¹⁶, he refers as a "young but diligent and ingenious dissector".

From overwork, Morgagni's health failed him for a time and he returned to his native town for a period of rest in 1709. Here, he took up the practice of medicine, and this new activity had much to do in directing his thoughts toward the correlation of the symptoms of common diseases with the underlying organic change.

During his stay in Forlì, he met Paola Vergieri, the descendant⁵ of a noble family of the town, who became his wife and the devoted companion of his life.

It was not long before Morgagni made his return to the stage of academic life. The death of Professor Guglielmini had created a vacancy in one of the two chairs of theoretical medicine at the University of Padua. Professor Vallisnieri was promoted to the first chair, and Morgagni was offered the second chair, apparently on the instigation of Lancisi, the arbiter and most celebrated professor of the time. On October 8, 1711, Morgagni accepted the appointment¹⁷.

At the time that Morgagni ascended the Chair, the once-renowned standards¹⁸ of the University of Padua no longer enjoyed the same prestige.

The coat of arms of the Nations of the *Universitas iuristarum* and the *Universitas artistarum* hanging from the walls of the yard and of the auditorium of the University were a reminder to Morgagni of a still-recent and glorious tradition of scholarship. Still fresh was the memory of the glory brought to the University by the achievements of past pupils like Copernicus, Gustav Wasa, Sobieski, Torquato Tasso, and Carlo Sigonio. There was a botanical garden, the first established on the Continent (1543), and an anatomical theater, graced by the teaching of Fabrizio of Acquapendente, Vesalius, and

Columbus and by the attendance of the student, William Harvey (1598-1602), the Councilor of the English Nation¹⁹.

However, in 1626, John Andreas, a student at the University, in a letter to O. Worm, of Copenhagen, a most celebrated anatomist and physician and former student at the University, bitterly complained of the decadence of the Studium¹⁹. Morgagni himself, after visiting Padua (1707) four years before his professorship appointment, wrote to Lancisi²⁰, describing how the standards of the teaching of anatomy had fallen; he said that Moneghino, the associate of the Chief, did not "cut any more" and that Molinetti, the Professor, did not "appear to have read the first page of any modern writing".

The Senate of the Republic of Venice, jealous and proud of the tradition of the University, was well aware that things were not going well. This is clearly indicated by a memorandum (1715) of Scipione Maffei^{20,21}, an enlightened "reformer" (a member of a special body of prominent citizens established in 1517 to guide the destiny of the University) of the Paduan *studium*, in which he pointed out the decadence of the *Studium*, the deficiencies of the anatomy course, and the antiquated system of the teaching of the major disciplines.

Morgagni did not turn a deaf ear to Signor Maffei's message and, through intelligent practice of post-mortem examination, truly created pathologic science and carried it to perfection.

The two main medical departments at the Medical School were those of practical medicine and of theoretical medicine. In 1714, with the death of Bernardino Ramazzini (1633-1714), the founder of occupational medicine, the Chair of Practical Medicine remained vacant. Although Morgagni was attracted to this position, Lancisi, his wise protector, advised him to wait for the Chair of Anatomy that, in his own words, "was more appropriate to him and carried higher prestige". One year later, with the death of Michelangelo Molinetti, this chair became vacant, and, on October 5, 1715, Morgagni was appointed *ad anatomem ordinariam* — the most important position in the School, at the annual salary of 2,200 golden *zecchini*.

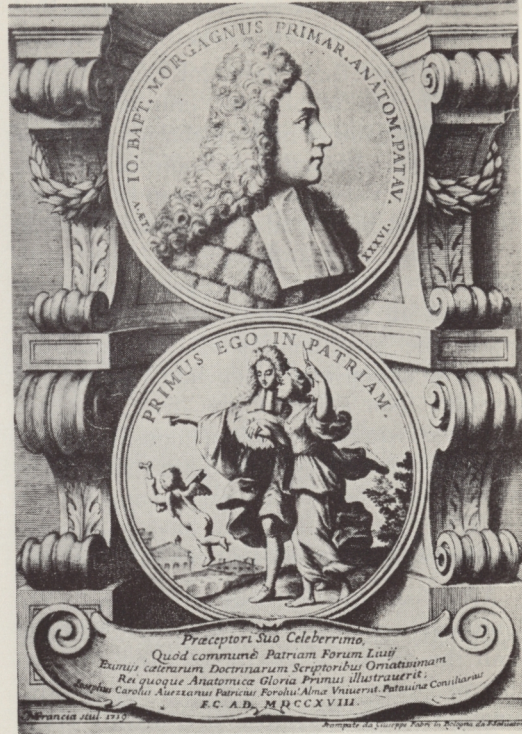


Figure 1. Portrait of Morgagni at the age of thirty-six years.

