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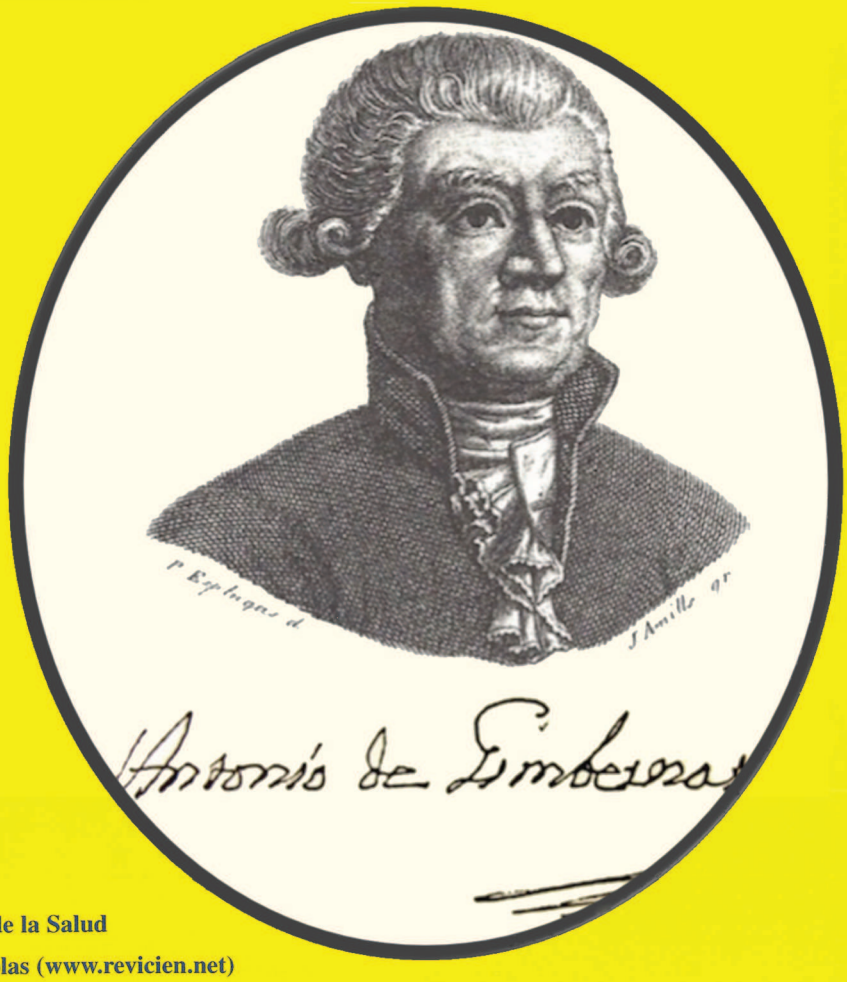
Cambrils (Tarragona)
19 November 2016
(Bicentenary of Gimbernat's death)



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Bicentenary of Gimbernat's death

Guest Editor: Prof. Dr. Dr. h. c. Pedro Mestres Ventura

PROLOGUE

On June 20, 2015 I met in Cambrils with Drs. Sitges (University Pompeu Fabra / UAB), Navarro (Catalan Society of Surgery), Vinyes (Royal Academy of Medicine of Catalonia), Sañudo (Complutense University of Madrid) to propose an act in memory of Don Antonio de Gimbernat to be celebrated in 2016, the year which marks the 200th anniversary of his death. The idea won unanimous support and it was decided that an academic conference with lectures on his life and work should be held on November 19 in Cambrils.

During this meeting we also discussed the publication of these lectures in a journal of international standing. Thanks to the generous offer of Dr. Sañudo, Editor-in-Chief of the European Journal of Anatomy, a platform for this publication was quickly found.

This book contains not only papers, which will be presented during the conference on November 19, but also others which were independently submitted and were accepted because of their thematic interest and quality.

Despite the many years which have passed, Gimbernat remains an historic figure, remembered and admired not only by anatomists, surgeons and physicians. From the beginning Gimbernat understood anatomy as an applied science; as a basic discipline for the practice and advancement of surgery. After a long stay in several European countries, Gimbernat returned to Spain where he initiated a process of renewal and Europeanization of both Spanish surgery and medicine. Gimbernat's professional reputation grew further after his return from Europe and gave him access to the most important positions in surgery and medicine in the Spanish Kingdom. The high prestige and political influence he thus enjoyed provided ideal conditions for his task of renewing the country's medical system. These and other aspects of Gimbernat's life are related in the contributions included in this book.

The book is divided into two parts. The first part has an historical/biographical character. In his contribution, Dr. Corbella discusses three main issues: the status of the surgical and medical profession, the most common diseases and the organization of public health in Gimbernat's day. A general biography of Gimbernat is presented by Dr. Mestres, in which particular emphasis is placed on his discoveries in anatomy and improvements in surgical techniques, as well as in the field of university policy and public health. The years Gimbernat spent in Cadiz have often only received marginal attention and so this is the main topic in the contribution from Drs. Prada, Carrasco, Ribelles and Carrera, in which they present detailed information on the circumstances surrounding Gimbernat's appointment to the *Real Colegio de Cirugia de Cadiz*. Dr.

Guerrero-Sala reports on Gimbernat's time in Barcelona, where most of his scientific work and the development of surgical techniques took place and where he founded his family.

Of the years Gimbernat spent abroad those in London were undoubtedly of fundamental importance for his future career; the contribution by Dr. Sala-Pedrós provides detailed information on Gimbernat's experiences during this period. Upon his return from Europe Gimbernat first returned to Barcelona and then moved to Madrid, where he remained for the rest of his life. Dr. Viejo deals with this most outstanding period in Gimbernat's biography in Madrid, during which the illustrious anatomist and surgeon was extremely active, not only in surgery and medicine, but also in the field of university administration and public health.

Among the publications concerning Gimbernat, the so-called "Inaugural Lessons" by Drs. Baños and Guardiola are prominent. Here the importance of anatomy and the characteristics required by students of surgery in order to later become good professionals are discussed. This unconventional approach reveals several aspects of Gimbernat's character and personality.

Finally, Dr. Benitez-Gomá examines an unusual phenomenon, namely the numerous applications of candidates from the *Campo de Tarragona* to train as surgeons at the Royal College of Surgery in Cadiz. This could be due to the fact that the founder and first director of the Royal College of Cadiz, Don Pedro Virgili Bellvé, was, as Gimbernat himself, a native of the region. Nevertheless, over a period of several years, many of these students native to Campo de Tarragona left the college as highly qualified surgeons.

The second part of the book is dedicated to the very interesting topic "Contributions of Anatomy to contemporary surgical techniques", which will be the topic of the session to be led by Dr. Sitges Serra during the academic conference on November 19. Two papers deal with topics closely related to Gimbernat's scientific and clinical activity. The first one by Dr. Emeterio, deals with cataract surgery and its on-going development. The second contribution by Drs. Pereira and Lopez-Cano covers Gimbernat's research on the anatomy of the abdominal wall and related surgical topics. A further publication by Drs. Sañudo, Maranillo, Vazquez, McHanwell, Quer and León deals with larynx transplantation, a surgery technique which has greatly been influenced by modern neuroanatomical concepts.

With regard to this second part, I would like to mention three presentations to the conference, which unfortunately could not be published in this book. Firstly a

contribution by Dr. Navarro on the "Vascularization of the pelvis and its importance in secondary bruises to severe fractures". Secondly a presentation by Dr. Serra Aracil on "The anatomy of the meso-rectum and its implications for rectal cancer surgery" and - last but not least - Dr. Gil-Vernet Sedó's discussion on "Topographic anatomy and its development in Urology in the 20th Century", a contribution recently published in the European Journal of Anatomy 20 (3): 231-247 (2016).

This project could not have been accomplished without the generous support and enthusiasm of many. My warm thanks go first to Dr. Antonio Sitges Serra for his generous and effective collaboration and the mediation of contacts, which significantly contributed to the successful realisation of this project. The publication of this book has been largely possible due to the generous support of the Catalan Society of Surgery and its president, Dr. Salvador Navarro Soto, to whom I express my most heartfelt thanks. The support received from the Rotary Club of Cambrils, Forn de Sant Salvador (Cambrils), Family Vidal I Barraquer (Cambrils), Mr. Ignacio Linares Fernandez and the descendants of the Riba doctors (Cambrils), is also highly valued; their logos decorate the cover of this book.

The Complutense University of Madrid and its School of Medicine have sponsored this project in many ways: in particular through members' contributions to the conference and this book and through the donation of a bust of Gimbernat for the "Antoni de Gimbernat" Hospital of Cambrils. I am extremely grateful for this support.

Thanks also to the Rovira i Virgili University and its Faculty of Medicine for the support received throughout the project and its contribution to the success thereof.

Sincere and deep acknowledgement goes to the City of Cambrils and Provincial Council of Tarragona for their generous and enthusiastic support without which this project could not have been realised.

I would also like to express my appreciation of the meticulous and highly professional execution of the editing (VITJournals) and printing (Grafiques Ortiga) of this book.

The town of Cambrils is celebrating Gimbernat in 2016 with an extensive program of activities; the publication of this book is an important part of this tribute.

Pedro Mestres-Ventura, Guest Editor.

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Medicine, Surgery and Public Health at the epoch of Gimbernat (1734 - 1816)

Jacint Corbella i Corbella

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SUMMARY

Antonio de Gimbernat (1734-1816) developed his work as a surgeon mainly in the second half of the eighteenth century. The most important milestones he achieved were as professor of the Royal College of Surgery of Barcelona; as founder, Professor and Director of the Royal College of Madrid; and as major administrative authority in the management of surgery in Spain. From the scientific point of view, he introduced some developments in anatomy and surgery of the inguinal region.

In this contribution three thematic points will be discussed: the status of the profession, the diseases of the time, and public health at the time of Gimbernat.

Key words: Gimbernat – Surgery – Medicine – Public Health – Eighteen Century

INTRODUCTION

In the eighteenth century, medicine and surgery were independent professions with often very strong tensions and confrontations between them. Besides, the level of these professions in Catalonia was then too low, because for many years Spain as a whole was isolated and without scientific relationships with the leading countries of Europe. In the early eighteenth century, a dynastic war between supporters of the Habsburgs and Bourbons finished with the loss of all the powers of internal self-government of Catalonia, which was assimilated and unified within the system that prevailed in Castile. One consequence was the loss of domestic laws, and the closure of all universities, which were suppressed. The central government created a new one, located in Cervera, a small town in the interior of the country, poorly communicated. From the point of view of medicine, a faculty was certainly created, but one with teachers of low qualification and few students, and no patients were available. Therefore, training was only theoretical. Surgeons, who did not have access to university education and had only one trade union formation, remained on the sidelines. Their level was only practical, but it not declined.

PROGRESS OF THE SURGERY

A very enterprising surgeon, Pere Virgili (1699-1776), formed in Tarragona, became army surgeon. Destined to Cadiz, he made some trips to the Spanish American colonies and became aware of the very low level of training of the surgeons who worked in the ships of the navy, and therefore of the minimal quality of care for passengers and crews. As he became acquainted with the surgical training in neighboring countries in Europe, he proposed the creation of schools to train surgeons for the Spanish Navy. Arguing about this situation, Virgili achieved the creation of the first Royal College in Cadiz in 1748, and he became the first director. He was successful, and in 1760 a second school was founded in Barcelona, of which he became director as well. Then, among other collaborators who moved from Cadiz to Barcelona, there was a young Catalan surgeon, Antonio Gimbernat, who already stood out and became professor at the new college. After a while Gimbernat was sent to visit several European countries to improve both the training and teaching of surgery in Spain. Years later, he moved to Madrid, where the third

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school of surgery was created, of which he became the first director.

THE INFERIORITY OF THE MEDICAL DOCTOR

There was a paradoxical situation. The surgeons, who had less education and a lower social and professional status, happened to receive a higher level of education than the medical doctors. They received more modern theoretical and practical learning that was better regulated, with more demands and requirements. In Barcelona, surgeons were formed with acceptable quality for that time, and they had knowledge about what was happening in their field in other countries, because some of the teachers had made study trips abroad. By contrast, doctors in Catalonia received lessons only at the University of Cervera, and in fact they were not learning very much.

In the first half of the 18th Century the country was overwhelmed by the political situation and there was a relative conformism. Gradually doctors demanded the re-opening of the Faculty in Barcelona, but their demands were ignored. A last attempt in 1754 remained unanswered as well. Meanwhile Catalan surgeons were formed first in Cadiz, and then also in Barcelona. The medical doctors insisted on a reopening of universities, but from Madrid they received the reply that only an application for an Academy of Medicine could have chances to be authorized. Thus, the main intervention of Jaume Bonells, a Catalan living in Madrid and a doctor of the Duke of Alba, made possible, on 4 May 1770, the creation of an "Academia Médico Práctica", which is the origin of the current Royal Academy of Medicine of Catalonia. This Academy was soon able to teach clinical medicine, with an exceptional teacher, Francisco Salvá Campillo. Students at the Royal School of Surgery could also learn medicine with patients of the Hospital de la Santa Creu, as well as complete their studies also as medical doctors, albeit with some bureaucratic difficulties. At the end of this century students of Barcelona could be surgeons and physicians, i.e., achieving two degrees, besides having learned considerably more than the others. Those students of Cervera, who had learned much less, got only one degree, that of physician.

There were attempts at the level of the entire state to unify the two professions, but it took many years to achieve this in 1827, and officially a new curriculum in 1843, with the creation of faculties for Medical Sciences.

PATHOLOGY AND DISEASES

We are, and still for many years, in a period dominated by major infectious diseases. In addition to the lesions of cutaneous manifestation (the most common and visible was smallpox), the most visible clinical sign was fever. For these reasons, in general, was talked of "fevers", sometimes with repeated peaks every few days: tertian, quarter and other fever forms. In view of today, they were often associated with malaria. Catalonia was a country where malaria was widespread, more in low-lying river areas such as the Ebro and Llobregat delta, river Ter and others places with less intensity. It was a plague evolving relatively slowly but continually, if compared to acute fevers, respiratory diseases often ending with "pneumonia", a feared diagnosis. Also intestinal infections, diarrhea of children, an important cause of child mortality, formed part of the disease spectrum. And an epidemic disease affecting all ages, but especially children, the smallpox, with episodes of mortality of more than a quarter of all affected, but with the advantage of leaving lasting immunity. Other frequent children diseases were measles, whooping cough, diphtheria or "garrotillo" (in Spanish), appearing in steps with high mortality, which were diagnosed by different clinical signs. The most obvious were, in the case of the measles, rash, the persistent cough in whooping often complicated with pneumonia, and the acute asphyxia in diphtheria.

