

A GLIMPSE OF OUR PAST

Giovanni Filippo Ingrassia: A Five-Hundred Year-Long Lesson

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Giovanni Filippo Ingrassia was born five centuries ago in Regalbuto, a small town in the center of Sicily. After his medical course in Padua, under the guidance of Vesalius and Fallopius, he gained international fame as a physician and was recruited as a Professor of human anatomy in Naples and later in Palermo. He is remembered as “the new Galen” or “the Sicilian Hippocrates.” He contributed to the knowledge of human anatomy through the description of single bones rather than the whole skeleton. In particular, he was the first to describe the “stapes,” the “lesser wings of the sphenoid” and various other structures in the head (probably the pharyngotympanic tube) as well as in the reproductive system (corpora cavernosa and seminal vesicles). He was also a pioneer in the study of forensic medicine, hygiene, surgical pathology, and teratology. As Protomedicus of Sicily, he developed the scientific culture in this country. During those years, he faced the spread of malaria and plague with competence and authoritativeness. Indeed, he was one of the first physicians to suppose that certain diseases could be transmitted between individuals, therefore, introducing revolutionary measures of prevention. He is remembered for his intellectual authority and honesty. Five-hundred years after his birth, his teaching is still alive. In this article, we survey the life and contribution of this pioneer of early anatomical study. *Clin. Anat.* 23:743–749, 2010. © 2010 Wiley-Liss, Inc.

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HISTORICAL INTRODUCTION

Human anatomy is an old discipline that has applied direct observations through the dissection of bodies, in particular those of animals, for centuries. Human dissection was prohibited by monotheist religions for centuries (Gerbino, 2005). Nevertheless, from the late Middle Ages to the beginning of the Renaissance, anatomists began violating the prohibition first clandestinely and then openly. Beginning in the 14th century, human dissection was officially allowed in faculties of medical studies (Sterpellone, 1990). From that moment on, human anatomy progressed greatly first in Italy and then in the rest of Europe.

The modern study of anatomy began in Bologna in 1300 with Mondino da Liuzzi, who used dissection for the comprehension of human body (Giorgi, 2004). During the following three centuries, illumi-

nated scientists, such as Leonardo da Vinci (1452–1519), Andrea Vesalius (1514–1564), and Marcello Malpighi (1628–1694), improved and developed anatomical knowledge. In the same period in Italy a new theory, the iatromechanics, looked at the human body as a set of systems with specific structures and corresponding functions. This negatively impacted the ancient “mood” of Hippocrates and the “spirits” of Aristotle and Galen, as well as changed the theoretical and practical bases of sci-

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Fig. 1. Portrait of Giovanni Filippo Ingrassia, as reproduced in the back of the inside cover of the book *In Galeni librum de ossibus doctissima et expectatissima commentaria* (see also Fig. 2). [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

tific research, suddenly illuminated by the Galilean method and the medical discoveries by Malpighi and his contemporaries (Webster, 1984). Unfortunately, this scientific Renaissance (preceding Renaissance art by a century) soon left Italy. On one hand, the control exercised over the Mediterranean by the Turks in the 17th century and the development of bourgeoisie and mercantile colonial culture made Italy poorer. Therefore, Italy was not able to become a modern Nation-State like France, England, and Holland. In the 17th century, Italy lost its lead in science, and scientists often began working in indifference, when not in hostility, toward the environment.

Giovanni Filippo Ingrassia (Fig. 1) was born in Regalbuto (in the current Province of Enna), Sicily, in 1510 and died in Palermo in 1580. He was one of the most famous Italian physicians of the 16th century. Much has been said and written about this intellectual man, defined as “a scholar of the human body,” “a glory of sciences,” and “an example of humanity” (Marchese, 2006). In this article, significant data from his biography (Table 1) and works (Table 2) are described.

Biographical Sketch

Ingrassia lived in a period of great cultural revolution, as scientific theories changed from the classic approach to the Galilean method (Germino, 2006). He grew up in a well-educated family, his uncle and his brother influenced his classical education, and learned Latin and Greek; he joined the group of the Accademici Accessi of Palermo when he was still very young (Li Voti, 1989). During this time, he met Giovan Battista De Petra, a renowned Sicilian physician, who trained him with animal dissections (Valenti, 1995–96).

From 1532, Ingrassia attended the University of Padua, which was considered the most important Italian University at the time, studying with outstanding intellectuals, such as Realdo Columbus and Bartolomeo Eustachius, and was taught by both Gerolamo Fracastoro and most notably, the legendary Andrea Vesalius. He took his degree in 1537 “with such expressions of high esteem by the Faculty to earn him a great reputation throughout Italy” as reported by Pitré (1913).

