

## Giovanni-Battista Morgagni (1682-1773): creator of pathological anatomy

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*“For those who have dissected or inspected many, have at least learned to doubt when the others, who are ignorant of anatomy, and do not take the trouble to attend to it, are in no doubt at all”.*

*De Sedibus et Causis Morborum,*  
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### Summary

*The great anatomist Giovanni-Battista Morgagni by his major textbook De Sedibus is the creator of pathological anatomy and the one who rendered this new discipline an indispensable specialization of modern medicine.*

**Key words:** anatomist, initiator of morbid anatomy, Morgagni

### Life and career

Morgagni was born at Forli, Italy, on 20 February 1682. Son of Fabrice and Marie Fornielli, Morgagni (Photo 1) manifests exceptional natural dispositions for the study of literature and sciences. He satisfies his greed for knowledge thanks to an incredible memory.

Educated at the University of Bologna, he graduated in philosophy and medicine in 1701. His teachers were Antonio Maria Valsalva (1666-1723), Albertini, Jacques de Sandris, and Marcelo Malpighi (1628-1694), who was one of the first to use the microscope for the study of living tissues. The latter passed on Morgagni his enthusiasm for anatomical research, but all of them stress the exceptional value of their young disciple. Morgagni became prosector under Valsalva, whom he admired for the rest of his life. When Valsalva left

Bologna for Parma, Morgagni succeeded him as demonstrator of anatomy. In 1706 he commenced a series of anatomical publications under the title of *Adversaria Anatomica* (Photo 2), which gave him an European reputation as an anatomist. In 1712, he was called to be professor of anatomy at Padua, a position he held for 56 years. Shortly after settling in Padua he married Paola Vergieri of Forli, with whom he had 15 children.

Distinguished doctor of a robust forming, big in size, and a happy expression, Morgagni was estimated by princes (Charles-Emmanuel III, king of Sardinia; Joseph II, emperor regent etc.), by other personages



**Photo 1.** Portrait of Morgagni, published in his *De Sedibus* (1761). Paris, Bibliothèque du Muséum National d'Histoire Naturelle.

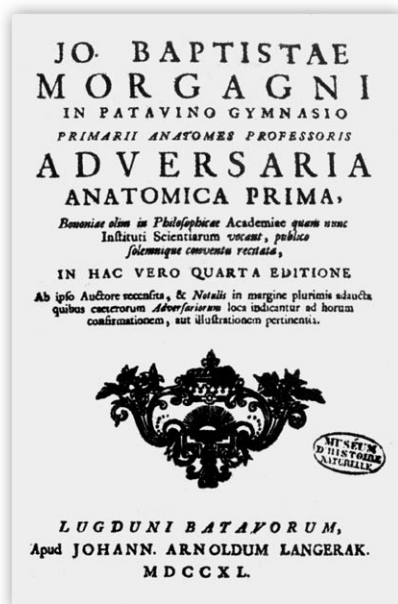


Photo 2. Frontispiece of his *Adversaria anatomica prima*.

(Popes Clement XI, Clement XII, Benoît XIV) and by the most famous scholars of his time [1].

Morgagni was beloved both by his colleagues, who showed no envy of his rapidly increasing stipend, and his students. His teaching enjoyed an extraordinary success and his works were widely spread. His students informally called him « His anatomical Majesty ». His international popularity amongst scientific workers was indicated by his election at the age of 24 as a member of the Accademia Naturae Curiosorum; the Royal Society (1724); the Academy of St Petersburg (1735); and the Berlin Academy (1754) [2].

All these honours came to him before he had produced his greatest work *De Sedibus et Causis Morborum per Anatomen Indagatis* (1761) (Photo 3) [3].

The chair of anatomy at Padua, which Morgagni held with such distinction, was perhaps the most revered medical professorship in the world. Indeed, his predecessors there had included Andreas Vesalius (1514-1564), Realdo Colombo (1510-1519), Gabriello Fallopio (1523-1562) and Girolamo Fabricius of Aquapendente (1537-1619). He was one of the pioneers in medicine who gained full recognition while still alive [4].

In 1763 in his native town a statue to his honour was raised. He died in full glory on December 6, 1771, after a myocardial infarct [5].