Among the non-infectious diseases, perhaps the most frequently diagnosed in rural areas and in old populations was the "apoplexy", stroke, or cerebral hemorrhage. Such disorders were often responsible for very long periods even for years of disability, being the patients "wounded" (from Catalan *feridura*) with speech and walking disabilities. Also, in younger women, complications or even mortality in parturition were a general problem. Puerperal infections were a danger for women that until shortly before were well full in life.

Another very dreaded disease, but with relatively little documentary trace, was the rabies. Here we find a discrepancy between the panic of the name of this disease, the spread of popular beliefs to prevent it or cure it, and the difficulty of finding an extensive trail as in other diseases in medical documents. In addition, there are to consider the outbreaks. The plague was a scourge, but the last major European outbreak was in 1720 in Marseille. In Gimbernat's time in the Iberian Peninsula there was the largest outbreak of yellow fever in Andalusia until the early years of the nineteenth century.

Finally, traumatic pathology should be mentioned, and the injuries and deaths of war, important in the case of practical surgeons, either by direct injury or by subsequent infections.

PUBLIC HEALTH, ATTENDANCE AND PREVENTION

The protection of public health from the governing institutions of a community is an essential task. There are two major aspects. The most visible is assistance to the patients. The second is to prevent the disease. Since ancient times, with more

development since the Middle Age, there were hospitals in towns and cities and from a rather scientific point of view "Health Regimes" (*Regimen Sanitatis*).

Assistance

Towards the second half of the eighteenth century, in times of Gimbernat, in Catalonia there were hospitals in most villages, some of them old and important. This is not the place to make the list. But most remarkable of all, by its volume, was the hospital of the Santa Creu in Barcelona. For five hundred years, half a millennium, it has been the most important medical center of the Catalan health services. And along with it, scattered throughout the region, many others, all of them with few resources and often with limited effectiveness. But that is as it was. The administration was in municipal hands or religious institutions, sometimes mixed, as was the case of the hospital of the Santa Creu. In some of such hospitals there are still today valuable data banks open to many studies.

Most of them were general hospitals. There were few hospitals with a specific character. Towards the outside of the populations, zones of isolation were settled, with leper hospitals for leprosy patients. In Barcelona until the early eighteenth century a hospital of this type was located in the Pedró's Square and then moved to the district of Horta. Others for the mental patients, the so-called "asylums" came later. Rooms for "crazy" patients in the general hospitals were literally frightening. This was the case at the Hospital of the Santa Creu. A third aspect was the children's room, partly for sanitary assistance and in part as educational place for those who survived. In Barcelona the hospital had had its own buildings in the urban vicinity of the Santa Cruz. It is still visible today, and preserved its turn to lodge babies who were abandoned in public care.

Another aspect was the municipal assistance. The city councils of small towns had associated physicians or surgeons. The doctor Camps have done extensive and well-detailed studies on such associations of physicians in Catalonia and "la Franja", a close area of the neighbor region of Aragón.

Prevention

We have already mentioned the role of the former "Health Regimes" (*Regimen Sanitatis*), perhaps the most important in the Middle Ages. Now, at the time of Gimbernat, following the title of this contribution, we have two more important aspects. One is in line with the health regimes. The other is because of the growth of scientific development.

This is a time that saw the dissemination of the first books on Domestic Medicine, representing an important development during the nineteenth century and followed more intensely in the twentieth with slight variations in approach. G. Buchan, a Scottish physician, published already in the eighteenth century one of the first such books that appeared in Spain, translated in Madrid in 1785. Then came others, such as Le Roy, Raspail and others.

The following is the most important aspect of all at this stage. In 1796 Jenner published his work on the smallpox vaccine. And this is one of the major developments in the history of mankind. This event took place at the time of Gimbernat's maturity. It was not related to surgery. It had an impact, not too immediate, but definitive in preventing the most serious children epidemic disease until then. It was very difficult to introduce the vaccination, and put it within the ideas of the people. Often it was not accepted, but ended up prevailing, with direct involvement of general and local governments. And together with this the ideological shift which means the introduction of vaccines. The second with more popular repercussion came much later, almost a century, the rabies vaccination, and thanks to the work of Pasteur turned out to be more visible than that of Jenner.

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Antonio de Gimbernat: Anatomist and Surgeon (1734-1816)

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SUMMARY

The aim of this publication is to recall to memory Don Antonio de Gimbernat i Arbós on the occasion of the second centenary of his death. Gimbernat was a prominent figure in the fields of anatomy, surgery and medicine in Spain during the second half of the 18th century. Born in Cambrils (Tarragona, Spain) in 1734, he studied surgery in Cadiz, thereafter commencing his professional career in Barcelona, where he made his more important anatomical discoveries.

His visits to France, England and Holland between 1774 and 1778 constituted a milestone in his life. After returning to Spain, Gimbernat founded the Royal College of San Carlos in Madrid and, with increasing fame, advanced in the Spanish medical hierarchy. In 1793 he published a memorable work on the anatomy of the crural region and the surgery of femoral hernias, which was recognized throughout Europe, being translated into English, German and French. He was also a brilliant surgeon and physician in other areas (liver diseases, ophthalmology, gynecology, urology, etc.), always regarding anatomy as the basis for his work. In the early nineteenth century he held high positions within national medical institutions, promoting inter alia the unification of the study of surgery and medicine; an important step in the modernization of Spanish medical education. The last years of his life were difficult and sad as, for political reasons, Gimbernat no longer received the recognition he deserved after a life so rich in professional successes. Gimbernat died in Madrid at the age of 82.

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Key words: Anatomy – Surgery – Hernia – Gimbernat – History of medicine – History of medical education

PREAMBLE

The year 2016 will mark the 200th anniversary of the death of Don Antonio de Gimbernat y Arbós, famous anatomist, surgeon and professor of surgery and medicine in the eighteenth and early nineteenth centuries in Spain. As a surgeon, Gimbernat mainly based his work on gross anatomy, but also on physiology, chemistry and botany. He contributed decisively to the modernization mainly of surgery, but also to that of medicine in general in Spain, which prior thereto had been stagnant in its evolution, still following practices and usages of the Middle Age (Arráez-Aybar and Bueno-López, 2013). His fame in Europe, particularly in England, was at that time unusual for a Spanish anatomist and surgeon. The celebration of Gimbernat's anniversary in Cambrils will offer present-day anatomists and surgeons an opportunity to contribute to the preservation of the history of the development of the two disciplines, anatomy and surgery.

HIS LIFE

His exact date of birth is not known, but the records show that he was baptized in Cambrils (Tarragona, Spain) on February 15, 1734, receiving the name Manuel, Luis and Antonio and the family names Gimbernat and Arbós, being the fifth of six children (Pi-Sunyer, 1936, Matheson, 1948).

His family, although not rich, was probably prosperous, as his paternal grandfather was a notary public in Cambrils, as was his maternal grandfather in Barcelona (Pagaroles, 1985). He attended primary school in Cambrils, at the same time helping in the work of the Catholic Church in the village. At school he was noted for his intelligence and motivation, and it was recommended to send

the boy to another school for further studies. The family acted accordingly and sent Gimbernat to Riudoms, a neighboring village about 8 km from Cambrils, where he studied Latinity in a Franciscan monastery, probably from 1747 to 1748. In 1749 he went on to the University in Cervera to study humanities and philosophy. This was, at that time, the only functioning university in Catalonia, due to reprisals by King Felipe V against the Catalan population after the Spanish war of succession. According to Pi-Sunyer (1936) Gimbernat remained in Cervera for 6 years and several sources indicate that he joined the Royal College of Surgery of Cadiz in 1756 as a student of surgery.

The move from Cervera to Cadiz is somewhat surprising. If Gimbernat wanted to study medicine why did he not remain in Cervera? In this connection, it is worth mentioning that in 1749, by royal command of King Fernando VI, the first Royal Spanish College of Surgery was created in Cadiz (Albiol Molné, 1999). The responsibility for this project was entrusted to the military surgeon, Pere Virgil i Bellvé, of Vilallonga del Camp (Tarragona), a village near Cambrils (Appolis, 1962; Albiol Molné, 1999). It is likely that Gimbernat had heard of Virgili or there may even have been some personal contact between the two, as Gimbernat did not hesitate in his decision to go to Cadiz.

Virgili, had begun his studies in surgery in Tarragona under the guidance of French surgeons who had remained there after the Spanish war of succession (1701-1715) and he had later continued them in 1733 in Montpelier and Paris (Comenge Ferrer, 1893; Appolis, 1962; Albiol Molné, 1992). After this formative period, Virgili had acquired extensive professional experience in the course of his activity as a surgeon in the Navy (Albiol Molné, 1992). He introduced the most modern concepts of French surgery in education and practice to the new Royal College in Cadiz (1748), with a strong emphasis on the study of natural sciences and on the powers of observation, i.e. teaching evidence-based surgical practice.

Gimbernat was very successful while in Cadiz, where he was awarded many distinctions as a student and enjoying the personal support of Virgili. His anatomical studies were, from the very beginning, application-orientated; he approached surgical and medical problems with a view to finding a solution for the patient and did not merely practice descriptive anatomy (Salcedo, 1926). While Gimbernat was studying in Cadiz, working intensively in the field of anatomy and performing numerous dissections, Virgili established in 1760 the second Royal College of Surgery in Barcelona, this one dedicated to the Army (Albiol-Molné, 1992). The preparatory work on the School in Barcelona required the presence of Lorenzo Roland, Professor of Anatomy in Cadiz, and Gimbernat was chosen to temporarily represent him, which, considering that he was still a student is an indication of the esteem in which he was held.

Following his graduation in 1762, Virgili nominated him to teach anatomy at the new college in Barcelona. Despite some administrative difficulties due to his youthful age, Gimbernat was appointed professor in 1763 (Gimbernat, 1826; Salcedo, 1926). The French influence was very evident at the college of Barcelona, as one of its first presidents was Pedro Perchet, first surgeon of the royal family, a citizen of French origin who had remained in Barcelona after the war of succession. This circumstance greatly facilitated the exchange of trainees with clinical centers in France.

At the early age of 29 Gimbernat was a Professor of Anatomy at the Royal College; surgeon at the Hospital of Santa Creu in Barcelona and with growing prestige, not only in the city, but also in the whole country. These were the years in which he acquired his great anatomical and surgical experience. Gimbernat was so renowned that King Carlos III commissioned him to visit several European countries, accompanied by Mariano Rivas, also a Navy surgeon and Professor at the Royal College of Cadiz. The study trip began in 1774 and ended in 1778. During this time he visited the hospitals Hotel Dieu and Hospital de la Charité in Paris, Guy's, St. Thomas', St. Bartholomew's and St. George's Hospitals in London, as well as hospitals in Edinburgh and Leiden (Gimbernat, 1826; Pi-Sunyer, 1936; Matheson, 1948). In fact, 1774 was a veritable turning point in Gimbernat's life (Fig. 1).

Upon his return, he devoted himself entirely to the establishment of the Royal College of Surgery

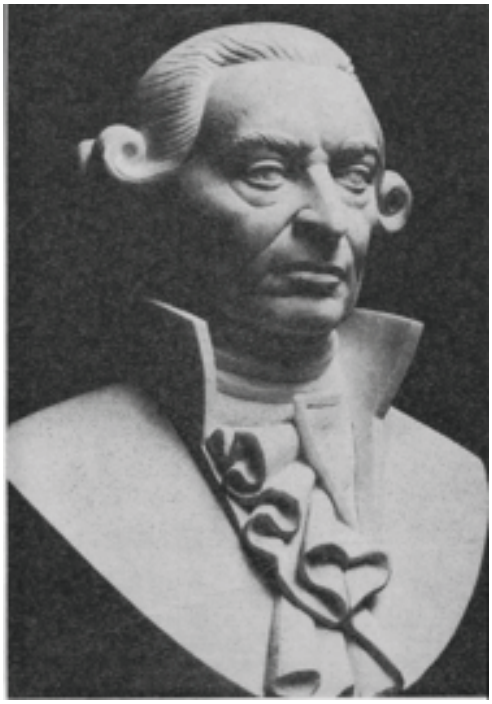

Fig. 1. Bust of Gimbernat by the artist Joan Rebull (1974), today exhibited in the Gimbernat Anatomical Amphitheater located at the Royal Academy of Medicine of Catalonia in Barcelona.

of San Carlos in Madrid, created at the behest of King Carlos III in 1780, an institution with seminal significance for the future Medical Faculty of the Universidad Complutense of Madrid. It was a fulfilling time of his life, in which he was active in many fields such as education and clinical work, college management, being the person of contact on numerous issues, meanwhile performing operations etc. He modernized the statutes of the Colleges of Surgery, by developing a new curriculum for surgeons and pursuing the unification of surgery and medical studies. Furthermore, he was involved in the training of the auxiliary medical services and, for example, stressed the necessity of improved training of midwives (Pi-Sunyer, 1936).

During this period his influence and popularity greatly increased, especially after a lecture he held in 1788 on his research into a new method of operating on femoral hernias. He was consequently relieved of his chair for operations and bone diseases and appointed personal surgeon of King Carlos IV on 23 January 1789. His first task in the new position was to attend Queen Maria Luisa of Parma during the birth of princess Maria de la O.

His most important papers, were "New method of operation on femoral hernia" published in 1793 (Fig. 2) and "Dissertation on eye ulcers" which appeared in 1802.

From here on, however, his career went into decline. Gimbernat began to display certain neurological changes, which also manifested themselves in his signature. He developed a disease that he had treated many times: cataracts. It was decided that an operation was necessary, which Dr. Josep Ribas performed without any complications. However, during the night after the operation, Gimbernat decided to examine his eyes and lifted the bandage, thus destroying the results of the successful operation. He was left with very limited vision, which he later lost completely. It seems that, by that time, the neurological disorders had also affected his mind. However, it is possible that other factors related to the situation in Spain in the early nineteenth century, may also have contributed to Gimbernat's decline. During the French occupation, between 1808 and 1813, Gimbernat, as so many Spanish liberal intellectuals, had collaborated with the occupiers, hoping for liberalization in political life in the country. However, as a result of these political views, he suffered a number of severe disadvantages when King Fernando VII was restored in 1813: Gimbernat's pension was withdrawn and he was dismissed from all his leading positions. Thus, during the last years of his life, he lived embittered in conditions inappropriate for such a famous and brilliant surgeon and physician. Gimbernat died in Madrid on November 17, 1816.