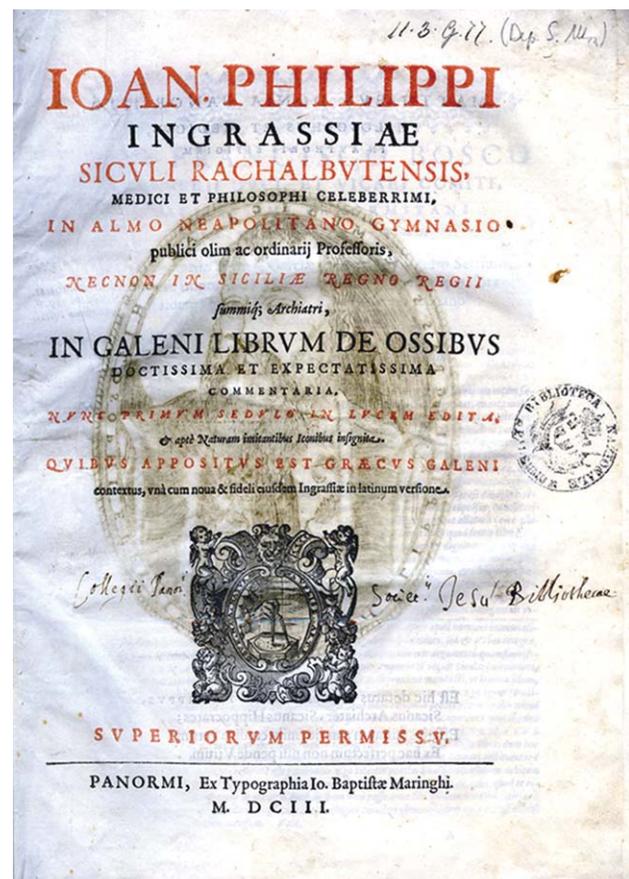


Fig. 2. Inside cover of the book *In Galeni librum de ossibus doctissima et expectatissima commentaria* published 13 years after Ingrassia’s death and edited by his nephew Matteo Donia. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

TABLE 1. Brief Biographic Notes on Giovanni Filippo Ingrassia

Date	Note
1510	He was Born in Regalbuto, Sicily, currently in the Province of Enna
1532	Fellow at the University of Padua, he attended lessons and dissections by Andrea Vesalius
1537	He took the degree in medicine
1540	He worked in Chiusa Sclafani, in the current Province of Palermo, and was employed as the personal physician of Isabella di Capua, wife of the viceroy of Sicily, Ferdinando Gonzaga, by Conte Alfonso Cadorna
1544	While accompanying Isabella di Capua from Chiusa Sclafani to Mantova, he visited Naples. His fame induced the viceroy Garsia Toledo to recruit him at the University of Naples as a teacher of Anatomy and Theoric and Practic Medicine
1556	He was recruited in Palermo as a Lecturer of Medicine and Anatomy at the Studium of San Domenico
1562	He healed Don Giovanni D'Aragona, Duke of Terranova, from a suppurated wound at the left hemithorax, already unsuccessfully cured by Vesalius and Eustachio. This event gave him an even greater national fame
1563	He became the Protomedicus of Sicily
1563–1565	He successfully treated key members of aristocratic families
1575–76	He managed the plague epidemic in Palermo
1580	He died and was buried at the Chapel of Santa Barbara, in the Cloister of the Church of San Domenico, in Palermo

After his studies, he became the personal physician to don Alfonso de Cardona, Earl of Chiusa Sclafani, a small town near Palermo (Marchese, 2006) and, in 1544, was recruited as professor of human anatomy at the University of Naples (Table 1); there, he dissected numerous cadavers and started studying human bones. All of these studies were reported in his *In Galeni Librum de Ossibus Doctissima et Expectatissima Commentaria* (Table 2 and Fig. 2), one of the finest anatomy volumes ever written, edited by Ingrassia's nephew, Matteo Donia, after his uncle's death, and published in 1610 thanks to the contribution of the Senate of Palermo (Dollo, 1984). In his

treatise, Ingrassia criticized the *De Ossibus* by Galen, particularly, demonstrating that it described monkey versus human bones (Spedalieri, 1817). However, the posthumous publication of this treatise did not allow for proper acknowledgment of his findings.