At the time of the appointment, Morgagni was thirty-three years old²².

The Chair of Anatomy was held in the highest esteem. Actually, the teaching embraced both physiology and pathology, and the anatomy lecture was the synthesis of all practical and theoretical knowledge available at the time.

The teaching of anatomy that Professor Molinetti, the predecessor at the Chair, had limited to a few hours had been extended by Morgagni to include a full semester of seventy lectures that he delivered himself, year in and year out, to the end of his days, with the same enthusiasm, industry, and perseverance that characterized all his endeavors. In the last year of his life Morgagni was writing to Sénac²³:

I am absorbed completely by the education of this youth entrusted to me by this most magnificent Republic, and to whom I devote humbly my effort.

This effort was fully appreciated by Morgagni's admirers²⁴ and pupils who, on leaving the School (*atenèo*), carried to far

Figures 2-A through 2-C. Reproductions from the 1719 edition (Patavii, J. Cominus) of the *Adversaria anatomica*.

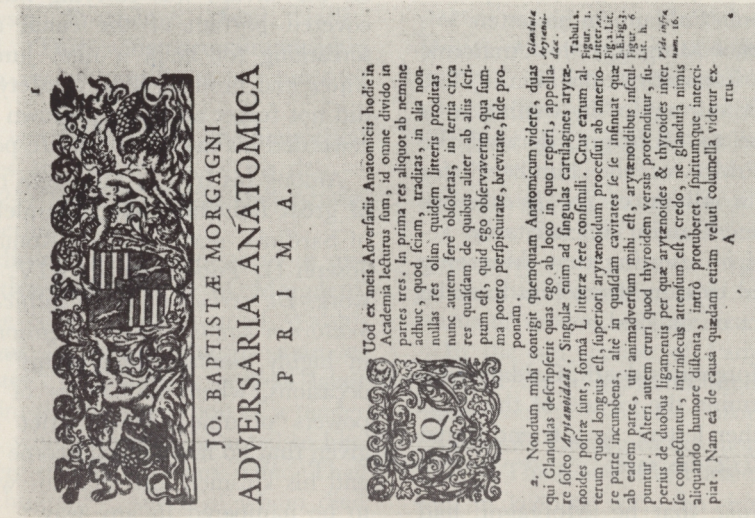


Figure 2-A. The first page of the *Adversaria anatomica* (Part 1).

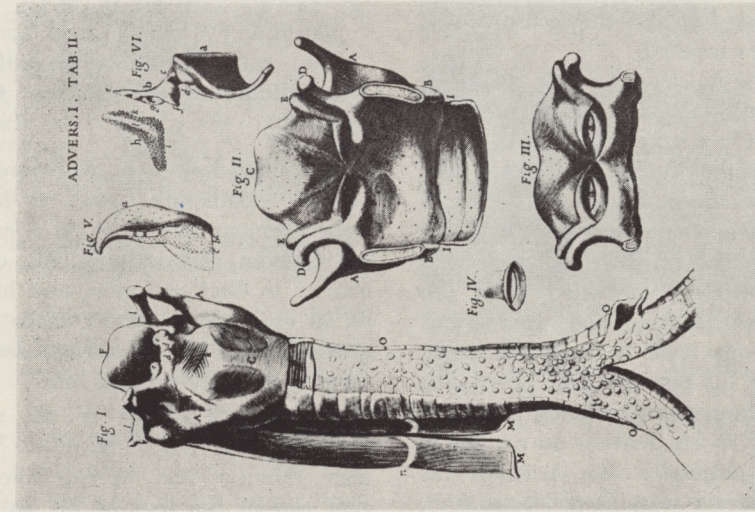


Figure 2-B. The drawings pertaining to the larynx.

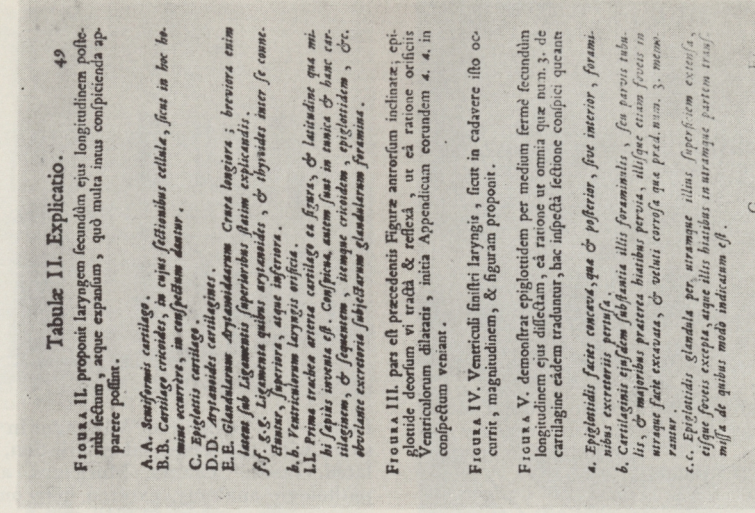


Figure 2-C. Explanation of the drawings.