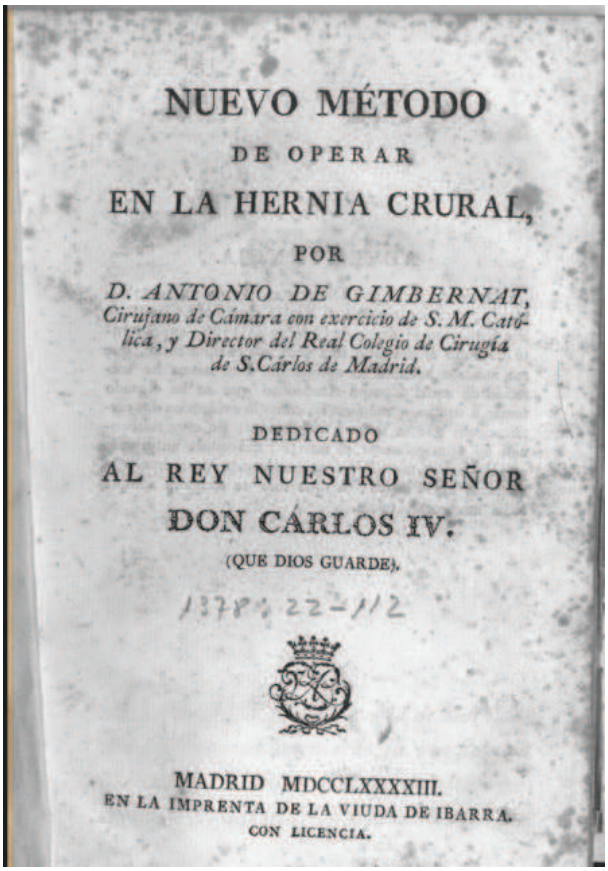
NUEVO MÉTODO
DE OPERAR
EN LA HERNIA CRURAL,
POR
D. ANTONIO DE GIMBERNAT,
Cirujano de Cámara con exercicio de S. M. Católica, y Director del Real Colegio de Cirugía de S. Cárlos de Madrid.
DEDICADO
AL REY NUESTRO SEÑOR
DON CÁRLOS IV.
(QUE DIOS GUARDE).
MADRID MDCCLXXXXIII.
EN LA IMPRENTA DE LA VIUDA DE IBARRA.
CON LICENCIA.

Fig. 2. First page of Gimbernat's publication on his method of operation on hernia (1793).

THE ANATOMIST

Already in his student days in Cadiz, Gimbernat had paid great attention to the study of anatomy and cadaver dissection, practicing in the anatomical amphitheater, even in his free time. A famous saying of his was: *My favorite author has always been the cadaver*.

In 1762, after graduating in surgery, he joined the College of Surgery in Barcelona, where he continued to practice his teaching and work methods. He dissected some 32 cadavers, carefully noting locations and features. Most of these dissections were performed in public in his lectures and seminars, during which he sought and encouraged student collaboration (Zaragoza-Rubira, 1963). During these demonstrations he also found anomalies which he carefully described and recorded, thereby giving these dissections a character resembling modern-day clinical autopsies and contributing to the understanding of surgery and disease (Nogales Espert, 2004). It is obvious that he strove to convey to his students that only anatomy could provide the scientific basis for surgery. His scientific research focused on regions and organs in which, in those days, most of the medical and surgical problems such as hernias, hepatic diseases, cataracts, kidney stones, obstetrics and traumatology, arose.

His anatomical studies of the crural region were the basis for the development of a new surgical technique for operating on hernias in this region

and represent his greatest contribution to anatomy as well as to the development of hernia surgery (Matheson, 1948, Martin Duce, 2000; Rutkow, 2003). Gimbernat refers to his first description of this region as follows:

> "*This part, although it is so remarkable, had been little examined, less understood by anatomists, till I demonstrated it for the first time in 1768*" (Gimbernat 1793, Engl. Translation 1795, page 30).

However, he still kept previous studies of Falopius (1606) and Poupart (1702) dealing with this region of the body in mind.

Gimbernat described the crural arch as follows:

> .." *In the lower part of the abdomen, the external oblique muscle forms a strong and wide aponeurosis. These fibers are parallel; they descend obliquely from without inwards; and the lower extend from the superior anterior spine of the ilium, to the os pubis, at a little distance from which they open into two bands, or pillars, to form the inguinal ring. In all this tract, the aponeurosis forms a duplicature inwards. This duplicature, which is more manifest towards the os pubis, constitutes a strong whitish cord, which Fallopius supposed to be a ligament; and so it was called, till of late, when it received the name of crural arch, because at the top of the thigh, it has some distant resemblance to an arch or vault"* (Gimbernat 1793, Engl. Translation 1795, page 31).

Considering the date of this publication by Gimbernat, it is clear that the term "crural arch" was erroneously attributed to Meckel in 1832 (Martin-Duce, 2000).

The lacunar ligament, that years later, in 1807, was named "Gimbernat ligament" by the famous surgeon Sir Ashley P. Cooper (Cooper, 1807; Martin Duce, 2000), was described by Gimbernat in the following terms*:*

> *"……moreover this pillar is not only inserted into the spine by a considerable union of aponeurotical fibers, but the duplicature of the arch being much greater there, it is continued inwards along the crest of the pubis, by means of a remarkable plait or duplicature, consisting of a portion of the aponeurosis…*"(Gimbernat 1793, Engl. Translation 1795, page 33).

It is interesting to note that Gimbernat did not denote this fibrous sheet as a ligament and it certainly does lack the character and attributes of true ligaments. However, as his description is the first precise and accurate one, this fibrous formation should bear the name of Gimbernat (Poirier and Charpy, 1899).

Gimbernat made fundamental observations on a ligament, which is still called Cooper ligament, although he was only born in the same year in which Gimbernat carried out these studies. Gimbernat's description of this anatomical formation was as follows:

> *"As soon as the aponeurotic intertexture reaches the great secondary external iliac artery, there is detached from the internal edge of the crural arch a membranous expansion (which is strengthened by the tendon of the small psoas muscle, when this muscle exists), and insinuates itself behind the great secondary external iliac artery and vein. This expansion goes to be inserted close to the external edge of pectineus muscle: moreover, one lamina from it passes over that muscle, and is attached to the crest of the branch of the os pubis, where it is united with the duplicature of the arch which terminates in the same crest. By this union is formed a species of ligament which passes along the crest, below which the superior extremity of the pectineus muscle is inserted"* (Gimbernat 1793, Engl. Translation 1795, page 35 and 36).

Finally, the existence of the lymph node in this region and today attributed to Jules Germain Cloquet (born 1790) and to Johann Christian Rosenmüller (born 1771), was already demonstrated with great precision by Gimbernat in 1768. Gimbernat described this lymphatic gland in the following terms:

> *"In the internal parts of sheath close to the branch of the os pubis, precisely where the insertion of the duplicature of the arch ends, and on the inside of the great secondary iliac vein, there is left a foramen sufficiently distinct, almost round, at which many lymphatics enter. A lymphatic gland is sometimes fitted into this foramen, and the parts, which form the crural hernia always pass through it, consequently we may properly call it crural ring"* (Gimbernat 1793, Engl. Translation 1795, pages 37-38).

Gimbernat was sure of the originality of his discoveries, as confirmed by his words:

> "*This arch offers to our consideration some peculiar contrivances, little or not at all understood, though the knowledge be absolutely necessary to a perfect idea of the crural hernia, and to the safe operation of its cure"* (Gimbernat 1793, Engl. Translation 1795, page 33).

These studies would probably never have been published if Gimbernat had not visited London in 1776, an experience which greatly influenced him. The task of editing the English version of Gimbernat's publication of 1793 was undertaken by Thomas Beddoes (1760-1808), physician and scientific writer, and it appeared in London in 1795. The German edition was issued by the German surgeon Dr. Bernhard Nathanael Gottlob Schreger and was published in 1817 by the Buchhandlung Stein (Nuremberg), while the French version ap-

peared later, in 1827, and was edited by the French anatomist Gilbert Breschet.

THE SURGEON AND MEDICAL DOCTOR

Gimbernat enjoyed great fame as an anatomist, but his renown as a physician and surgeon surpassed this by far. The anatomical studies described above were carried out during his stay in Barcelona (1762-1778), including the four years he spent abroad. His public lectures on these studies in 1768 were intended to open up new paths in surgery, rather than present pure anatomical research without any immediate practical application. In view of the clinical significance of femoral hernias at that time, Gimbernat worked intensively on the development of a new method of operative treatment of this disorder (Zaragoza-Rubira, 1963).

The importance of Gimbernat's surgical technique was evident, since in the early sixteenth century surgical therapy of femoral hernias consisted merely in the peripheral section of the stenotic portion of the hernia neck in cases of irreducible hernias and especially in strangulated ones (Arechaga, 1977). As already mentioned, King Carlos III had supported Gimbernat's and Ribas' study trip throughout Europe with the aim of acquiring information on the progress which had been made in surgery and then implementing the new ideas and procedures in Spain. Their stay in London was a major milestone in Gimbernat's biography and career. The biography written by son Agustin (1828), tells of a series of notebooks, but only those related with the stay in London were found. In these notebooks, written largely in English by Gimbernat himself, he recounts what happened on the day of April 25, 1777, during one of the lessons held by John Hunter, the great surgeon and anatomist. In that day's lesson Hunter lectured on femoral hernias. When operating on femoral hernias, Hunter had pointed out that

> "*.....to achieve the reduction, should be cut Poupart's ligament, warning that if the expansion is obliquely outwards, the epigastric artery is cut, while inwardly are affects the spermatic cord, and therefore the only means of avoiding these dangers was cut forward looking to cut very little* ".

At this point, and after asking for permission to intervene, Gimbernat publicly explained his method, based on his excellent knowledge of the anatomical region.

Gimbernat was convinced that the treatment of hernia incarceration should be limited to the ligament which today bears his name -Gimbernat or lacunar ligament – and not the Poupart ligament or Fallopian ligament as it is sometimes called, as was the opinion of surgeons and doctors at the time. Thus, his technique is restricted to the section of the ligament named after him, an approach,

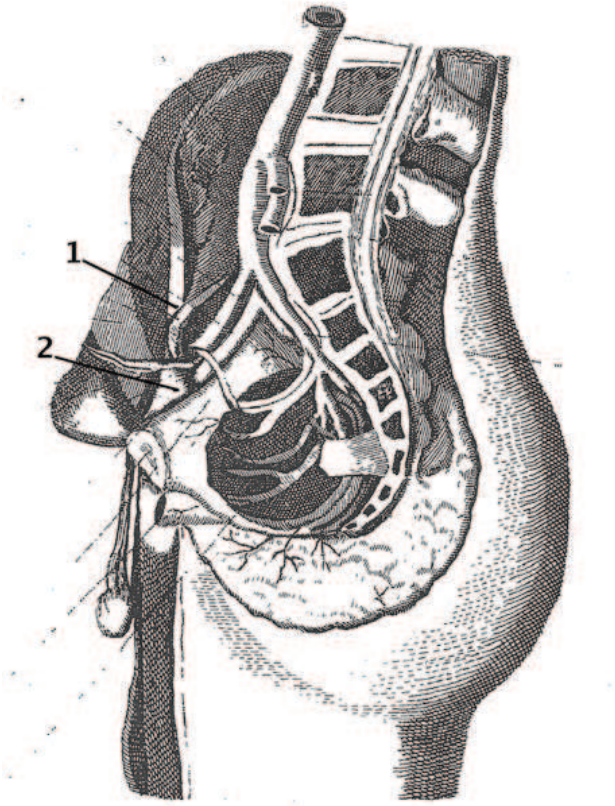

Fig. 3. Lamina I of Gimbernat's publication on the operation of the femoral hernia. Pelvis and abdomen are seen in section through the median line. 1: Inguinal ligament, 2: marks where the Gimbernat ligament becomes sectioned according with his own operation method.

which also avoids damage to structures such as the inferior epigastric artery or the spermatic cord during operation (Fig. 3). He added that he had already successfully applied this technique in operations on two women in Barcelona in 1772 and 1773. Hunter, with the simplicity of great men, replied:

> "*You are right Sir, I will made public your method in my lessons and publish it so when I have opportunity to operate in vivo*" (Gimbernat, 1828).

Hunter kept his word and certainly contributed to Gimbernat's good reputation in London and beyond. His experience with Hunter must have strongly influenced Gimbernat's decision to publish his method of hernia operation. Elaborating on this view, Thomas Beddoes, translator of his work on hernias into English (pages i, ii) says:

> *The superiority of Mr. Gimbernat's method of operating for the femoral or crural hernia will not, I believe, be contested. The difference, indeed, appears to me to be exactly this: the patient who is treated according to Mr. Gimbernat's method will infallibly recover whereas former modes of operating are well known to have been attended with the utmost danger. This was sufficient motive for*

undertaking to translate the following tract. I with my translation may raise some curiosity in our surgeons with regard to the publications of their brethren abroad. Englishmen in general are disposed to undervalue the productions of foreigners; and among surgeons propensity has, I think, been largely strengthened."

It is interesting to note that, according to Morris (1968), Townsend, in the preface of his book "Elements of Therapeutics" (1795), described the hernia operation that his friend Gimbernat had explained and demonstrated to him, this probably being the first description of Gimbernat's operation in English. Gimbernat's contribution to the progress made in hernia surgery has been repeatedly analyzed, with all authors confirming its medical historical value (Matheson, 1948; Martin Duce, 2000; Rutkow, 2003; Loukas et al., 2007).