### Between dissection and autopsy

Morgagni begins his work next to his teacher



Photo 3. Frontispiece of his *De Sedibus*. Paris, Bibliothèque du Museum National d'Histoire Naturelle.

Valsalva. The student prepares for his teacher, with great care, the anatomical pieces. Anatomy owes him the structure and form descriptions of a great number of organs. Not a single part of the human body escapes this inveterate anatomist.

His works are more than an elementary description. The dissection of bodies offered to the University, bodies of healthy young men (many of them criminals), allowed to specify normal anatomy. However, the comparison of healthy organs to organs affected by a disease remains an indispensable stage for a better understanding of morbidity. Morgagni is the first scientist to be convinced of such a fact. The signs observed before death and the specific post mortem lesions explain one another. Thus, he demonstrates that apoplexy is caused by a vessel lesion, not by a cerebral alteration.

His writings offer a presentation of his experiences, methods, and researches in an attempt to systemize the disorderly medical conceptions of the 18th century. In nice latin *Adversaria anatomica prima*, reunites the complete inventory of his anatomical observations. Adhering to the traditional order, as it was adopted since Antiquity, beginning by the head and ending with the feet no internal organ escapes

him. Many of his conclusions will contribute to the creation of legal medicine.

In 1711, following the composition of a commentary regarding Eustachio's anatomical table, Morgagni is taken up with the drawing of his own tables. Presented in the form of 66 letters for the benefit of a young doctor, he becomes aware of the experience gained after having performed more than 700 autopsies [1].

## Justified Pathological Anatomy

In his letter « to Guillaume Bromfield, a very experienced surgeon in London », Morgagni (Photo 4) begins by mentioning the difficult early stages of anatomical dissections: « In ancient times, since it was not permitted to dissect human cadavers, Hippocrates or his early successors, would look for the source and cause of the diseases in the animals' entrails. Galen, and other doctors before and after him, observed this practice which became even more frequent in modern times. Some centuries after him, during a pest, the same practice was carried out in Constantinople by doctors who used this way to look for the causes and various symptoms of the diseases. However, since granting permission for this practice, which finally was agreed in Italy and became imperceptibly more and more frequent, it becomes evident by the works before the end of 15<sup>th</sup> century or after the beginning of the next one, that our ancestors were very eager to make the same researches. The writer, therefore, progressively guides his readers to an evident finding, that is based to the fact that dissections are necessary but not sufficient for better understanding the diseases. Thus, arises the necessity to compare clinical signs before death to organ lesions» [6].

If the expression «anatomical pathology» is attributed to Hoffmann, it is though Morgagni the one who rendered this new discipline an indispensable specialization of modern medicine.

For a long time, Morgagni thought that it was necessary to perfect or even rewrite Bonet's *Sepulchretum* which appeared in 1679. The project was excellent, *Sepulchretum* or *anatomy in practice, started by examining diseased cadavers, presented the history and the observations of almost every affection of the human body and revealed their hidden causes*. It is evident that the title itself provides a whole syllabus. As Morgagni himself mentions, it is a compilation «of everything that can be found during the dissection of diseased cadavers, set in such order that forms one single body; in such a way that what used to be scat-



Photo 4. Portrait of Morgagni, published in his *Adversaria anatomica prima* (1740).

tered in the infinity of volumes and was of little usage, today, joined and coordinated, offers the greatest of advantages ». However, there are several downsides. Not everything is clarified; Doctors' observations of that time are absent, unnecessary mentions are included and repetitions are quite often. It often lacks critical thought and healthy bodies are mistaken for diseased ones. But Morgagni mainly criticises two points. Bonet is ignorant of the fact that a disease is a whole, which is in turn translated to a primary affection and secondary ones.

Therefore, *Sepulchretum* needs rewriting. Morgagni chooses the task of epistolary, as according to him, letters are a form of personal treatise. Morgagni has a philological thought. He needs to transform, to modify the texts that he corrects by adding his observations. In this sense Morgagni needs Bonet because it is through Bonet's defects that *De Sedibus* is created, a work that maintains as much tradition as fantasy. The work is divided in 5 books that each one of them is preceded by a preface for the benefit of a representative of each one of the foreign Academies where Morgagni was accepted.