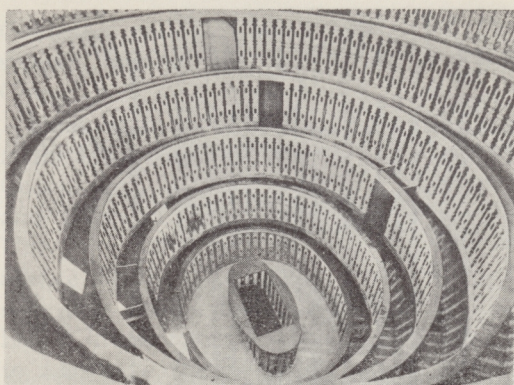


Figure 3. Morgagni's lecture room at the Paduan Athenaeum. It was built in the 16th century according to designs of G. Fabrizio da Acquapendente.

lands not only the inspiration of a true intellectual message but also the treasure of a new investigative method.

This highly stimulating teacher attracted to the University great numbers of students, especially from the northern European countries. In 1715, the Guild of the German Nation, over a thousand students strong, chose Morgagni as their patron. They also presented⁵ him with an inscribed memorial.

Morgagni was well provided with the qualities necessary to attain the summit, but not a few persons tried to cross his path. Well known are his disputes with the Swiss, Jean Jacques Manget, a practicing physician and compiler of lavish treatises on medicine, anatomy, and surgery¹¹. But perhaps his most bitter slanderer was his colleague and, ultimately, his successor to the Chair, Leopoldo Marcantonio Caldani. In his letters^{26,27}, Caldani nicknames Morgagni "his Anatomic Majesty" and ironically calls him "The Monarch". Caldani, again, in writing to a friend also close to Morgagni, derided the "well known Prince of the Butchers" for claiming that his edition of the *Decameron* was a rare one; Caldani uncharitably accused Morgagni of asserting that everything that he possessed or came from him must be the most perfect of its kind.

Even after Morgagni's death, Caldani continued to undermine the virtues of the great master; in another letter²⁷ to a friend dated February 28, 1772, he says:

Finally the yoke that he [Morgagni] had



Figure 4. The house of Morgagni in Via San Massimo, with the memorial inscription, which, translated, reads: "Giamb. Morgagni, after founding pathologic anatomy, expired here on December 6, 1771".

placed on everybody's neck and that everybody carried because of indifference or ineptitude, has been shaken. Great names are like veils that obscure the sight. . . .

One may, however, rely more confidently on the judgment⁵ passed on Morgagni by Pope Clement XIII who, in a letter, "praises his wisdom, his culture, his courtesy, his charity to God and men, and holds him up as an example to others, since with all his good qualities he had not aroused the enmity or envy of those around him".

If gratitude is one of the attributes of greatness, Morgagni possessed this quality also. When a child, he had fallen in a canal that ran in the rear of his paternal home. As the stream was carrying him under the covered portion of the canal and he was screaming for help, a man jumped in the water and brought him to safety. The child did not forget and, when grown to maturity, rewarded his savior with a life pension²⁸.

Among his friends Morgagni counted men of great influence, like Emanuele III, King of Sardinia, and the Holy Roman Emperor, Joseph II. Pope Benedict XIV, in his classic work, *De servorum Dei beatificatione et de beatorum canonizatione*, mentions Morgagni in highly commendable terms^{29,30}. On two occasions, when the armies of two foreign powers occupied Forlì, strict orders were given that no harm should come to Morgagni and his kinsmen and that his work was not to be hampered in any way²⁹. (Some years

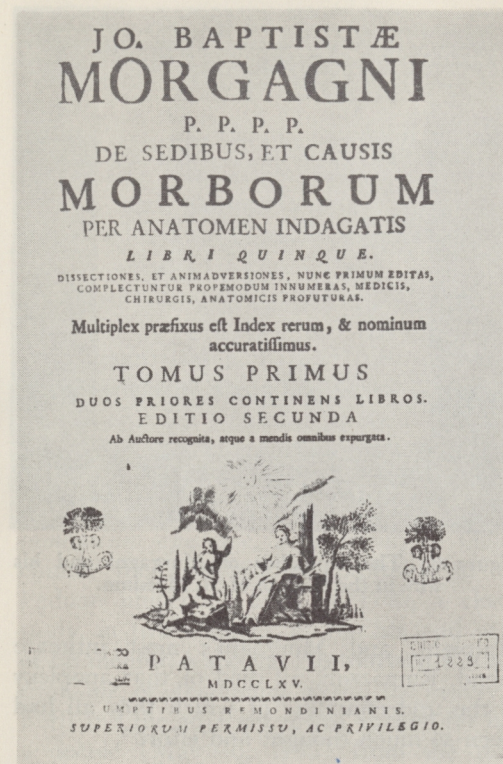


Figure 5. The frontispiece of Morgagni's *De sedibus*, second edition, published in 1765.