In addition to hernias, Gimbernat focused on other medical topics. He recorded in his notes that almost half a year previously, on December 14, 1776 to be exact, he had been at St. Bartholomew's Hospital, where Sir Persival Pott was chief surgeon. They had conferred together about a tumor in a patient's thigh, which was suspected to be due to an aneurysm. Gimbernat did not agree, his opinion being based on an examination, which he himself had performed (compression of the artery above the tumor without any decrease in the size of tumor; no sign of pulsation after compression release). The operation confirmed Gimbernat's view that it was not an aneurysm (Gimbernat, 1828; Salcedo, 1926, vol. 1, p. 187-188). Thus, Gimbernat gained the appreciation and recognition of other distinguished professors in London (Townsend, 1796; Salcedo, 1926, vol. 1, p. 190-191).

The years in Barcelona were very fruitful and, in addition to the activities described, his work in the field of obstetrics must also be mentioned: he carried out remarkable studies on teratology, leaving a legacy of pencil drawings of fetuses with malformations (today conserved at the Museum of Anatomy of the Medical Faculty at the Universidad Complutense of Madrid). Furthermore, in the aforementioned biography, his son Agustin refers to unpublished manuscripts of his father found after his death, in which a series of surgical interventions are described in great detail (Gimbernat, 1828). One example is that of June 11, 1773 when he operated on a 13 year-old boy with stones in the urinary bladder, using a lithotomy device of his invention. The development of surgical instruments was an area in which Gimbernat was very creative. A second intervention was performed on a woman who suffered from a liver abscess. After a detailed examination and, according to his notes, Gimbernat saw that the problem was

"*...an inflammatory tumor on the outside of large lobe of the liver, a days ago formed a suppuration into the substance of the liver, precisely in the part to the exterior elevation observed in the right upper quadrant, particularly on the forequarters of the false ribs and therefore having this tumor already abscess character*" (Gimbernat, 1828).

Gimbernat describes the surgical intervention and therapeutic protocol followed until the patient had fully recovered. From this and autopsies of similar cases Gimbernat was able to extract valuable conclusions about abscesses and other liver pathologies.

Over the years Gimbernat also became interested in ophthalmology, performing 47 cataract operations, of which 41 were very satisfactory. For these operations he designed the so-called "eye-ring", which served to keep the eyelids open; a further example of his involvement in the development of surgical devices (Puig-Lacalle and Marti-Pujol, 1995).

THE PROFESSOR AND ACADEMIC ORGANIZER

One of his biographers tell us that "*if knowledge is difficult to be acquired, to teach what you know it is even more difficult*" and in these tasks Gimbernat also demonstrated his talent for organization and his teaching skills, this being one of the reasons why the three monarchs of Spain who reigned during his lifetime placed so much trust in him. (Freixas -Freixas, 1916).

As a chair-holder, first in Barcelona and later in Madrid, he paid great attention to teaching and to the preparation of his lectures, with particular emphasis on practical teaching. His numerous dissections, which have already been mentioned, were mainly performed in a didactic style. Gimbernat publicly expressed his views on this on two occasions: namely the inaugural conferences of the academic year, once on October 5, 1768 and again on October 5, 1773. He stressed the important roles of anatomy and surgery and presented a catalogue of the qualities and the commitment expected of a good surgeon.

In the Royal College of Barcelona, founded in 1764, so-called "*Juntas literarias*" (clinical meetings) were held. These events were similar to colloquia where relevant cases were presented and accordingly discussed and even assessed. About 200 protocols of such colloquia from 1765 on still exist. These gatherings were highly innovative and represented a form of continued education unknown until then, as well as being an instrument of popularization as such meetings were open not only to students and professors but also to the public (Pérez-Pérez and Sitges-Serra, 2010). However, Gimbernat's name does not appear in the protocols of the "Juntas literarias" and he is only mentioned a few times by his colleagues (Pérez-Pérez, 2007). This is surprising in view of the importance such "Juntas" had in the educational concept of the Royal College

of Barcelona.

The burden of organizational duties was probably not so great during the years in Barcelona, but this situation changed after his four years in Europe. At Gimbernat's recommendation, King Carlos III founded the Royal College of Surgery of San Carlos, and by royal command Gimbernat was ordered to remain there. Installed in Madrid, he was responsible for setting up the College, a task which confronted him with a comprehensive range of new activities. Gimbernat was also responsible for institutional administration and the professional organization of physicians and surgeons. His professional colleagues were, however, not always in agreement with the privileges granted to Gimbernat to perform these duties.

In those years Gimbernat worked tirelessly. Finally, on January 27, 1787, the King passed and made public the Ordinances or Bylaws of the Surgical College of San Carlos (Madrid). Gimbernat, as the King's personal physician, was named Director of the new college, which was a non-religious college, in contrast to all other academic institutions in Spain at the time. One of the features of the new college bylaw was that it provided for a five-year curriculum and appointed professors and other academics who had been in London, Bologna and Paris and had returned with impressive curriculum vitae, as new fellows to the College (Pi-Sunyer, 1936).

The opening ceremony of the new college took place on October 1, 1787, and Gimbernat gave a lecture on "The proper use of sutures and their abuse." The inauguration was an outstanding success and was attended by government ministers and numerous personalities. In 1788 he gave a lecture at the new college in which he presented his new method of operation on femoral hernia, undoubtedly the studies which had earned him the most fame. At that time Gimbernat founded the new anatomical-pathological museum in Madrid, which was one of the best in the world and today is located at the Medical Faculty of the Universidad Complutense de Madrid (Sañudo, personal communication).

The position he had reached, his long career, his didactic and practical surgical abilities, the managerial qualities he had displayed in establishing the College of Madrid and his work as a surgeon to the King, culminated in his official ennoblement by King Carlos IV on March 9, 1790 (Pagaroles, 1985). It was a token of recognition by the monarchy of this great man's achievements.

In March 1790 he was commissioned to reform the bylaws of the Royal College of Surgery of Barcelona, introducing significant changes in the number of professors, each professor being responsible for his own specialist field and with the provision of remuneration of students' work. The respective regulations were passed in 1795 and came into effect the same year. In this connection, it is of interest to note that the central institution, the Board of Royal Colleges of the Spanish Kingdom, strove, under the directorship of Antonio de Gimbernat, to assimilate all existing colleges into that of San Carlos in Madrid. However, there was some resistance to this concept of centralization. Despite these difficulties, Gimbernat made arrangements to found new colleges, for instance, in Salamanca and Zaragoza (Pagaroles, 1985). On 12 September 1801 Gimbernat was nominated for the vacant position of leading personal physician to the King. Thus, at the age of sixty-seven, he had become the country's Chief Surgeon and was Chairman of the Board of the Royal Colleges of Surgery; he had reached the zenith of his career.

At the end of the 18th century great concern arose in Spain with regard to the many fatal – and increasing - cases of smallpox in the Spanish colonies in America and Asia. To deal with this contingency, a large expedition was organized in 1803 to bring the benefits of vaccination to the New World. Francisco X. Balmis, a Navy surgeon born in Alicante, led the expedition and was responsible for its organization and execution (Balmis, 1803; Puerta, 2003). Cook (1942) reports that never before in the history of medicine had an expedition of this size been undertaken with such success. Gimbernat, at that time chairman of the first scientific advisory committee in Spain, was responsible for planning and authorization of the project and, having understood its importance, he ensured its speedy implementation - somewhat uncommon in Spanish administration at that time! In view of Gimbernat's extensive contacts in England, he was sure to have had knowledge of the activities of the English physician Edward Jenner, the inventor of vaccination in 1798 (Matheson, 1948). It is unclear why Gimbernat should have diversified from his field of surgery and anatomy to that of public health. One can only conjecture that he may have decided to intervene as he was acquainted with the vaccine, but possibly also on the grounds of the duties, which arose from the high positions he occupied.

CONCLUDING REMARKS

His love of anatomy led him to surgery, the first forming the basis of the latter. Gimbernat was the first to introduce the term "surgical anatomy", emphasizing the value he placed on the relationship between the two disciplines (Martin Duce, 2000). Gimbernat put observation and evidence-based knowledge ahead of syllogisms and outdated theories; a conviction which characterized his work. He was not only a great anatomist, but also a great surgeon and clinician, who made an immense contribution to the modernization of medicine in Spain.

For us, the name of Gimbernat is merely linked to an anatomical structure he discovered and

which bears his name: Gimbernat ligament, also known as lacunar ligament. However, he deserves to be remembered far more as the historical figure he was. And indeed, in Spain Gimbernat and his work have not been forgotten, quite to the contrary. At the Medical Faculty of the Universidad Complutense in Madrid, the anatomical museum (Museo de Anatomia de la Universidad Complutense) founded by Gimbernat has been maintained and preserved to the present day and is a jewel amongst the museums in Madrid. Originals and facsimiles of all Don Antonio de Gimbernat's publications were collected by his son Agustín and committed to the custody to the Universidad Complutense (UCM). Today, this documentation can be found at the Biblioteca Historica "Marques de Valdecilla" of UCM (www.biblioteca.ucm.es/historica), for the most part in digital form. In addition, the San Carlos University Hospital, UCM, awards distinguished doctors every year the so-called Gimbernat Excellence Award ("Premio Antonio Gimbernat a la Excelencia").

The Royal Academy of Medicine in Barcelona has, since the 19th century, maintained the anatomical amphitheater where many years before Gimbernat prepared and conducted anatomical demonstrations. This building, which bears his name, serves a splendid location for academic ceremonies (Fig. 4). Furthermore, since 1984 this institution has edited the "Gimbernat" Journal, dedicated to the history of medicine.

Another medical organization, the Catalan Society for Surgery, awards two prizes every year, one for Spanish nationals named after Virgili and one for foreigners dedicated to Gimbernat.

Worthy of mention is also the existence of so-called Gimbernat university schools (*www.eug.es)* in Barcelona and Cantabria (Nord Spain), in which mainly nursing and physiotherapy courses are offered.

Fig. 4. Main façade of the Royal College of Surgery of Barcelona, in which the Royal Academy of Medicine of Catalonia is currently located, and where the Gimbernat anatomical amphitheater (Gimbernat room XVIII century) is still preserved in its original state (please also refer to the contribution of Dr. Guerrero in this issue).

And finally his hometown Cambrils proudly remembers its son, where the street in which Gimbernat was born and the recently-built city hospital are named after him.

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Gimbernat's stay in Cadiz and his discovery of the human anatomy

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SUMMARY

The dates on which Antonio Gimbernat studied at the Navy Royal College of Surgery in Cadiz (Real Colegio de Cirugía de la Armada, RCCA) show some discrepancies between different authors. A detailed reading of the Royal College archives, especially the books of enrollments kept in the Department of History of Medicine at the University of Cadiz, allows us to clarify this issue.

In this contribution we present the academic records of Gimbernat in Cadiz, as well as annotations on his participation in college life, where his remarkable vocation for anatomy is reflected. On the other hand, we will see aspects that have had influence on his curriculum during the short but productive and notable period of studies in the Royal College. Moreover, we will analyze the contents of the academic curriculum followed by Gimbernat, which was designed by Virgili, although some other aspects of the academic life of the RCCA were not supported by our honoree surgeon.

Finally, through generic documents on the customs and habits of the Navy Royal College of Surgery in Cadiz we outline how Gimbernat's life and habits were during his time as college member.

Key words: Gimbernat – Cádiz – Anatomy

ARRIVAL AT THE ROYAL NAVY COLLEGE OF SURGERY OF CADIZ

In the enrollment books of the RCCA it is recorded that Don Antonio Gimbernat became student of the College on May 22, 1758 (Figs. 1 and 2). This is clarifying information, since there are other sources that give other different beginning dates for the period of stay of Gimbernat in Cadiz (Loukas et al., 2007). Mistakes may be due to the different sources used. Or even by the assumption that the dates on which Gimbernat goes to Cadiz should correspond to those in which by age all schoolboys go in educational institutions. In our case, the possibility to have access to the documents of the epoch that remain in the Faculty of Medicine of Cadiz has prevented possible errors. The books of enrollment are handwritten notes related to all educational issues (such as academic exams, merits and awards, or even demerits and punishments), and refer to the students of the Navy Royal College of Surgery in Cádiz.

Some authors have reported that Gimbernat travelled to Cadiz in 1756, to conduct preparatory studies before entering as Schoolboy in the College in 1758 (Rueda, 2013). However, it remains unclear what type of preparatory studies Gimbernat could have completed in Cadiz. Perhaps these studies were in some way related with the practice of surgery, allowing Gimbernat to have access to the circle of the director of the RCCA. If so, in these previous years the sponsorship and personal interest of Pedro Virgili, Navy Chief Surgeon and Director of the RCCA could have emerged. Virgili's devotion to Antonio Gimbernat continued in the future.

This should not be considered an exceptional situation. Few years later, in 1765, José Sabater, born in Montmelo, would enter the RCCA. In his college entrance exam, it was noted that José Sabater was valet of surgeon, since his father was a surgeon in turn. This type of non-academic learning connections was based on classical schemes of expertise and should be common at that time. After studying in Cadiz, Sabater became Director of the RCCA (Albiol and Albiol, 2004).

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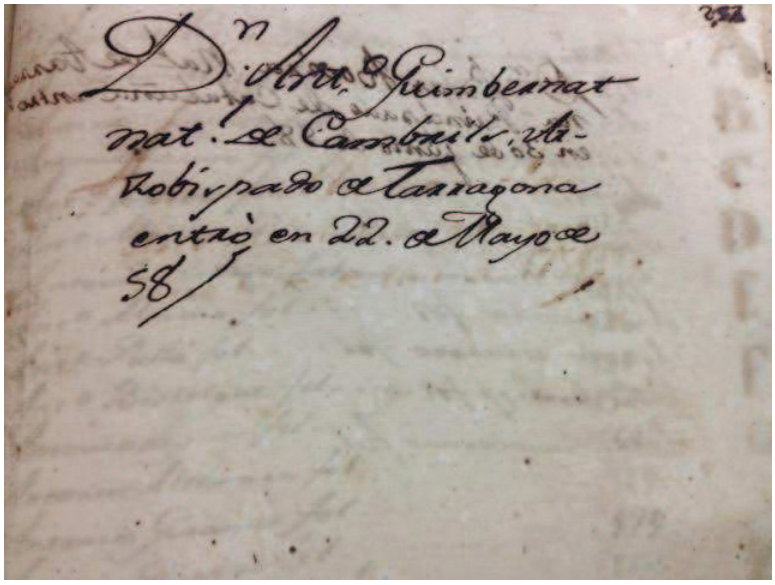

Fig. 1. Paleographic transcription of the information in the Enrollment Book 11 (1750-1758) f. 257: "D^{n}. Ant^{o}. Guimbernat nat^{l}. de Cambrils, Arzobispado de Tarragona entrò en 22. de Mayo de 58/.". [L. M. 11].