Morgagni mentions the objections to opening up human cadavers: « In cadavers we can find lesions that were operated only during or after death.

*In certain cases these lesions are more the result of a mistreatment rather than the result of a disease; finally, in other cases, they are not the cause but the result of the disease, in such a way that often death occurs not as a result of the disease itself but by its effects* ». Initially he proposes a systematic practice of cadaver autopsy, the number of autopsies, and then he proposes to pay extra attention to the circumstances that preceded the affection, look for the symptoms' sequence and order. Of course, it is imperative to continue to open up healthy cadavers and make comparisons. Morgagni is absolutely persistent on the «*history*», meaning on the systematic and well-ordered description. It is important to describe everything related to the causes that preceded the disease, the symptoms or the lesions of the parts observed in the cadaver. Morgagni's medical culture is immense and doctors of past times constantly referred to it. A fast calculation allows us to interconnect the authors cited in *De Sedibus* : Hippocrates 87 times, Celsus 74 times, Galen 57 times, Caelius Aurelianus 24 times, Aretaeus of Cappadocia 15 times, without counting citations of Oribase, Musa, Scribonius, Varron...

*«We affirm that the nature of a disease or its causes could never have been put forward if it wasn't for dissections of cadavers that really guarantee them»*. This is a statement that Morgagni had already made back in 1712. What was really needed was a man dedicated to normal anatomy and to its practice. The history of the disease is equally important. Anatomy of diseased cadavers is the description of all modifications that can be attributed to one deadly cause, through what is visible to the practitioner. Thus anatomy is only conceived in relation to certain standards. Form distortions, transformations, displacements, alterations, all of the above constitute an exit from post-mortem semeiology that either confirms or undermines the semeiology of lifetime. Morgagni, whenever possible, compared the results that he had observed before death to the autopsy results. Because, in reality, what the anatomist of a diseased cadaver does is to indulge in a semeiology. *«Even the most acknowledged doctors confirm that for every disease, there are hardly three or four persons who featured their pathognomonic signs, something that distinguishes them from all the rest, whereas all the other (diseases) can only be recognized by the collection of all the signs, because virtually always they do not depend on a simple cause that affects only one part... Without normal anatomy, there wouldn't be pathological anatomy, without these two anatomies there wouldn't be any specific or rational diagnosis, any source or nature of the affection...»*. Morgagni

was the first to make such an acknowledgement. Pathological anatomy also serves to confirm the first: *«As if the second one did not work marvellously, not only to confirm the usages of parts but to make them clearer, based on a lesion of a certain part that coexists with the disturbances of a function »*[7].

## The rise of Pathological Anatomy

Since Vesalius, the idea had grown that the good practitioner must be proficient in gross anatomy. An inevitable consequence was that increased attention began to be paid to the connexions between the sick body and the disease signs afforded by the corpse. Anatomy, in other words, paved the way for pathological anatomy and new skills in reading pathological signs in the cadaver. Post-mortem investigation would show the changes brought about within the body by disease (not least, cause of death), and give insight into the sources of the deceased patient's symptoms and signs.

The trail was blazed by Morgagni. Building on earlier necropsy studies by Johann Wepfer (1620-1695) and Théophile Bonet (1620-1689), Morgagni published his great work *De Sedibus*..., which surveyed the findings of some 700 autopsies he had carried out [8].

In *De Sedibus*, the foundation-stone of pathological anatomy, Morgagni demonstrated that diseases are located in specific organs, that disease symptoms tally with anatomical lesions, and that pathological organ changes are responsible for most disease manifestations. It was Morgagni who thus finally clinched the direct relevance of anatomy to clinical medicine. Morgagni followed a largely empirical method in morbid anatomy, believing that repeated observations improved the reliability of the results [9].

The study of the anatomy of diseased organs was not new, but it could not become a science until normal anatomy had been established. This Leonardo da Vinci (1452-1519), Vesalius, and their successors at Padua had achieved in the 16th century. During subsequent years many collections of abnormal or morbid anatomical findings had been made, the earliest being those of Antonio Benivieni (1440-1502) in Florence. William Harvey (1578-1657), too, collected many such observations. Post-mortem examinations were reported by such men as Frederik Ruysch (1638-1731) in Holland, by Raymond de Vieussens (1641-1715) in France, and especially by Théophile Bonet in his *Sepulchretum*..., which was a survey of 3000 autopsies made since classical times. Morgagni saw himself as improving on Bonet's work by adding to it his own 700 post-mortem descriptions [4].