later, the same honor and distinction befell Lazzaro Spallanzani and Antonio Scarpa, both pupils of Morgagni and distinguished professors at the University of Pavia, when Bonaparte occupied and ransacked Pavia²⁹.)

The great estimation in which Morgagni was held is best revealed by his intimate relationships with learned men of his time, such as Ruysch, Boerhaave, Mead, Haller, and Meckel. This wide acquaintanceship brought him recognition from all parts of the world.

Morgagni was elected¹⁴ to the important royal societies and academies of his day — England, 1724; Paris, 1731; St. Petersburg, 1735; and Berlin, 1754.

All these distinctions did not seem to disturb the patriarchal serenity of Morgagni. To quote the concise expression of Walsh⁵, Morgagni was "a simple, happy man of domestic tastes". Morgagni's endless labor earned for him the compensation of a tender domestic life, which was fully granted to him by Paola Vergieri, his virtuous wife. They had fifteen children^{5,14}, seven of whom died



Figure 6. Portrait of Morgagni at the age of eighty-three years, as seen in the Remondiniana edition of his *Opera omnia*.

in infancy of a jaundice that, on Morgagni's testimony³¹, had appeared soon after birth. One of the sons, a fine poet³¹, died when he was a young man, another son became a Jesuit⁵ and taught in the Jesuit School of Bologna, in the magnificent building in which now resides the Academy of Fine Arts, and a third son (who did not survive his father) went into medicine⁵. All Morgagni's daughters who grew to womanhood became nuns⁵.

Under the roof of a serene and humble household, science and religious faith had grown harmoniously, both reaping the rewards of modest self-sacrifice.

In the old section of Padua, at Number 3003, in Via S. Massimo, there is a memorial inscription³²: "Giamb. Morgagni fondatore l'Anatomia Patologica qui moriva 6 Dicembre 1771". The house is of classical, simple lines, well in keeping with the simplicity of taste



Figure 7. The Church of St. Massimo in Padua where Morgagni was buried.

of the man who had renounced all frivolities of life in order to devote all of himself to the progress of science and welfare of mankind.

Nature sometimes seems to take pleasure in releasing the boundaries of time for those laboring in behalf of the common good. Morgagni lived to be eighty-nine years old and, to the last, retained clearness of thought and limitless energy.

On several occasions before Morgagni's demise, it was rumored that he had died³³, but it was on either the fifth or sixth day of December, 1771, that Morgagni actually died in his house on the Via S. Massimo. In the Register of the Dead of the Church of St. Massimo, for from March 23, 1708, to February 16, 1796, now kept in the chancellery of the *Curia vescovile* (the Bishop's residence) of Padua, there is an annotation³⁴ on Morgagni's death, stating that "it occurred after a gastric distress with catarrh that lasted twenty hours"; more accurately, however, the reporter, Giuseppe Gennari, specified that Morgagni died of "an apoplectic stroke by which he lost consciousness".

It is a strange coincidence that Morgagni's teacher, Valsalva, and Valsalva's teacher,



Figure 8. The sepulcher of Morgagni and his wife in the Church of St. Massimo.

Malpighi, and Morgagni's most intimate friend, Ramazzini, all died of that apoplexy to the understanding of which they all had given so much thought and effort³⁵.

Morgagni was buried in the Church of St. Massimo, close to his beloved wife who had left him the year before, on September 2, 1770³¹. About one hundred years later, on the request of the townspeople of Forlì, who wished the remnants of their great son to be returned to his birthplace, the tombs were opened (August 18, 1868). They were found to contain ten skulls and a confused mass of bones, but no remnants could be identified of either Morgagni or his wife³⁶.

In a letter to his friend Bianchi^{27,37}, Caldani said that Morgagni had died a rich man and that all the estate, with the exception of a few silver pieces and some thousand *zecchini* "all rolled up and ready to be sent home", had been transferred to Forlì before death occurred. Caldani added that, in life, Morgagni had accumulated much money, "especially since he always lived like a beggar or a little less".