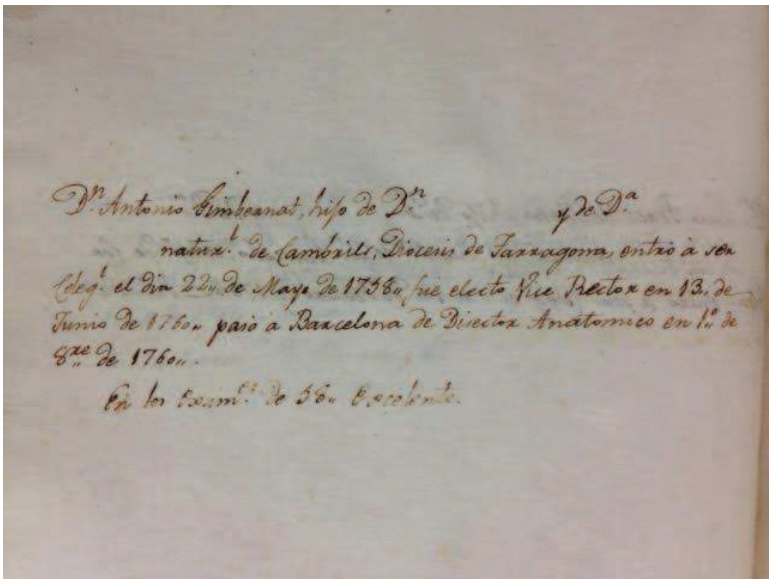

Fig. 2. Paleographic transcription of the information in the Enrollment Book 1 (1749-1758) p. 118: "D^{n}. Antonio Gimbernat, hijo de D^{n}. [en blanco] y de D^{a}. [en blanco] natur^{l}. de Cambrils, Diocesis de Tarragona, entró à ser Coleg^{l}. el dia 22, de Mayo de 1758, fuè electo Vice Rector en 13, de Junio de 1760, pasò à Barcelona de Disector Anatomico en 1^{o}, de 8re, de 1760,. "En los Exam^{es}. de 58,, Excelente.". [L. M. 1].

THE CIRCUMSTANCES OF GIMBERNAT ACCESS TO THE ROYAL COLLEGE

The access of Gimbernat is mentioned in the books of enrollment of 1758, i.e., he became college student at the age of 24 years. A very advanced age if compared with uses of the time and those at the RCCA, where a highest age of 21 years was imposed (RCCA ordinances, 1791)[1]. Although exceptions to this rule of one year were proposed, in principle an exception with Gimbernat could seem unjustified. However, good personal conditions of Gimbernat during the previous period of training could contribute to reduce all or some preventions in relation to his access to the Royal College. The requirements for applicants to study at the Royal College appeared collected in the Ordinances of the Royal College (1791)[2]. And these same conditions give us a picture of what would be the college students, and therefore also Antonio Gimbernat.

The cited preconditions to be met by applicants

[1]Ordinances, 1791. *"XVIII. Circunstancias que han de tener los pretendientes a plazas de Colegiales. Los que se admitan á plazas de Colegiales han de ser de edad de diez y siete á veinte y un años, y no han de tener defecto corporal que los haga inútiles para su profesión: deberán haber estudiado la Latinidad y curso de Filosofía , lo que harán constar por certificaciones de sus maestros; bien entendido, que si se presentase alguno que posea además buenos conocimientos de Geometría y Física experimental, ó entienda los idiomas griego , francés , ingles , ó italiano, se les dispensará el exceso de un año en la edad." Brief translation: Circumstances must have the pretenders to places of RCCA. Collegians must be aged seventeen to twenty-one, and should have no body defect that makes them useless for his profession. They should have studied latin and philosophy, which will be certified for their teachers; well understood that if anyone has good knowledge of geometry and experimental*

relates that students, no more than a hundred, should come from a good family, with economic resources and bring studies of Latin and philosophy. Gimbernat amply fulfilled these requirements, because he had followed Latin studies in his hometown and Arts and Philosophy at the University of Cervera (Lleida) (Arráez-Aybar and Bueno-López, 2013; Martin, 2000; Matheson, 1949). It should not be surprising that in his years of study in Cervera, Gimbernat had had contact with the studies of the degree in Medicine, considering that these studies were taught in Cervera (Olagüe, 1984)[3]. Remember that in these years the studies of Medicine and Surgery were still maintained separated, and it was precisely the effort and dedication of Pedro Virgili at the RCCA who contributed to unify both studies, "*lo qual acredita que las materias en que se les instruye se dirigen á reunir la suficiencia necesaria para el exercicio de la Medicina y Cirugía*" ("the subjects are designed to acquire the necessary sufficiency to practice Medicine and Surgery") (Ordinances, 1791). But there is another peculiar aspect, as discussed below in terms of the RCCA scholar system, which probably deliberately fails with Antonio Gimbernat. The period of admission to the college was September, while Gimbernat entered in the month of May, almost at the end of the academic year. Again presumably because of special conditions shown by the candidate, such as skills or predisposition to the study, his admission as a college student was possible.

THE CITY OF CADIZ GIMBERNAT FINDS

In 1733, Pedro Virgili disembarked in Cadiz after a year's stay in Paris, where he could know all was happening in the European cradle of surgery. After his years of service in the Navy, these trips to France reaffirm his view that it was necessary to unite the knowledge of Protomedicato (Medicine) and Surgery. Virgili arrived in Cadiz with the endorsement of Juan Lacomba, Navy Chief Surgeon and Director of the Hospital of the Navy in Cadiz (Fig. 3). Lacomba had the best references of Virgili as major Surgeon of the Army, in the battles of Gibraltar and the siege of Oran, and won him for his project naming Virgili Navy Assistant of Staff Surgeon.

Fig. 3. Entrance to the Royal Hospital located today to the Faculty of Medicine, which origin was the Royal College of Surgeons of the Navy, today administrative headquarters of the University of Cadiz. Detail of the Royal Shield (frontispiece).

Pedro Virgili, established in Cadiz, married Juana Roland in October 1734, and became the promoter of a vast project, i.e., to create the first school in Cadiz in which studies of Medicine and Surgery could be unified. Virgili convinced the Marquis de la Ensenada, minister of King Fernando VI, of the need to create such center to unify the studies of medicine and surgery, and so the Navy could have expert surgeons aboard ships[4].

When Virgili arrived in Cadiz, the city lived one of the most splendid moments of its history. Cadiz remained reference port of trade with America, where wealthy merchants were established in the City. In the mix of names, many were of Venetian, Neapolitan and French origins. Many of them, coming from southern France, with geographical proximity to Catalonia and to the Provencal languages, explain the large number of surgeons

[2]Ordinances of the Royal College of Surgery of Cadiz Navy were undergone several revisions. Initially drafted as "Book of Royal orders and decrees" were a set of rules enacted since the origin of the Royal College by Fernando VI in the origins of the Royal College. They were later published in 1791, ratified by Carlos IV under the College direction of Vicente Lubet. They were ordered and in effect for the Colleges of Cadiz and Barcelona, once created the latter.

[3]Some author described as Canivell and Francisco Vila (1721-1797), who was one of the teachers Gimbernat, specifically in Osteology- studied the Bachelor of Medicine in Cervera, before embarking as second Assistant Surgeon. Canivell was claimed by Virgili to join the RCCA of Cadiz, to take care of the Library. He became director of RCAP twice (1769-1777) and (1780-1789).

[4]Ferrer (1960), transcribed part of the communication made by Virgili in front the Court: "*Todos estos perjuicios e inconvenientes son imposibles superarlos, si no se hace un Colegio en el cual se enseñe la Cirugía con el método que se requiere, deduciendo sus doctrinas de los experimentos físicos, observaciones y experiencia práctica, para lo cual siendo preciso hay un Hospital donde haya u ocurran muchas enfermedades y que también se encuentren Cirujanos de grandes conocimientos y que puedan explicarlas a los Practicantes colegiales haciéndolos trabajar en la Anatomía efectiva y exponiendo todas las demás partes de la Cirugía. Este Hospital no lo hay más propio, cómodo y conveniente que le Real de la Armada en Cádiz." Brief translation: All these damages are impossible to overcome. We want a school where the surgery is taught with an experimental method based on, observations and practical experience, which is needed a hospital where there are many diseases and Surgeons great knowledge. This hospital there is no more appropriate, comfortable and convenient as the Royal Navy in Cadiz.*

Fig. 4. Courtyard of the Royal Hospital.

from those lands.

For instances, the Roland and Beau, both surnames deeply related to the RCCA of Cadiz. With origins in the Rhone, they established in Cadiz and associated with surgery. The children of this marriage served as a link to many of those who came to create and manage not only the RCCA, but also in Barcelona and Madrid. Among those who are linked to this common civil, family and professional origin are Lorenzo Roland, Pedro Virgili, Francisco Nueve Iglesias, Francisco Canivell, and José Sabater. All of them were members of the Faculty of the RCCA, and in some occasions founders or directors thereof (Massons i Esplugas, 1994).

Although through the harbor of Cadiz the annual arrival of a thousand of ships was recorded, not only goods from around the world arrived. The arrival of the galleons of America, full of precious metals, was part of the stowage disembarking at the port of Cadiz. An illustrated splendor flooded the city, which made Cadiz a renovator and melting pot of ideas and trends throughout the civilized world. And this would necessarily influence the RCCA, even in its origins. Without such vision of convergence it is impossible to understand why all these mentioned surgeons of the Navy landfall in Cadiz.

The Hospital of the Navy became part of city hospital services. In major disasters suffered Cadiz, the Navy Hospital, located alongside the RCCA -current location of the Faculty of Medicine (Fig. 4) - served to care of Cadiz population. Data were collected on clinical observations and notes on college student's attendance as well as aspects of the civilian population of the city in normal times (Márquez, 1986). But also in exceptional circumstances, such as the tsunami and flooding suffered in Cadiz after the earthquake of Lisbon in 1755. Three years before Gimbernat arrived in Cadiz, during the process of creating the RCCA, the popular neighborhood near the Hospital of the Navy was partly under water.

Under similar conditions, in the minutes of the College it was registered that the neighboring "Casa de las Viudas" (*Widow's Home*) had to be served by the college students. This was a house, today close to the Faculty of Medicine, dedicated to the care of widows and orphans of surgeons of the Navy. Another case deals with the Hospital San Juan de Dios, not linked in this case to the institution of the Navy, which became during long time the provider of corpses for the RCCA Anatomical Amphitheater (Ferrer, 1960).

THE CURRICULUM OF THE ROYAL COLLEGE OF SURGERY

The RCCA as the name suggests, belongs to the Navy and thus was governed as a military institution. Also, the way by which the schoolboys belong and are part of RCCA have the character of military training. And, as such institution, much of the living conditions of schoolboys are perfectly detailed in the Ordinances, from the clothes, salaries paid or the regime of their daily lives.

The access to RCCA was determined by a "suitors exam" that would take place preferentially each year in September, and conducted by the faculty, in which the vote of the Director of the College was decisive. Therefore we believe that the age requirements could have been bypassed Gimbernat with the aid of the two persons governing the RCCA, Pedro Virgili and Lorenzo Roland. Even without substantiating documents, Gimbernat had left a deep mark of dedication and study devoted to surgery, which would help to overcome

details of college admission.

In addition to the abovementioned, previous studies must meet the suitor, he had to submit reports of good family origin, blood cleansing, up to baptism faith even of grandparents, so "*mediante que con estas circunstancias acreditarán ser sugetos de buen nacimiento…*" ("these circumstances will credited to be subjects of good birth") (Ordinances, 1791). In addition, they should have their own means for maintaining a tutor, "*una obligación de persona abonada de mantenerle decente de vestido y calzado el tiempo que permanezca en el Colegio*" ("Collegians has the obligation to maintain decent clothing and footwear the whole time he remains in the College").

The studies at the RCCA, would undergo an interesting change in the year before Gimbernat's pre-registration, since, after the first years of the College, Virgili decides to give fresh impetus with the addition of disciplines that begin to proliferate in Europe. This program of subjects is extraordinarily novel[5]. Virgili ensures that the first students of the College, in 1751, i.e., before Gimbernat, would be able to visit various European countries, as pensioners of the Navy, to improve subjects what would be taught in the RCCA (Ferrer, 1960; Márquez, 1986).

Also the conditions of entry in RCCA changed, and knowledge on Latin and philosophy was required, as mentioned above, unlike the first students, who were required only elementary studies. And this occurred because of the incorporation of new subjects into the curriculum of the RCCA. In fact, from the Royal Order of 1757 on, the studies of the RCCA were awarded with the range of Bachelor of Philosophy, in order to be revalidated as Medicine ("*a fin de que graduados con la suficiencia que tienen, puedan presentarse en el Tribunal de Protomedicato para ser revalidados"* ("so that the sufficiency graduated, they can appear in the Court of Protomedicato to be revalidated") (Ordinances, 1791). This Order gives the RCCA an equal capacity like universities, to grant university degrees (Orozco, 1988).

The college students were committed to continue their studies for a period of six years, being unable to get an appropriate degree before. But this was not the case of Gimbernat, whose studies in Cádiz did not extend beyond two years, as can be read in the books of enrollment. In early October 1760 one can read in his file that Gimbernat was chosen to accompany Lorenzo Roland to Barcelona, where, together with Pedro Virgili, he would create the new Royal College of Surgeons, in the image and likeness of the college in Cadiz. Meanwhile Virgili had been promoted to the position of Royal Chamber Physician and Staff Surgeon of the Navy. Virgili shared with his brother in law, Lorenzo Roland, anatomic demonstrator, government and design of studies at the RCCA of Cadiz, laying these experiences as bases for the foundation of the Royal College of Barcelona. And for this project they had Gimbernat, who had shown great determination and skill. It was obvious that the excellent results of Gimbernat were highly appreciated: his merits in learning all subjects are mentioned in the books of enrollment.

In this connection, much care was taken that the designation of Gimbernat to move to Barcelona was not a detriment for him. His virtues and good results were well recognized, and although he did not conclude all subjects included in the curriculum, it was stated that his transfer to Barcelona did not involve the loss of seniority or his rights or merits in the College (Figs. 5 and 6). It is also known that it was Lorenzo Roland's decision to choose Gimbernat to accompany him to Barcelona. And so finished Gimbernat's stay in Cadiz. We will see that Gimbernat have had another opportunity to visit the Royal College of Cádiz, as an eminent and renowned surgeon, albeit with a less pleasant mission and goals.