## His works

In 1761, in Venice, Morgagni publishes in latin his great masterpiece, *De Sedibus*, the first work of pathologic anatomy which did not include any illustrations and was only concerned with macroscopic pathologic anatomy, since it seems that Morgagni had never placed a single tissue under the microscope. It contained no less than 700 case histories and pathological appearances and included many discoveries. This brilliant work enjoyed a great success. The book had been reedited 7 times until 1825 and translated 3 times in other languages [10].

According to its author, *De Sedibus* was written by chance. This is how: « *After the publication of Valsalva's writings on anatomy and of my relevant notes, I left Padua, during the summer as I used to do at that time. During my vacation I frequently enjoyed the company of a young man, of excellent character and much will for the study of all sciences, mainly those relating to medicine. He read those writings and notes and from time to time encouraged me to have a conversation, which I found immensely agreeable, on my teachers Albertini and mainly Vésale, as he wanted to know every small detail of their practice* ». During those conversations, the young man, named Lelius, begged Morgagni to put on record his own observations: « *I was to write with familiarity, as I wished, and add in my writings the subject of our conversations and other similar things, that even though were meticulous did not cease to please him. What was I suppose to do? I couldn't resist...* »

This is how at the age of 79, Morgagni, describes the circumstances that pushed him to write this monumental work. Every autopsy account of his, every patient that he had treated, carried their own number what gained him a lot of precious time.

Morgagni's work was enormously vast. It was also very lasting and in 1894, Virchow, the greatest anatomopathologist of his century, praised him vibrantly. A habit that all medical students shared proves Morgagni's unequalled popularity: when they wanted to say in front of non medical students that they would perform an autopsy, they would say let's meet « *at Morgani's* » [11].

Morgagni's *Epistolae Anatomicae* were published in Venice as an appendix to the 1740 edition of Valsava's treatise. They were based on independent research and conscientious verification and gave full credit to Valsava.

In his anatomical studies Morgagni described: adipose tissue, the muscular structure of the oesophagus, that of the celiac cavity (Morgagni's frenum and

reticle), at the rectum level the valves and columns which bear his name. He described, too, biliary tract, muscles, arteries, hyoid bone, uvula, pharynx, tongue, epiglottis, sebaceous and lacrimal glands, bladder, uterus, vagina, female genital organs, ventricular bands. He elaborated on the structure and function of the laryngeal ventricles. He also described in pairs, the arytenoid glands, in form of capital L [12].

Among individual entities first clearly identified by Morgagni were hepatic cirrhosis, renal tuberculosis, syphilitic lesions of the brain, and pneumonic solidification of the lung [13]. He also described the echymoses, the multiple erosions and the atrophies in the area of the gastric muscular structure [14].

Morgagni resolved many misunderstandings, such as the idea that a brain abscess was an effect – rather than a cause – of pus formation in the ear, and that paralysis in half of the body was due to an injury in the opposite brain hemisphere. In experimental pathology, too, he was a pioneer. He benefited surgery directly by investigating the results of tying off various blood vessels. Likewise, he described several malignant tumours and gave advice for operating on them, even though he himself never practised surgery.

He laid bare divers disease conditions, including syphilitic aneurysm, syphilitic tumours of the brain, acute yellow atrophy of the liver, and tuberculosis of the kidney. He showed the clinical features of pneumonia, and demonstrated that intracranial suppuration is a sequel of discharge from the ear.

Morgagni established the dictum of his teacher, Valsalva, that, in stroke, the cerebral lesion is on the opposite side from the resulting paralysis [8].

The credit for understanding and demonstrating the significance of prostatic hyperplasia goes to Morgagni. He made a distinction between abscess of the prostate and prostatic hyperplasia, which he thought must be either a preternatural tumor or a growth of the prostate and he favored the latter opinion.