It is not surprising that the search for a successor to Morgagni was of great concern to the Senate of the Republic. Perhaps the most concerned was Doctor Caldani; the opportunity for which he had waited a lifetime was finally at hand. Running in the contest for the chair were two distin-

guished anatomists of the time, Dalla Bona and Girardi of Parma.

In the end, Caldani did capture the Chair. The throne to which he had aspired for a lifetime was his, but the crown eluded him to the last. The curtain, falling on five continuous and glorious centuries of Italian medicine, was rising again beyond the Alps. In the words of Cruveilhier³⁸, France succeeded fertile Italy as "the classic land of pathological anatomy".

Morgagni was a man of cultivated taste and a scholar of Latin and Greek of unusual distinction. He was able to write with the same ease and fascinating style used in his medical subjects a literary essay entitled, *In aurelium corn. celsum et quintum serenium samonicum epistolae*, a biography of Guglielmini, the distinguished professor at the Paduan university, and, by 1740, a classic study, in two volumes, of the life and work of his mentor, Valsalva. His fourteen *Epistole Emiliane*, or *Aemilianae dictae*, the history of Forlì and the adjacent towns, earned for him a decree (May 30, 1763) from the town Council, stipulating that a bust be erected in his honor in the Town Hall³⁹. Actually, in the end, the bust shrank to the size of a simple medallion, with a flowery testimony to Morgagni's worth.

Morgagni was versed in physics and mathematics, as well as in history and archaeology, and on each of these varied endeavors he left the imprint of the perfectionist. During his early years, in Padua, he was also closely associated with the work of the distinguished astronomer, Giovanni Poleni, whose premature death he much regretted⁴⁰.

Despite the fame acquired through his *Adversaria anatomica*, leading to his call to Padua and to his title, "Prince of the Anatomists", Morgagni would never have succeeded in earning a permanent place among the benefactors of mankind if, toward the end of his life, he had not undertaken the superhuman task of depositing sixty years of observation and unhurried thinking in his *Seats and Causes of Disease*⁴¹. The author, in his own introduction, explains that the book was conceived when he was paying a visit away from Padua and met a most

charming student. This young man, captivated with what he had heard respecting Morgagni's observations on the causes of disease, induced the Master to describe to him, in a series of letters, his medical experiences. This request was granted, and explains the particular literary form of the book. Thus, seventy letters, including the records of approximately seven hundred necropsies, the majority by his own hand, the rest by Valsalva and other friends, were gathered together in a mighty book with which the name of Morgagni will ever be connected.

For some time medical Europe was aware of this new labor of the Master, and, consequently, there was much speculation concerning the content of the book. In this case, Caldani also was informed and this time was fully accurate. In a letter²⁷ to a friend (February 10, 1759) Caldani wrote that he had "information from Padua" to the effect that Morgagni's book was soon to be published and that the book was going to be composed of "anatomical sections, preceded by the history of the disease", and the "pathognomonic signs," from which Morgagni could "foresee the disorder of this or that organ".

Doctor William Cooke, in his 1822 abridgment of the work of Morgagni, expressed the view¹¹ that Théophile Bonet should be recognized "as the forerunner, and in some respects the master of Morgagni, and that Lieutaud, Ruysch, and Baron Haller deserve to hold a place close by his side".

The wide distinction between Bonet and Morgagni rests on the fact that the former was a scholar but not a master, whereas the latter encompassed the qualities of both master and scholar.

Again in the words¹¹ of Benjamin Ward Richardson, the great English physician of the end of the 19th century, concerning *De sedibus*:

To this day no medical scholar can help being delighted and instructed by the study of this wonderful book. To move into it from the midst of the body of current medical literature is like passing from the periodical flux of current general literature to the perusal of the "Pilgrim's Progress," a Shakesperean drama, or "Paradise Lost."

It is a transition from the mediocrity of incessant repetition of well-known truths told in long and hackneyed terms, back to descriptions derived direct from nature and fresh from her treasury.

This treasury encompasses: the description of cerebral gummata and vegetative endocarditis (including a case secondary to gonorrhoea); early accounts of syphilitic aneurysm and acute yellow atrophy of the liver; tuberculosis of the kidney; the first recorded case of heart block; the identification of the clinical features of pneumonia with solidification of the lungs and of visceral syphilis; the demonstration that intracranial suppuration is really a sequel to discharge from the ear, a phenomenon that even Valsalva had believed to be the other way around; additional proof, in support of Valsalva's *dictum*, that the cerebral lesion in apoplexy is on the side opposite the resulting paralyzed side; good descriptions of cirrhosis of the liver and renal calculi; and atrophied kidney and hydronephrosis with ureteral stricture. He recognized also the ulcers of typhoid fever, with the accompanying enlargement of regional lymph nodes, and a "spleen three times the natural size" — a condition that he had frequently seen "after other fevers"⁴².