Ingrassia started working in Palermo in 1556 when the Viceroy, Giovanni De Vega, employed him as a lecturer of Medicine (Insegna, 1842), establishing his workplace in the monastery of Saint Domenico, in the center of the ancient Palermo, where he would also be buried after his death. He taught anatomy by lecturing about four of the most studied and contested authors, namely Hippocrates, Galen, Avi-

TABLE 2. Main Works by Giovanni Filippo Ingrassia

Title	Year of publication	Place of publication
<i>Iatropologia</i>	1544	Venice
<i>Scholia in iatropologiam</i>	1549	Naples
<i>De tumoribus preter naturam</i>	1553	Naples
<i>Ragionamento fatto sopra l'infermità epidemica dell'anno 1558</i>	1560	Palermo
<i>Trattato assai bello et utile dei doi mostri nati in Palermo in differenti tempi</i>	1560	Palermo
<i>Constitutiones et capitula nec non jurisdictiones regii protomedicatus officii Siciliae</i>	1561	Palermo
<i>Quaestio utrus victus a principio ad statum usque procedere debet sub riliando.</i>	1568	Venice
<i>Quaestio de purgatione per medicamentum atque obiter etiam de sanguinis missione, an sexta die possit fieri</i>	1573	Venice
<i>Galenus ars medica</i>	1573	Venice
<i>De frigidae potu post medicamentum purgans epistola</i>	1575	Venice
<i>Informatione del pestifero, et contagioso morbo: il quale affligge et have afflito questa città di Palermo et molte altre, e terre di questo Regno di Sicilia, nell'anno 1575 et 1576</i>	1576	Palermo
<i>Methodus dandi relationes pro mutilatis torquendis aut a tortura excusandi, pro deformibus venenalisque judicandis; pro elephantiacis, extra urbem propulsandi, sive intus urbem sequestrandis, vel fortassis publice conservari dimittendis</i>	1578	Venice
<i>In Galeni librum de ossibus doctissima et expectatissima commentaria</i>	1603	Palermo

TABLE 3. Excerpt From *Iatropologia* (Venezia 1544, p 251–252), Where Ingrassia Criticized the Decline of Medicine and Advocated a Return to a Time When Theory and Practice (Medicine and Surgery) Depended on Physicians and Apothecaries

<<And, certainly, medicine has not only had a little misfortune but it has also been shipwrecked by forgery and barbarism, as well as being entirely corrupted and brought deep down in such a condition. Once, indeed, physicians did not use hands just for cutting, burning and performing other such treatments; in fact, there were also perfumers and bleeders; each of them used to prepare homemade drugs and evaluate such preparations, using them at will, according to the type of diseases after considering whether they were needed or not. Everyone gathered raw materials on their own or bought them from excellent, erudite apothecaries. ... In my opinion, in the last fifteen years or so, such tasks have been devolved – not without detriment and considerable danger for the patients – to other figures, who actually ignore grammar and sometimes even the teaching of their fathers. In fact there are three categories that could be defined as surgeons. These are perfumers, barbers and all of those who – apart from surgeons, of course – carve either heads or tombstones. Oh, God, so much human suffering has been caused by the vainglory of contemporary doctors. Indeed, surgery has been abandoned to some inexperienced, empiric physicians, most of whom are not only lacking in dogma, but also in what relates to the Art. Yet we pride ourselves on living in such conditions: and those (who do believe not to ignore anything), so pompous do not want to learn anything new>>.

cenna, and al-Razi (Cerami, 1932). However, he maintained a critical perspective on each of these authorities (Dollo, 1984). For example, in his work *Iatropologia*, he strongly supported the idea that medical and surgical branches had to be integrated into a unique discipline to prevent the application of surgery by unqualified people (Table 3).

In the latter part of his life, he had several political charges: in 1563, he was made Protomedicus of the Reign (please ask the authors if they mean “King”) of Sicily, and, in his capacity as authority-in-charge of public health care, he expressed a strong wish for the constant education of physicians and suggested that they should “attend dissections every 5 years in the cities of the Reign (please ask the authors if they mean “King”)” otherwise risking the title of “imperfect and ignorant physicians” (Cerami, 1932).

During these years he wrote treatises on infectious diseases and their treatment, which earned him the reputation of a pioneer in the fields of both legal medicine and public health (Bilancioni, 1915; Salomone Marino, 1887). He always insisted that medicine be considered a scientific discipline, aiming at achieving objective knowledge to avoid subjective interpretations and guarantee the best treatment (Table 4). In the next paragraphs, we report Ingrassia’s main discoveries and observations mostly regarding human anatomy and dating back to his academic period in Naples.