His observations of abnormal prostate included « *a tumour so hard that when cutting it with a knife, it felt as if it were cartilage or ligament* », and « *glands of the prostate which invaded the bladder and glands of the same kind in the patient's groins* » – a case of carcinoma with lymph gland involvement. He also found two varieties of calculi in the prostate [15]. He described the lacunae of the urethra, *foramina*, so well that nothing of note has since been added [15, p 59].

Morgagni was the first to use the term *gonorrhoea* and he distinguished this condition from spermatorrhea and from other types of urethritis or *false gonorrhoea*. He disproved the concept of ulcerations in gonorrhoea [15, p 60]. His observations disproved the

theory of caruncles and carnosities. He considered that caruncles were extremely rare but often noted «*scars projecting into the urethra, like pale cords directed obliquely in the middle of the urethra towards its posterior part; these fleshy fibres have been able, soon after their formation, to form excrescences and give the illusion of caruncles*» [15, p 68]. In the works of Morgagni, most of the diseases affecting the kidneys known today are described. He observed solitary kidney, compensatory hypertrophy in unilateral disease, the frequent absence of local pain even in advanced lesions, and the lobulated surface of certain kidneys «*full of humours (pyonephrosis and hydronephrosis) which irritate the walls*». He noted the hematuria and edema of nephritis [15, p 82].

Morgagni was also the first to describe enlarged prostates which could refer to carcinoma of the prostate. He used the terms *seminal vesiculae* [15, p 439].

## Discussion

The rise of pathological anatomy made anatomy more immediately relevant to medical theory and practice. Morgagni sought signs in specific organs that he believed were the seats of disease [16].

Morgagni created around pathological anatomy, a concrete system of thought which in turn would lead in a rational medical nosology. Morgagni perfects the search for exactness of the disease by creating a coherent whole including the cause and the anatomic lesions. If Hermann Boerhaave (1668-1738) is the initiator of anatomico-clinical method, Morgagni is the real creator of that system which allowed, in the dawn of the 19th century, to regularize medical thought by offering an even more sophisticated classification and nosology.

Morgagni puts us in front of an intellectual course, opposite to that of Boerhaave who sought in cadavers the cause of the disease that he had observed and treated before death. Morgagni was the first amongst modern anatomic pathologists to associate the lesions observed in the cadaver with clinical semeiology. This is an anatomic pathologist's practice and Morgagni insists on the fact that those cadavers, destined for anatomic verification, should be accompanied by a description of the disease, as detailed and thorough as possible, in order to clearly prove the relation between anatomic lesions and clinical symptoms.

Morgagni's great achievement was the union which he effected between anatomy and pathology on one hand, and clinical medicine on the other. Medicine

was thus transformed into a rational, exact science.

The development of morbid anatomy by Morgagni, with its conviction that post-mortem dissections would reveal disease lesions, eventually crowned the New Philosophy's confidence in structural/functional correlations and in the value of anatomical and physiological investigations [9, p 375].

Morgagni laid down the principles of modern pathology and in his major textbook he carefully described each patient's case history, the events leading to the final illness and death, and then the detailed results of the post-mortem examination with an attempt to explain how the symptoms were the results of the pathology [17].

Often his description of a disease clinical course and pathological anatomy is so exact and clear that we can easily diagnose it today.

## Epilogue

Morgagni's work disposed of the ancient humoral theory of a single morbid cause for all disease and established the concepts and methods of study which provide to this day the basis of medical investigation and teaching.

Morgagni's influence in the medical profession of his time had been considerable and his popularity made him recognizable throughout Europe. For some, even today, Morgagni is the most important medical personage of the entire 18th century.

Distinguished successors to Morgagni were the Scott Matthew Baillie (1761-1823) and the Frenchman Xavier Bichat (1771-1802). Bichat shifted the focus of morbid anatomy to the tissues that make up organs rather than the organs themselves. Without the use of a microscope Bichat succeeded in identifying 21 different tissues. His insistence that tissue was the prime element in the study of pathology facilitated the transition from Morgagni's theory of organs as principal components of the body to the doctrine of Virchow that the cell was the basic unit [18].

All three men moved toward thinking in the opposed categories of normal and abnormal, and all believed with Bichat that opening corpses would supply solutions to medical puzzles.

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