Unquestionably, Morgagni had seen and assembled in his five books the major facts in the gross representation of disease from head to heel — *a capite ad calcem* — and had succeeded in laying them, in orderly fashion, before a bewildered medical world in one of his greatest classics.

Whereas it would be impossible to survey the factual knowledge contained in the mighty book, one cannot escape calling attention to the two appended indices. They include a list of clinical data with the corresponding anatomic findings, and these, in turn, are correlated with the clinical symptoms. Thus, the indices become a unique catalogue, of both natural historical facts and inductive reasoning.

It would be a mistake to consider the *Seats and Causes of Disease* a book of pathology in the modern sense. It could better be identified, as Caldani perceived even before the book had been published, as a medical work with anatomic explanations of disease symptoms. The uniqueness of the work lies

in its complete correlation between the patient's ailment and the post-mortem revelation. The "anatomical concept" (*Gedanke*), as Virchow called it many years later^{7,8}, had broken the humoral speculation on the essential nature of disease by disclosing its perceptible seat.

The subjects of Morgagni's reports are introduced as people, rather than as case material. Thus, the book becomes the story of the pilgrimage of a physician seeking to penetrate the suffering and anguish of mankind. There is an appealing human touch in the presentation of one of his cases of lobar pneumonia, wherein he writes⁴³ that a Paduan nun was:

seized in the night with fever, with which she first shivered and was cold through her whole body, and after that, grew hot. After an interval of twenty-four hours a pain on one side of the breast was added to the fever, with a cough quite dry and a hard pulse. Death occurred on the seventh day.

Then he proceeded to give the description of the necropsy findings: the lungs were heavy, consolidated, and covered with a thick, white membrane, and, on section, there was the predicted "substance of liver". All this is followed by the epicrisis, with the final conclusion that inflammation of the lungs had been the cause of death. From this time on, the descriptive term "hepatization" was used routinely for the alteration of the lung that characterizes lobar pneumonia.

As Long says⁴⁴ concerning Morgagni:

Merchants, lawyers, thieves, highway robbers, priests and nuns, bishops and princes, share his pages. . . . For example we have his case of a "woman of Padua, by name Jacoba, the wife of Angelo Zanardi. Finding thirteen ribs on each side of her body, I enquired out her name and noted it down, something I am not accustomed to do among the common people".

Morgagni's carrying of such class distinctions into the dissecting room makes understandable his omitting of the name of the prostitute who died of an aortic aneurysm that ruptured in the pericardial sac, with the aorta revealing "in some places the whitish marks of a future ossification, in others, small

foramina and in still others, parallel furrows drawn longitudinally"⁴⁵. Even though nameless, this prostitute occasioned the enduring contribution of one of the finest descriptions of syphilitic aortitis.

The precise method in recording his own observations and the accurate reference to the work of others are indicative of his perfectionism. Bonet, Wepfer, Vallisnieri, Lancisi, Haller, Boerhaave, Meckel, Mead, and many others are quoted again and again, humbly and courteously, and, whenever the occasion arises, he gives credit and pays homage to his mentor, Valsalva.

The book is organized into letters on the morbid conditions of the parts of the body from the head to the heel. What might have been a major weakness in a work designed to correlate symptoms of disease and underlying organic disorder is, at least in part, overcome by Morgagni's intuition that there exist minute connections between parts of the nervous system that may provide the basis for symptoms some distance away from the site of the primary disorder. This concept is illustrated by the case of a middle-aged man, annoyed by frequent attacks of sneezing followed by difficulty in breathing and a feeling of pressure over the chest, who finally died during an especially violent attack. In discussing the reason why the diaphragm should be excited into a sympathetic reaction by the presence of an irritant in the nose, Morgagni casually reminds the reader that the mucous membranes of the nose are partially supplied from the fifth pair of cranial nerves, the small branches of which are connected with the phrenic nerve. Thus, Morgagni, more than a century before Claude Bernard, traced distant reflex nervous action in human physiology⁵.

In connection with a case of epilepsy in which the seizures were consistently accompanied by a fetid odor and a sense of discomfort in the upper abdominal region, Morgagni visualized the existence of nervous connections between the olfactory mucous membranes and the abdominal viscera. The demonstration of these connections was to come much later, with the discovery of the sympathetic nervous system.

That Morgagni was chiefly concerned with the morbid process as a whole and its evolu-

tion, rather than with the static alteration of the organ involved, is illustrated by his anticipation of the role played by the pressure of the blood on the formation of vascular aneurysms. He pointed out that the first noticeable alteration is a degeneration of the inner coat of the artery, followed by the formation of furrows that weaken the middle coat, and, when this occurs, the vessel undergoes dilatation. He realized that these progressive changes are brought about, to a considerable extent, by the pressure of the blood against the arterial wall, and, in support of this concept, he remarked that aortic aneurysms occur most frequently in the arch because of the direct exposure of this portion of vessel to the stream of blood that is projected by the heart. As a logical conclusion, he warned against excess in diet and exercise and mentioned the harmful effect of emotional upsets.