Researches in Osteology

Vesalius is presently acknowledged as the first scientist to study osteology by using human skeletons, rather than those of animals, and describing both the anterior and posterior sides. Additionally, Ingrassia should be considered the first to study the details of single bones or homogenous groups of bones (Spedalieri, 1817). Particularly, he described several parts of each bone to improve their identification and anatomical description and to introduce functional correlations (Fig. 3).

Ingrassia’s studies focused mainly on the skull (Pinero, 2002). Galen had previously identified six cranial bones (the upper and lower jaws, as well as the parietal, temporal, frontal, and occipital bones), whereas Vesalius and Columbus had distinguished two more segments (the ethmoid and sphenoid bones). Ingrassia’s observations added numerous details to each of these bones: he depicted the lesser wings of the sphenoid, still called the *processes of Ingrassia*, as well as the *crista galli*, the cribriform plate, and the perpendicular plate of the ethmoid (Finger, 2001; O’Malley, 1970; Spedalieri, 1817); moreover, he isolated the inferior nasal concha from the upper jaw, and he was the first scientist to describe the sutures of the skull (O’Malley, 1970), the frontal sinus, the pterygopalatine fossa, and several foramina of the skull (Spedalieri, 1817). He also accurately depicted the occipitoaxial and temporo-mandibular joints. Additionally, he was also the first to hypothesize that the paranasal sinuses have an important function in phonation rather than “attracting air for nourishing vital spirits, as well as in purging blood flowing to the brain,” as Colombo had previously asserted (Spedalieri, 1817).

Ingrassia also described some differences between human and animal bones with regard to the vertebrae, sternum, and clavicles, adding some functional considerations to morphological details. For example, he reported that the maxillary bone is

TABLE 4. Excerpt From *Quaestio utrus victus...* (Venezia 1568, p 57)

<<Who would not greatly wonder at doctors obtaining contradictory results? It would be the same if, looking at something very white, it were red to me, green to another person, and perhaps white to someone else. Many contradictions of this kind occasionally occur among physicians. This is indeed... worthy of wonderment. In fact, if among philosophers there are many controversial views such as whether the world is just one or more, or whether it was created or eternal, and so on, it is no wonder that in our experiments everything is subjective. And that is the reason why there are many things we cannot assess at all, and others need to be carefully thought of. And it is actually the same for treatments that could either help or harm patients. If treatments turn out to be useful, they must be appreciated and made well known; otherwise if they are detrimental, they should be avoided and rejected. Instead, treatments whose effects cannot be properly assessed, should not be taken into account>>.



Fig. 3. Photograph from the book *In Galeni librum de ossibus doctissima et expectatissima commentaria*, on p 57, showing individual skeletal segments. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

longer in animals than in men and related it to the practice of chewing. Finally, he observed that the human vertebral column lies in the same axis with the limbs, whereas in quadrupeds it forms a right angle, and realized that such a difference could be the reason for bipedalism in man.

Studies on the Ear

Ingrassia is best known for his studies on the ear. In fact, in 1546, he identified a third small bone in the middle ear calling it "stapes" or "deltoid" stating that "by chance, while showing students the two small bones of the middle ear, the malleus and the incus, I noticed that a third bone had fallen on the dissecting table, and for its similarity to a bracket or to the Greek letter Delta, I thought to call it 'stapes' or 'deltoid.'" Several authors, such as Columbus, Eustachius, and Collado, attempted to claim this discovery as their own, but after the authoritative intervention of Vesalius, Fallopius, and Coitero, it was properly accredited to Ingrassia (Cushing, 1962; Finger, 2001; Gitter, 1990; O'Malley, 1970; Spedalieri, 1817). Furthermore, he described the oval and round windows (Schelhammer, 1684).

As reported in the *De Ossibus*, Ingrassia correctly stated that the mastoid air cells, connected to the middle ear, may have the function of improving sound transmission. He also described in detail the cochlea, the semicircular canals, the stapedius mus-

cle, and, last but not least, the auditory tube, the discovery of which had been falsely attributed to Eustachius (according to Spedalieri, 1817).