GIMBERNAT'S RESULTS DURING HIS COLLEGE STAY IN CADIZ

[5]*As Orozco recognizes, "se inicia, posiblemente a partir de 1757, un sistema de enseñanza no solo inédito en España por su metodología, sino también por la novedad de las materias o asignaturas que se imparte". Entre estas encontramos la Anatomía; la Física; Higiene; Enfermedades de los Navegantes; Tumores; Enfermedades Venéreas, de los Ojos, de Mujeres y Niños; Heridas de Armas de Fuego, o la Botánica.* Brief translation: The studies start from 1757, with a system of teaching not only unprecedented in Spain for its methodology, but also by the novelty of the subjects that are taught". Among these are the Anatomy; physics; Hygiene; Sailors´ diseases; tumors; Venereal, Eye, Women and Children Disease; Firearms injuries or Botany.

[6]Ordinances: "*Duración de la residencia de los alumnos en el Colegio. XXIV. Deseando poner este estable- cimiento en el estado de perfección que se requiere para que salgan discípulos dotados de la mejor instrucción en la Medicina y Cirugía, con que puedan des - empeñar la asistencia de los individuos de mi Real Armada embarcados, la de sus hospitales y del público que recurra á su ministerio en toda clase de males; es mi voluntad que hayan de completar precisamente los Colegiales seis años de escuela, sin que antes de cumplir este tiempo y concluir todas las materias, se les embarque, ni puedan retirarse de mi servicio á menos de obtener la correspondiente licencia para ello: y si para lograr en alguno mayor perfección sobre qualquiera de las dos facultades , ó para adelantar los conocimientos de alguno de sus ramos auxiliares á que tenga declarada inclinación , se considerase necesario prolongar el tiempo de su mansión en el Colegio , se podrá extender esta á los ocho años."*
Brief translation: "Duration of residence of students at the College. XXIV. To the state of the best instruction in Medicine and Surgery, which they can assist my Royal Navy Army; it is my will that Collegians have completed the six years of school. They can extend this to eight years to achieve greater perfection in any advance knowledge or any of its branches.

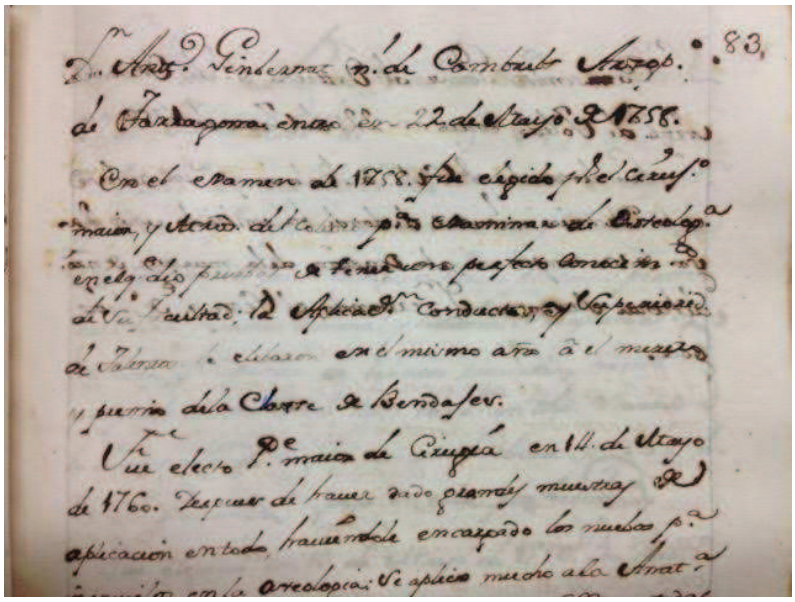

Fig. 5. Paleographic transcription of the information in the Enrollment Book 6 (1753 -1772). f. 83: "D^{n}. Antt^{o}. Ginbernat n^{l}. de Cambrils Arzop^{o}. de Tarragona entro en 22. de Mayo de 1758.
"En el examen de 1758. fue elegido p^{r}. el Ciruj^{o}. maior, y Mrôs. del Colegio p^{a}. examinar de Osteolog^{a}. en el q^{e}. dio pruebas de tener un perfecto Conocim^{to}. de su facultad; la Aplicac^{on}. Conducta, y Superiorid^{d}. de Talentos. le elebaron en el mismo año â el merito y premio de la Classe de Bendajes.
"Fue electo P^{e}. maior de Cirugía en 14. de Mayo de 1760. Despues de haver dado grandes muestras de aplicacion en todo, haviéndole encargado los nuebos p^{a}. instruirlos en la Osteologia: Se aplico mucho a la Anat^{a}, abrazando tod^{s}. las demas Clases sin excepc^{on}. y en todas â Sobresalido; y en Vistta de las Speranzas q^{e}. da de Salír buen Sujetto, no fue promovido, prefiriendole otros muchos mas modernos, y de mucho menos meríto, pues huvíera Sido lastima desacerse Tam presto de Tan buen Sujeto.
"En 13. de Junio fue electo por Vice-rrector de estte Colegio en presencia de todos los maestros.
"En Primero de Ôctubre [al margen: "1760"] p^{r}. R^{l}. Ôrn que permite a D^{n}. Lorenzo Roland, q^{e}. passe a Barz^{na}. â elegido para que lo acompañe, con Lizencia, para q^{e}. no pierda ni su antiguedad, Meritos y drô en este R^{l}. Colegio-". [L. M. 6].

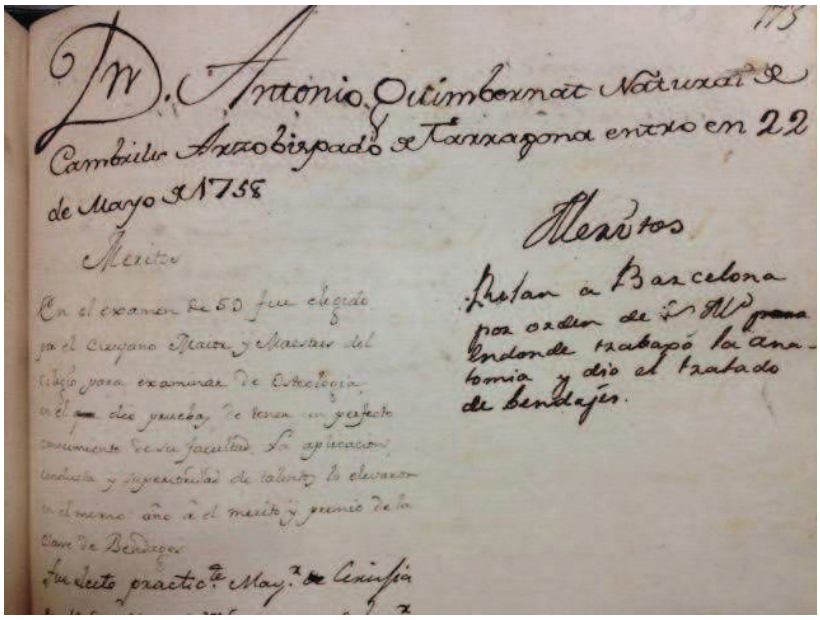

Fig. 6. Paleographic transcription of the information in the Enrollment Book 7 (1753-1766). f. 130 (173): "D^{n}. Antonio Guimbernat, Natural de Cambrils Arzobispado de Tarragona entro en 22 de Mayo de 1758
"Meritos[1]
"En el examen de 59 fue eligido por el Cirujano Maior y Maestros del Colegío para examinar de Osteologia, en el que dio pruebas de tener un perfecto conocimiento de su facultad. La aplicacion, conducta, y superioridad de talentos lo elevaron en el mismo año â el merito, ÿ premio de la Classe de Bendages
"Fue electo practic^{te}. May^{r}. de Cirujia en 14 de Mayo del 760, despues de hav^{r}. dado grandes muestras de aplic^{n}. en todo, haviendosele encarg^{do}. los nuevos, p^{a}. instruirlos en la Osteologia, se aplicó, mucho â la Anatomìa, y abrazando todas las demas classes sin ecepctión y en todas ha Sobresalido; y en vista, de las esperanzas q^{e} dà de salir buen Sujeto, no, fue promovido prefiriendole otros otros muchos mas modernos, y de mucho menos merito, p^{s}. hubiera sido lastima deshazerse tan presto. de tan buen Sujeto.
"En 19 de junio fue elegido por Vice Rector de este colegío en precencia de todos los Maestros.
"Fue destinado para acompanar el S^{r} D^{n}. Lorenzo
"Merítos
"Rolan a Barcelona por orden de S M^{d} [tachado "para"] en donde trabaxó la Anatomia y dio el Tratado de Bendajes.". [L. M. 7].
1This is the heading of the column where the "demeritos"should be noted, that do not exist, so the phrase it continues initiated as in the previous (meritos).

The courses began in October, following the admission of new suitors in September and lasting until July of following year. College students were required to go through a yearly evaluation process[7]. These evaluations took place also in September, after the summer period of recovery of the strict military regime to which students were subjected. The results of such evaluations were reflected in records transmitted to the Navy State Secretary. Moreover, a summary of the evolution of college students remained registered in the books of enrollment, as well as demerits, negative incidences related with results or behavior of the college students recorded by the College Director.

The books of enrollment say that during the stay of Antonio Gimbernat at the College of Cádiz his evaluations were excellent (Figs. 5 and 6). In the first year, in 1758, he must attend subjects such as anatomy, experimental physics, chemistry, botany and bandages. Explicit references were found on osteology exams: *"dio muestras de tener un perfecto conocimiento de su facultad"* ("he showed signs of a perfect knowledge in this faculty") and because his application, talent and conduct received an award on the subject of bandages. The subject of bandages should be particularly important. In fact, among the obligations of all college students it was "*cortar lienzos*" (cut canvases), a technique to prepare material for cures. This task should take half an hour a day. College students in the early courses had to participate in "elaborate topics", i.e., to perform cures at the Hospital of the Navy, from six o'clock to nine o'clock (Orozco, 1988).

Since Gimbernat was at the RCCA for two academic years, we can only have this information. In 1760, the registrations, which should correspond to his next instructional-year, clearly indicate the enforcement of Gimbernat in all subjects, without near specifications. Following the study of Orozco-Acuaviva (1988), he probably had studied the subjects of physiology, hygiene, general pathology, therapeutics and medical matter. We note the enormous similarities of this list of subjects and matters studied in this time in the RCCA with the official curriculum of the Bachelor of Medicine and Surgery in 1973, approved for the Spanish Education Minister two centuries later.

One adds in the registrations that, because Gimbernat was an excellent student, the teaching of osteology of college students of first course was entrusted to him. Without going into details, it is registered in the book of enrollment that results in all subjects were outstanding. And this teaching assignment has been reported in numerous publications as a job named "substitute teacher of anatomy".

However a note is remarkable, Gimbernat was not promoted to next course, although he was so brilliant in contrast to other students, because was preferred he continues the work deepening and improving anatomy, probably as usual at the RCCA, in order to prepare Gimbernat for a senior professor position. This note in the book of enrollments is a clear appreciation about the good professional prospects of Gimbernat, which states "*hubiera sido lástima deshacerse Tan presto de Tan buen Sujeto*" ("it would have been a shame get rid as soon of this so good subject"). Moreover, he was elected a senior practitioner in surgery (at the hospital) (Figs. 5 and 6), as it was sched-

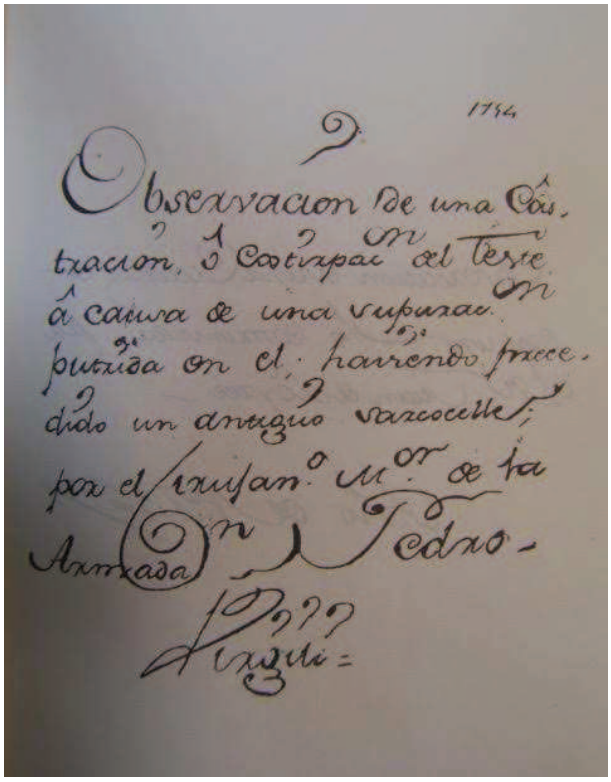

Fig. 7. VIRGILI, Pedro: *"Observación de una Castracion, ô ex tirpac^{on} del teste, â causa de una supurac.^{on} putrida en el ; habiendo precedido un antiguo sarcoceles; por el Cirujan^{o} M^{or} de la Armada D^{n} Pedro Virgili. 1754".* Cuadernillo de 20 pp. (205x145 mm). *Arch. Fac. Med. Cádiz. Universidad de Cádiz, España*. [C. Márquez-Espinós (1986): pp. 49 y 79].

[7]Ordinances: *"Exámenes generales que ha de haber. XXVIII. Cada año se hará á los Colegiales un examen general de las materias que hayan estudiado, á presencia de Director, Catedráticos, Profesores de la Armada y demás personas que quieran concurrir á este acto, en el que cada Maestro les preguntará sobre la materia que respectivamente les corresponda, sin perder de vista que el principal objeto de los conocimientos que hayan adquirido es la habilitación para la Medicina y Cirugía."*
Brief translation: "General tests that must be. Each year, Collegians will do examination in general materials that have been studied, in the presence of Director, College Professors, Professors of the Navy and other people who want to go to this event, in which each teacher will ask them about the appropriate matter, without losing sight that the main object of the knowledge they have acquired is the development for Medicine and Surgery."