Similarly, in conjunction with his studies on the variations of the pulse, Morgagni visualized, far ahead of his time, that relations exist between the nervous system and the circulatory system. He was cognizant of the fact that circulation may be disturbed by two sets of nervous irritations — one inter-mediated by the pneumogastric nerves, the other through nerves subservient to the arteries. He gave credit to Valsalva for the discovery that functional disorders in the cardiovascular system follow the division of pneumogastric nerves and he also praised Molinelli for modifying Valsalva's experiment by tying, instead of dividing, these nerves.

Richardson¹¹ used a succinct quotation from *De sedibus* and added his own paraphrase to point out that Morgagni was well aware of the dangerous influence of alcohol on the heart's action:

"In persons addicted to drinking, I have known this to occur several times, and in all of them I believe the extreme pulsation was owing to the influence of the nerves, as there were no particular indications of other diseases. . . ." When the heart is flaccid, he asks, how can it occasion a full and strong pulse, except through the influence of the brain and nerves?

In dealing with the rhythm of the pulse, Morgagni recognized two kinds of intermit-

tency. One kind was of long duration and of serious nature, which he considered due to hypoxia; this was the kind of disorder with which Lancisi, according to his own testimony, was afflicted¹¹. Morgagni also recognized another type of intermittency, in which the intermission was brief; this is illustrated by the case of the distinguished professor of physic at Bologna, who happened to discover that once in a while his pulse was intermittent. Morgagni's advice was to tell this patient to take his finger off his wrist and not to inquire too anxiously about his condition. The advice was followed, and resulted in a complete recovery¹¹.

Morgagni's perfect correlation of morbid anatomy with clinical medicine is shown also when he deals with tumors; it appears that he was acquainted with the pathology of all common tumors⁴⁶. He gave accounts of cystic tumors of the ovary with ascites, tumor of the adrenal gland (*ren succenturiatus*), and prostatic, gastric, and esophageal carcinomas. He stressed the difficulty of recognizing pancreatic tumors during the patient's lifetime and he praised Valsalva's acumen in diagnosing rectal carcinomas by the clinical history.

His advice on the treatment of tumors¹¹ is as valuable today as it was in his own time. He recommended removal of tumors by the knife, whenever feasible, as the quickest and safest method when done by a bold and skillful surgeon.

He also anticipated modern surgery's position regarding rectal prolapse, procidentia uteri, and hernia; however, he warned against excessive cranial operations, realizing their poor results and ill effects on the organism in general.

Morgagni's penetrating insight grasped the concept of contagion⁴³. In a wool comber, whose symptoms seem to have been those of pulmonary anthrax, he refrained from opening the chest. He insisted that the bodies of prostitutes should remain a certain length of time before being dissected, and, like Valsalva, he was reluctant to do autopsies on patients who had died of consumption. This position, thoroughly stressed in the section entitled "On the Spitting of Blood", was undoubtedly of the greatest service to the medical world in directing attention to

the tuberculous patient and his part in the spread of the disease.

Like many of his predecessors, Morgagni made no etiologic distinction between gonorrhea and syphilis⁴⁵. In his work on aneurysms, however, he referred to the possible relation to syphilis and he keenly commented that aortic aneurysms occurred more frequently in guides, postilions, and people constantly on horseback than in people of other trades.

Apoplexy greatly intrigued Morgagni, as it did his contemporaries, and, here, also, he made an outstanding contribution, but his progress in this subject was not so revealing as in other topics that he touched. He retained the ancient classification of serous and sanguineous apoplexy and, in doing so, he assigned to this category cases that probably were cerebral softening and cerebral edema. However, he brought additional evidence in support of Valsalva's masterly observation that the paralysis ensuing from cerebrovascular accident occurs on the side opposite the lesion (as I mentioned before). Morgagni also made reference to the role that rupture of small aneurysms of the cerebral vessels (first described by Wepfer and Brunner) may play in the occurrence of cerebrovascular accident, but he put more emphasis on some sort of disorder in the choroid plexus as the most frequent cause of the hemorrhage. Here, his reasoning has a touch of ancient humoral medicine, but, even so, the recital opened new avenues of thought.