Studies on Male Reproductive System

During the period he spent in Naples, Ingrassia was also interested in the mechanisms for erection of the penis, as he reported in the treatise *De tumoribus praeter natura*. Particularly, he studied the structure of the corpora cavernosa and described them as a "numerous arteries and veins stacked on each other, forming a network of interwoven vessels that constitutes a vascular complex resembling the flesh of a mushroom." He also studied the glans and its numerous arterial and venous vessels and thought that "a substance made of volatile, or otherwise imperceptible, components, responsible for the swelling of the corpora cavernosa, flows from the vascular ends, distending all of the vessels thus allowing blood to fill the vascular spaces."



Fig. 4. Photograph taken from the book *Trattato assai bello et utile dei doi nostri nati in Palermo in differenti tempi*, which has Ingrassia's pioneering contributions to what is now known as teratology. [Color figure can be viewed in the online issue, which is available at wileyonlinelibrary.com.]

The studies of Ingrassia should be considered exceptional given that at the time, blood circulation or the exact differences between veins and arteries was still unknown. Finally, his treatise also contains one of the first descriptions of the corpus spongiosum, urethra, and seminal vesicles.

Other Anatomical Analyses

Ingrassia is also remembered for his description of the origins and distribution of various cranial nerves (such as the three branches of the trigeminal nerve, including its nervous ramification and ganglia) and for his studies on nails, as well as the blood supply and innervation of the teeth (Spedalieri, 1817). In addition, during his studies in Naples, he described 163 different types of tumors, reported in his treatise *De tumoribus praeter natura*. For these reasons, he should be considered a pioneer of modern surgical pathology. Moreover, in his book *Methodus dandi relationes pro mutilatis torquendis aut a tortura excusandi*, he performed an anatomical evaluation of the efficacy of torturing methods adopted by the Tribunal of Inquisition (presently the Steri's Palace, the Rectorate of the University of Palermo) in Palermo during the 16th century (Malta and Salerno, 2007). Finally, he should be considered one of the founders of teratology in view of his *Trattato assai bello et utile dei doi mostri nati in Palermo in diversi tempi*, where he described in detail two Siamese twins (Fig. 4).

Other Studies

Ingrassia was a physician and a very eclectic scientist. It is impossible to list all of his works exhaustively in this article. As reported by Cushing (1962), Fallopius stated "it is evident from his published writings that this man is so skilled in all branches of our art that he can justly be considered and called a most consummate physician, as indeed he is." He was the first scientist to distinguish measles from scarlet fever and to provide the first detailed description of the latter as an epidemic disease (Marchese, 2006). As the *Protomedicus* of Sicily, he instituted water drainage in the surrounding swamps and developed "isolation hospitals" for contagious patients, thus staving off many cases of malaria, which was endemic in Palermo during the 16th century (Giarrizzo, 1978). In 1575, he was also able to keep the plague under control by instituting three types of hospital wards (Pinerò, 2002): the first for suspected cases, the second for infected patients, and the third for convalescents (Ingaliso, 2005). The success of Ingrassia was not determined by curative measures, but by preventive ones, such as the isolation of infected patients and cleaning (what today we would call "sterilization") of everyday objects (Ingaliso, 2005).

During his years as the *Protomedicus*, Ingrassia led Sicilian physicians as only a man without criticism could have. Spedalieri (1817), talking about the meaning of Ingrassia's teaching, stated: "man... does not live on earth for idle wandering... he must

constantly fatigue and exercise these beautiful and valuable gifts that he has received... fatigue... is the only way... to contemplate and understand the hidden mysteries of nature and... to make works worthy of being passed on to the memory of posterity... as well as those of Ingrassia."

Ingrassia's students followed the path traced by their teacher in Palermo, although they did not have as much fame and success. In 1621, Baldassarre Grassia established the first Academy of Anatomy in Palermo renamed the Academy of the Iatrophysics and Medicine in 1645. The latter still exists today as the Academy of Medical Sciences of Palermo. This Academy was very active in teaching anatomy and surgery through dissections as well as being an important cultural meeting place (Pasqualino di Marineo, 1991).

Notes on the Bibliography Sources

Some sources on Ingrassia are found in the library of the Human Anatomy Section of the Department of Experimental Biomedicine and Clinical Neurosciences at the University of Palermo, which preserves ancient volumes, dating back to the 17th century. A copy of the book *In Galeni Librum de Ossibus Doctissima et Expectatissima Commentaria* can be found at the Central Library of the Sicilian Region in Palermo, Italy, as well as at the Library of the Wellcome Foundation in London, UK, where one can also find other cited sources, such as a copy of a book by Arcangelo Spedalieri (1817), which is also available through the following web site of the Stanford Libraries: <http://books.google.com/books?id=yBHXdDON0o8C&hl=it>.

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