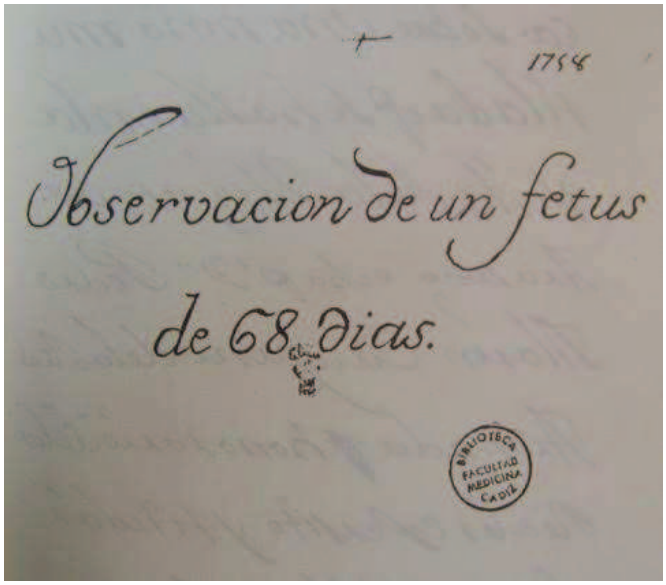

Fig. 8. CALLEXA, Athilano: "Observacion de un fetus de 68 dias con una disertacion sobre la generacion, escripta por dn. Athilano Callexa, Collegial que fué en el Colegio Rl. De Cirujia de Cadiz, y actualmente Cirujano 1º. de la Rl. Armada". [1758]. Cuadernillo de 20 pp. (205 x 145 mm.). Arch. Fac. Med. Cádiz. Universidad de Cádiz, España. [Paleographic transcription of C. Márquez-Espinós (1986): pp. 51 y 80].

uled in the Ordinances for students who had reached at least the fifth course[8]. This is an appreciation, which implies the recognition of students who stood out most in the completion of studies at the RCCA. In fact, the appointment as major practitioner represents a preeminent situation to occupy in the future the highest positions available in the Navy surgeons organization.

Several authors refer this stay of Gimbernat as a long period of production and dedication to dissection and anatomy. It is regrettable that we have no other better sources. One can add what Matheson (1949) said, that anatomy occupied much of Gimbernat's time, even his leisure time; and recording observations about peritoneal spaces and congenital anomalies. Unfortunately, we were unable to confirm these data with other sources (Márquez, 1986).

It is remarkable that Virgili promoted the so-called "*Observaciones*" (today clinical studies, case reports, reviews, presentations of observations obtained in the dissection, etc.) as a way to transmit knowledge acquired during work and daily task. Virgili learned this practice in his visits to Montpellier and Paris, introducing them into daily life of the RCCA (Fig. 7). And so acted both Directors and Navy Surgeons, until many college-students dissertations were written and presented as a way to transmit daily practice and experience (Fig. 8). In a careful study, Marquez (1986) reviewed these "*Observaciones*," collected as signed manuscripts by Lacomba or Virgili including many students and teachers of the College. These "*observaciones"*, after being exposed to the Board of Professors, received considerations of the Censors, who valued the work presented by college students as well (Márquez, 1986). Although one must keep in mind that much of such information appeared in anonymous manuscripts. Unfortunately we could not find references to "*observaciones*" made by Gimbernat itself; although it is very likely that they were produced (many observations are unsigned and are registered as anonymous). His fame and talent for dissection and surgery remained surely registered. However, we insist on these novel forms of study of the College of Cádiz, with very similar issues today with the Final Degree Projects developed now in our faculties.

On June 19, 1760 Gimbernat was elected Vice-Rector of the College. Unlike our current account,

[8]Ordinances. "*Practicantes mayo- res de Medicina y Cirugía. XXXII. De los colegiales se elegirán los Practicantes mayores de Medicina y Cirugía, sin atender á la antigüedad, sino al adelantamiento ,aplicación y conducta de cada uno, y á que hayan entrado á lo menos en el quinto año de Colegiales; y será obligación de los facultativos, mientras concurran á las visitas de sus respectivas salas, ilustrarlos, é instruirlos en los casos prácticos que ocurran, para que de este modo adquieran la experiencia necesaria para el desempeño de sus encargos […]".*
Brief translation: "Of the Collegians will be selected the mayor practitioners of Medicine and Surgery, without regard to seniority, but the advancement, implementation and conduct, and must be entered at least in the fifth year of the College; and Physicians will be obliged to instruct them in practical cases that occur during the visits to attend their respective rooms, to thereby gain the necessary experience to carry out their orders [...]".

[9]Ordinances. Rector y Vice-Rector de los Colegiales. XXVI. Para Rector de los Colegiales, que ha de ser cabeza de la Comunidad y á quien han de tener ellos toda subordinación, se elegirá en junta del Director y Maestros un Profesor de la Armada de la clase de primeros […]. Del mismo modo se hará la elección y aprobación de Vice-Rector, que ha de ser siempre un Colegial de los de mejor conducta y le obedecerán los demás lo mismo que al Rector, de quien dependerá observando sus órdenes como dimanadas del Director".
Brief translation: Rector and Vicerrector of the Collegians. Rector of Collegians, which has to be head of the community and who all of them must to have subordination, will be elected in the Claustro of the Director and Professors [...]. Likewise will the election and approval of Vice-Rector, who must always be a Collegian of better behaviour, and everybody obey the same as the Rector, who depend observing his orders as emanating from the Director.

this meant an executive checkpoint daily life in ancient universities, and also, in our case, at the RCCA. That position supposes the recognition of a high prestige among students and professors of the Navy, being elected, like the Rector, by the Director and faculty board[9]. Both Rector, who must be a professor of the Navy (if this was not possible, then the position could be assumed by a college student), and Vice-Rector were responsible for ensuring order and fulfillment of the Ordinances and therefore should be persons of greater closeness and trust of the College director.

ANATOMISTS OF ROYAL COLLEGE OF CÁDIZ WHO INSTRUCTED GIMBERNAT

At this time, one can add that Gimbernat should receive anatomy lectures from several surgeons of the RCCA. Because it was one of the most important subjects, every morning during the cold months, dissection classes with cadaver were scheduled, from 9:00 to 10 and a half. To these events we should add the lessons given in the form of lecture or presentation by the professor.

At the arrival of Antonio Gimbernat to the RCCA, Lorenzo Roland was the anatomic demonstrator and Francisco Canivell Vila was responsible for osteology from 1751 until 1758. Apparently from 1759, professor Juan Manresa was in poor health, a situation, which would explain the aforementioned request to Gimbernat for 1758 or 1759 (according to the books of the RCCA transcripts) and probably until January or October 1760, when he was destined for Barcelona. A long exhibition on how temporarily classes in anatomy and surgery were held according to the internal rules issued by Virgili is recorded in the Archives of the Faculty of Medicine of Cadiz[10]. In these few years they had to happen changes of the teachers of anatomy in general and osteology in particular, reasons why other than its worth, was commissioned Antonio Gimbernat with these disciplines.

GIMBERNAT AND THE DECLINE OF THE ROYAL COLLEGE OF CÁDIZ

All historical figures are made up of gray shades. In all circumstances they can be assessed in positive or negative ways, depending on the historical consequences of their acts occur. And this also happens in the case of Gimbernat. His anatomical dowries and dedication to work and to surgery, or his efforts to create appropriate institutions for the study of medicine and surgery, will be not undervalued if we put light on the consequences that years later would have his actions at the RCCA.

On December 29, 1796 in Cadiz was signed the creation of the Scholastic Board. This organ was created to analyze, improve and coordinate the teaching of the Royal Colleges of Cadiz and Barcelona, to which just joined the College of Madrid, put into operation in 1787 and directed by Antonio Gimbernat and Mariano Rivas. This document relates details that Antonio Gimbernat, a member of that Board, was in Cadiz at this time accompanying the King Carlos IV.

In this Acta or document a very thorough internal audit of the expenditures of the Royal College of Cadiz is done, mainly those expenses related to the Anatomical Amphitheater and surgical practice. Abandonment and lack of compliance with these practices at the RCCA are also mentioned. This is not consistent with the information contained in the files of the Faculty of Medicine of Cadiz, in which are registered payments and use of 100 to 150 cadavers for surgical and anatomical demonstrations (Cabrera, 1985; Ferrer, 1960). This document, moreover, added some background of that Board. In May 1796, the Board determines the College of Cádiz to assume Ordinances of the College of Barcelona, based in summary form in the poor education system.

The Governing and Scholastic Board, in which Gimbernat formed part and was one of the signatories, caused serious damage to the RCCA, which from now on was relegated and conditioned in their economic support (Cabrera, 1985; Ferrer, 1960). For the project led by Gimbernat to launch the Royal College of Surgery of San Carlos de Madrid, the Royal College of Surgery of Cadiz was a serious competitor, although it still had a highly recognized expertise among surgeons who left their classrooms.

THE ENDURING MEMORY OF GIMBERNAT IN CADIZ

In 1835, several years after his departure from Cadiz and even his own death, the figure of Antonio Gimbernat was remembered in the Royal College of Surgery of Cadiz even with veneration. In a manuscript preserved in the archives of the Faculty, a History of the Royal College is collected. In the detailed description of professors who took part in the RCCA of Cadiz the great figures and textbooks they wrote are recognize. Starting from the origin of the College by Pedro Virgili, one reads in that History: "*El objeto de esta fundacion fué el de formar cirujanos científicos, que reemplazando a los ignorantes que prostituían entonces su noble arte con oficios bajos y mecánicos surtiese á la Real Armada de Profesores que supieran atender y curar los infinitos males quirúrgicos, que aflijían á las tripulaciones de las numerosas Escuadras*

[10]*Libro de Reales Ordenes y Decretos…pp. 576-573: "Methodo Instructivo q.e según la mente de nuestro Director deben observar en sus Clases, y Conferencias los Maestros de este R.l Collegio" Archivo de la Facultad de Medicina de Cádiz. Transcripción paleográfica realizada por Carlos Márquez. Recogido en Márquez-Espinos, 1988).*

que entonces ecsistían, en las heridas que resultaban en los combates, y demas contratiempos de la vida del mar.[…] Así es que desde luego se empezaron á publicar obras y tratados elementales de la Profesion, que compitieron con los que salían á luz en los países mas cultos de Europa. […] El del Catedratico Gimbernat sobre el Método de Operar la Hernia Crural, adoptado por toda la Europa, y que se sigue en la actualidad por los cirujanos mas célebres de todas las Naciones" The purpose of this foundation was to train scientists surgeons that could replace the ignorant ones who prostituted his noble art with low and simply mechanic trades and supplying the Royal Navy with good professors, able to solve the infinite surgical problems, afflicting the crews of the Navy Squadrons, in the wounds that resulted in fighting, and other mishaps of sea life [...]. Then published books and basic treaties on the profession began to appear, which competed with those coming to light in the best educated countries in Europe. [...] The book of Gimbernat on the method of operating the Hernia Crural was adopted throughout Europe, and is still today followed by the most famous surgeons of all nations.

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L. M. 6 = "Libro Sesto. Libro intitulado procesus Colegiaruz. El qual Contiene todos los meritos, y Demeritos de tods. los Colegs. de estte Real Colegio, y Se comenzo en 6 de Nove. de 1753. en cuio dia fue elegido pr. Rector de estte Real Colegio Dn. Jaime Pruna Mtrô. Cirujo. de la Pontifa. y R.l Universd. de Cervera, Principado de Cataluna; Su autor el mismo Con licencia, y orden del Sor. Dn. Pedro Virgilii, Cirujo. Mayor de la Real Armada De S. M. y Director de Estte Real Colegio.". (Libro de Matrículas 6, 1753-1772). Ms. (285 x 200 mm.). f. 83. Arch. Fac. Med. Cádiz. Universidad de Cádiz, España. [Transcripción paleográfica de J. R. Cabrera-Afonso].

L. M. 7 = "Libro Septimo. Libro intitulado Procesus Collegarii. El qual Contiene todos los meritos, ÿ demeritos de todos los Colgls. de éste Rl. Colgo. La qual obra se comensó en 6 de Nobre. de 1753 Día en qe fué elegido por Retór de éste Rl. Colgo. Dn. Jaÿme Pruna Mtro. Cirujo. de la Pontifa. ÿ Rl. Univerdad. de Cervera, Prinpdo. de Cataluña. Su Autor el mismo. Con licencia, ÿ Orden del Sr. Dn. Pedro Virgili Cirujo. Mr. de la Rl. Armada de Su Magtad. ÿ Director de éste Rl. Colgo.". (Libro de Matrículas 7, 1753-1766). Ms. (385 x 250 mm.). f. 130 (173). Arch. Fac. Med. Cádiz. Universidad de Cádiz, España. [Transcripción paleográfica de J. R. Cabrera-Afonso].

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Antoni de Gimbernat and Barcelona (1760 – 1779)

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SUMMARY

Barcelona is a most important city in the life of Antonio Gimbernat Arbós. In the period in which he was living there, 1760 to 1779, he completed his training, he initiated and developed his teaching as professor of the Royal College of Surgeons, he conducted research of high quality describing anatomical structures of the femoral ring, and he described his new surgical technique for hernia, which practiced as major surgeon of the Hospital de la Santa Creu. He also founded his family, married and had six children, all born in Barcelona. At this period, he carried out a European tour for the acquisition of new knowledge that he first applied in Barcelona, and later in the capital of the Spanish kingdom, in which he achieved the top in management and health accountability of his time, as well as great fame.

Key words: Antonio Gimbernat – Royal College for Surgery of Barcelona – Hospital of Santa Creu of Barcelona – Gimbernat ligament – Anatomy in the eighteenth century – Surgery in the eighteenth century

PREAMBLE

17 November 2016 marks the second anniversary of the death of Antonio de Gimbernat Arbós, one of the most important Catalan surgeons in history, with a prominent place in the annals of surgery worldwide.

The first centenary was celebrated in 1916 at the University of Granada by initiative of Victor Escribano, Chair of Topographical Anatomy and Operations, who delivered the speech "Data for the history of the Spanish Anatomy and Surgery in the eighteenth and nineteenth centuries", published in 1918 in conjunction with Gimbernat's work "New method operate in inguinal hernia," a booklet translated into Catalan and distributed to all doctors in Catalonia by proposal of the Academy of Medical Sciences and Laboratory with various institutional supports and personals (Escribano, 1918). In Gimbernat's hometown, Cambrils, the first centenarian anniversary was also honored with an act of the City Hall on 17 November 1916; it was initiated by the Medical Faculty of the University of Barcelona with the support of the town of Cambrils (Pagarolas, 1985).