Morgagni described a woman who was brought to the hospital with complete loss of senses and no power of motion¹¹. She died within two days, and necropsy disclosed a turgid, congested choroid plexus and a small quantity of clear, fluid material in the lateral ventricles. The clinicopathologic correlation in this case is not clear, but Morgagni's discussion that followed opened the way to the consideration of the degree of compression that the brain can bear before symptoms of compression become apparent. There is a great difference, he said, which is dependent on the part of the brain that undergoes the increase in pressure. He said that if the pressure is localized to a small area of the brain, the effect will be limited and will reveal itself by special symptoms, but if the entire mass of the brain is exposed to

increased pressure, the functional disorder will be of a general nature, and the whole body will be affected, just as in this particular patient.

In another example of apoplexy — an Ethiopian about thirty years of age who died suddenly while playing the trumpet — the sudden demise was attributed to air in the vessels of the brain¹¹. In this case also, the epicrisis was far from being satisfactory, but Morgagni took this occasion to discuss the effect of air in the circulatory system. He mentioned some experiments of Wepfer on the effects of the introduction of air and other gases into the vessels and other experiments of Valsalva and himself, in which ligation of, or injection of various substances in, the carotid arteries was followed by death of the animals, with manifestations of apoplexy. These experiments stressed further his concern with the mechanisms of disease. However, his implication that, in some disease states, the blood undergoes some sort of decomposition, which may result, first, in separation of air, and then in air embolism¹¹, is a reflection that pathologic anatomy had still to contend with the prevailing humoral doctrine.

It is apparent that Morgagni understood the demand for a chemical pathology, as well as the value of experiments. The experiments that he performed were of a very simple nature, and the results were often proportional to the effort.

Apparently, tasting of organ secretions was part of the routine of a carefully performed post-mortem examination⁴⁷. This had been done by Malpighi, Valsalva's teacher, in the fluid of hydrocele sacs. In the case of a woman with a fistula tract that extended from the right lobe of the liver to the iliac bone⁴⁷, Morgagni mentioned that Valsalva tasted the fluid, which was bitter and clotted when exposed to heat. Morgagni mentioned elsewhere that Valsalva exposed to heat serum from the abdomen of a little old lady and noted that it became cloudy on boiling, whereas fluid from an ovarian cyst did not clot after exposure to either heat or acid solutions⁴⁷.

Morgagni also described⁴⁷ a more complex experiment performed by Valsalva on fluid matter found at the center of a renal mass.

The fluid was divided in three equal portions; one portion was submitted to heat, another to sulfuric acid, and the third to ammonia salts.

Morgagni himself, despite his precautions, did not resist the temptation of tasting the humors. He mentioned that he tasted the fluid contained in cysts of the spleen of pigs and found that it was sweet. In dealing with jaundice, he crushed gallstones and exposed them to the effect of heat and of various chemical agents⁴⁷.

Morgagni's interest in the disorders produced by poisons made him fully aware of the importance of the finding of a rust-colored bile in the stomach and intestine of a boy (the son of the painter Francesco Ridolfi) who had died of tertian malaria⁴⁷. Morgagni noticed that the blade of the knife that he was using for the dissection had assumed a violaceous tinge, and so, with the same knife, he instilled the rusty bile under the skin of two pigeons. Both pigeons died soon afterward, with convulsions. Then Morgagni gave the same material to a rooster, which then died in the same way. Morgagni thus provided the standard for a controlled experiment by using parenteral and enteral inoculation.

The *Seats and Causes of Disease* was not the last labor of the great master. Close to his eightieth birthday, with the assistance of Antonio Larber (an *archiatro*, or principal doctor of the Court)^{48,49}, Morgagni undertook the task of gathering material for his *Opera omnia*, which, in five volumes, saw the light several years later, in 1765⁴⁸. Again, it is impossible to survey the factual knowledge contained in his last daring project. Here he deposited his innumerable observations and experiences that had not been placed in his previous distinct studies.

Morgagni's three *Responsi medico-legali* are as much revealing as his clinicopathologic correlations — for instance, his recommendation to Pope Benedict XIV to permit the performance of Caesarean sections in women dying during pregnancy, in order to attempt to save the infant⁵⁰. In this respect also, the reader finds anticipation of what is supposedly medical thinking of a more recent time.

Although Morgagni did not revolutionize

pathology, as did Bichat or Virchow⁴², he did far transcend the limitation of his times. His irrevocable and priceless contribution to medicine lay in his method of co-ordinating clinical medicine and morbid anatomy, to their mutual benefit, and, because of his stringent methodical standards, neither science would ever be approached superficially or cursorily again.

With his limitless vision and his capacity to stretch the horizons of men's minds, Morgagni conceived the guiding principle of looking for the "seats of disease", and, in so doing, provided the basis for the future development of two other disciplines — physical diagnosis and roentgenology² — on which rest the foundations of the medical practice that we know today.

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