Also a son of Cambrils (Tarragona), an actual fellow citizen, Dr. Pere Mestres-Ventura, Professor Emeritus of the Faculty of Medicine at Saarland (Germany), organized as a tribute one academic session around the figure of Gimbernat. The Royal Academy of Medicine of Catalonia, to which I belong, which actually occupies the same building as the Royal College of Surgeons of Catalonia inaugurated in 1764, and the Catalan Society for the History of Medicine, which I chair, cannot remain indifferent to such an initiative. This is the reason why I accepted the request of Dr. Pere Mestres-Ventura to describe the stage of Antoni Gimbernat Barcelona, underlying, moreover, the institutional consideration that this important surgeon, in advance of his own times, deserves.

THE TIME BEFORE BARCELONA

Antoni Gimbernat i Arbós was born in Cambrils (Baix Camp, Tarragona) on 15 February 1734 in a home of wealthy farmers, with genealogical ramifications in the establishment of notaries and scribes of the time (Pagarolas, 1985). He was the fifth of seven brothers. He completed his first studies in the school of Cambrils and after the death of his father he moved to the Franciscans in Riudoms to study Latin (Gimbernat Grassot, 1828). In 1749

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he was at the University of Cervera, the only one operating Catalonia by imposition of Bourbon King house, and there studying the last year Latin and fifth of philosophy and humanities. In 1756 he obtained the degree of Bachelor of Arts.

For reasons that could not be documentarily explained, he moved to the Royal College of Surgery at the Navy, created 1749 in Cadiz following the project of Pere Virgili, another very famous surgeon, born in Vilallonga del Camp (Tarragona), near Cambrils (Guerrero, 2014). In a short time this College demonstrates to be a necessary and excellent school of surgeons, modern and with progressive increasing prestige that contributed to avoid the embarrassment of providing the Navy and Army with foreign surgeons. Moreover, it was crucial to sweep the Galenism and Empiricism from the military and civilian surgery. The quality of its practical training fully justifies the motto of the shield of the College and others will appear: *manu qua, auxilio quo*.

In 1758 Gimbernat became practicing scholar of surgery. Gimbernat became student of the anatomy demonstrator and major surgeon of the Army, Lorenzo Roland, son in law of Virgili, and was appointed in 1760 interne college member as outstanding student, taking benefit of the prerogatives of this condition. He studied anatomy and dissection, bandages, physiology and hygiene, general pathology, pathology, surgery, surgical algebra (traumatology), obstetrics and venereal diseases, diseases of the eyes and teeth. He followed Winslow's anatomy texts, the "Principles of Surgery" by Francesc Puig and the pathology of Boerhaave and von Haller and others, and was a student who excelled at all times. He attended clinical meetings called "Observations" and often also to the "Literary Meetings" which are held with a regulated frequency. In the same year 1760 Virgili calls Roland to Barcelona to join the faculty of the new Royal College of Surgeons. Without ahis own position, Roland began at the Hospital of the Santa Creu (Fig. 1) during 1760 to 1761 with twelve students selected among practitioners of the hospital without asking too many requirements, but in the following years he was required to be enrolled training Latin, logic and experimental physics. While some authors claim that Gimbernat at the final period of his studies in Cadiz, still a student, had replaced his absent teacher (Pi i Sunyer, 1936), but he was such a good anatomist and skillful dissector that Ronald took him to Barcelona (Albiol, 1999), where he developed activities as anatomy dissector, giving practical lessons of anatomy, anatomical preparations and bandages, all with solvency and recognition.

Fig. 1. Partial view of the ensemble of the Hospital de la Santa Creu.

THE TIME IN BARCELONA

Shortly after inaugurating the building of the Royal College of Surgery of Barcelona (RCCB) on 7 January 1762, he passed the theoretical and practical part of the professional examination and became Latin surgeon. Pere Virgili began to prepare the teaching staff of the institution then working in the General Hospital of the Santa Creu (HSC) and soon would have its own location, and asked the Court to register Gimbernat as teacher and surgeon of the hospital. Youth and lack of experience of the candidate was the cause of resistances and the application did not succeed, but he continued his teaching under the protection of Roland. Meanwhile and because of lack of staff, Virgili continued to teach for almost a year. In 1763 Virgili insisted on his request and added as outstanding merit, that Gimbernat had served in the Army; thus, highly valued, the situation changed and he was appointed honorary teacher with the obligation to replace any other teachers temporarily without receiving remuneration, but with the right to be a permanent teacher when the first vacancy occurred. At that time he taught a class of 186 students. Pere Virgili resumed his position at the Protobarberato (chief surgeon organization) and moved to Madrid.

On 2 August 1763 he married Eulalia Grassot Ballester (Calbet and Corbella, 1982), daughter of

Carles Grassot supernumerary teacher of "Real Colegio de Cirugia de Barcelona" (RCCB), a surgeon who enjoyed notoriety in the city. The ceremony took place in the parish of Saints Justo and Pastor in Barcelona, and acting as witnesses RCCB professor Diego Velasco and major military surgeon Joseph Payssa (HSC). Between 1764 and 1779 the couple had six children born in Barcelona; some of them would be distinguished persons, for instance, his son Carlos.

Before 29 March 1764, the date of inauguration of the neoclassical building of the RCCB, Gimbernat was recorded in the cloister professorial as supernumerary teacher. The president was Pedro Perchet, the director Pere Virgili, the Vice President and first teacher Lorenzo Roland. Other teachers were Francesc Puig i Josep Payssa, major surgeons the HSC, and Peter Maville and Tomas Rancé surgeons consultants. The ceremony, presided by the Marquis de la Mina, Captain General of Catalonia, was opened with a speech of Diego de Velasco, former student of the College of Cadiz and now professor of the College in Barcelona. Since then every year an inaugural speech of course was made. Due to a royal decree, Spanish was required and the use of Catalan prohibited.

1765 Gimbernat has been already tenured at the Royal College. Pere Virgili definitively moved his residence to Madrid as Royal Chamber Surgeon. Roland remained at the RCCB as strong man and Virgili's trusted person, but gradually shirking his responsibilities, which were assumed with delight by his secretary Francisco Puig. Puig was concerned with education; fight intrusions against the rights of the College of Surgeons in front of medical doctors and empirical surgeons and hauling unions of the past. Gimbernat taught Anatomy lessons in the first year (career five years) and in fourth year lessons on operations, which mainly comprise surgery and obstetrics practice.

The RCCB educated elite Latin surgeons with 2, 3, 5 and 9 examinations, occupy the best professional positions, but also so-called basic "romancistes" surgeons with 1 and 2 exams, who worked as bleeders and village surgeons and practiced as barber in order to survive. The RCCB also gave a degree of dentists, midwives and oculists. The access to studies was not easy and required at least seventeen years age, usually between seventeen and twenty and should show a certification of baptism, a certificate of "vita et moribus," and one of "clean blood", an economic guarantee for the complete cycle of training and a certificate of having passed two years of learning with a surgeon with title and in practice. Since the College was acquiring prestige, more students were getting enrolled, but many dropped out because rigor and unexpected difficulties emerged. With time the number of registered students would match the number of those completing their studies (Massons, 1994).

The analysis shows that graduate surgeons of the time predominate over groups of pharmacists and doctors. In the villages of the country there were more and more surgeons "romancistes" and bleeders formed at the RCCB than bachelors in medicine.

In 1765, on the occasion of the death of Joseph Payssa, Antonio Gimbernat replaced him as major surgeon of the HSC. The hospital was owned by the City Council and the Church, represented together in the Very Illustrious Administration (MIA = Molt Il·lustre Administració), a powerful institution that initially disagreed with the Bourbon legislation, which granted the administration of HSC surgery positions to RCCB. The MIA conferred Payssa's position to Manuel Capdevila, since 1759 deputy surgeon at the HSC, while Gimbernat claimed his right. Virgili, Roland and Puig with all determination took party with his protégé and the dispute was resolved in 1766 in favor of Gimbernat.

At this time the HSC disposed of enough personnel to attend patients, including three medical doctors and two family doctors or practitioners, several major surgeons (including Gimbernat), a "fadrí major de cirurgia" (equivalent to deputy of surgery department) that was responsible for four "fadrins de post" (equivalent to head of surgery room) and fourteen practitioners, midwives, nurses, waiters and waitresses; also collaborate volunteers and with staff of religious congregations and the religious order Darderes (Un hermano de la Caridad (*A Brother of Charity*) (anonymous, 1935). To get an approximation of the number of patients received, in early 1786 there were 660. In this society brotherhoods proliferated for mutual aid: these were approximately thirty — officially regulated (Zarzoso, 2006).

In a session of the RCCB in 1765 Gimbernat reported his successful intervention of a liver abscess. Gimbernat was a practical teacher with great anatomical knowledge and accurate diagnosis, as well as a very skilled surgeon of greater renown, who said: "my favorite author has always been the body ... the human body is the natural book, I do not turn away and always preferred to whatever author, even the most illustrious, and of these, only those that fewer move away from this book". (Gimbernat 1773, re-printed 1934) He was totally distanced from the Galenism that reigned in the past and still present outside of the college, and also the textbooks used at the RCCB followed a renewing trend. He gave his lessons at RCCB, operated at HSC, and created a teratology collection that years later would be transported to Madrid. The College functioned reasonably well, but with some shortcomings, such as the fact that in 1766 Roland complained that the number of cadavers was insufficient for the lessons.

Gimbernat (1768) in a public anatomy lesson (in the amphitheater that now bears his name, Fig. 2), explained the structure of the crural arc. The de-

Fig. 2. Anatomical amphitheater chaired by Gimbernat bust sculpted by Pere Virgili. In the center of the image one sees the table for dissection of the Royal College of Surgery of Barcelona.

tailed knowledge of this anatomical region, which according Escribano deserves to be called "Gimbernat region" (Ferrer, 1968), allowed Gimbernat to operate its pathology in innovative ways. Some later anatomists have gained an eponymous describing anatomical structures already described above in detail by Gimbernat, such as the so-called Cooper's ligament and lymph node of Cloquet or Rossenmüller. On 5 October 1768 he read the inaugural speech of the course, which praise great surgeons citing Pere Virgili and La Peyronie.

At this time there was still a struggle between doctors and surgeons and among educational centers, which was more specific between the University of Cervera and the RCCB. From 4 March 1769 on, the Cervera medical studentswereforced to take a new school regulation, learning one hour per day for eight months the subjects Anatomy, Physiology and Surgery. The medical school students went right reluctantly and arrogantly and despising the RCCB and all that they represented to be against its Bourbon University, and caused various conflicts. On one occasion, the students agreed to take seats in the front rows of the anatomical amphitheater, which in law were not for them. They caused an uproar in which they came to insult Gimbernat, who was giving the lecture, and his colleagues as well (Massons, 1993). This needed the intervention of the military guard, who would be present there at other times. Francesc Puig, secretary of the center and professor, communicated these incidents by letter to Pere Virgili.

Anatomy was taught with wax and ceramic models, but whenever possible, with cadavers. The dissection of cadavers was made especially in winter as the low temperatures slowed down the process of putrefaction. However, the foul odors in the building were considerable. As a reference one can take a subsequent letter from the time of Gimbernat in Madrid, signed together by Ribas and Fernandez Solano at the College of San Carlos, where they describe "... infect exhalations of hanging clothes, the bad air to be breath inside ... by stench of general rooms ... by the odors of cadavers and anatomical pieces, because the neighborhood of cemetery... by decreased ventilation because nearby walls....."(cited in Aparicio, 1956). At the RCCB the smell of death, latrines, the humidity, smoke of fireplaces and the stench of people had also contributed to create an environment hardly breathable, suitable only for those wonted.

Pere Virgili, in 1770, aged and in poor general condition, left the court and returned to Catalonia. He made a long stay in Caldes de Montbui, hoping to recover his health with medicinal waters, but the improvement did not occur and in 1772 he moved back to Barcelona, full of aches and pains, away from real influence on the professional and institutional fields. No one could count on him for anything, although he maintained his status in the organization awarding professional licenses in surgery, and remained director of the Colleges of Ca-

diz and Barcelona.

1772 and 1773 Gimbernat successfully operated two strangled crural hernias following a new method discovered by himself, based on his anatomical observations, especially the ligament lacunar at the femoral channel, today called "ligament of Gimbernat". However, he did not publish this technique until twenty years later, when the international medical community already knew it by oral transmission initiated by Gimbernat itself. In 1773 he extracted a stone of the urinary bladder by lithotomy with a device of his own creation. In the same year, he taught the inaugural lesson dealing with the skills needed to become a good surgeon, e. i. , good anatomic knowledge, dissection of cadavers and assistance to patients. Among other things, he says: "... how can someone perform similar wonders when he lacks those natural dispositions I have referred to, a deep knowledge of anatomy in practice, to be very applied, and with continuing assistance to Hospitals? Certainly one cannot expect it in any way, because neither the speech nor the intelligence nor the knowledge of the crippled parts, nor necessary skills, they cannot accompany him to do such great works and wonders of this class, it is necessary to possess perfectly all those principles and precise circumstances already referred; otherwise it is clear that many patients could not have similar benefits, as they have achieved since the establishment of the Royal College Surgical anatomical" (Gimbernat, 1934). Gimbernat says, "you must know well the ill part of the body in order to make a better treatment" (cited in Martinez, 1999); this will be a localization-dependent perspective of the morbid process (Martinez, 1999).

Despite he was a well-recognized teacher, he never reached the position of first teacher in Barcelona, since for this position seniority was required.

Carlos III appreciated the success of the royal colleges, and following a suggestion of his Court, he decided to create a new one in Madrid, less peripheral and able to bring assistance to his people. With this purpose, in 1774, two most prestigious surgeons made a stay in other countries to incorporate other forms of work and treatment. The commission fell to Antonio Gimbernat (Fig. 3), who has then forty years old and had a great experience, and Mariano Ribas, surgeon major of the Army and Professor of the College of Cadiz. Gimbernat tried to keep his position as fourth teacher and for the time of his absence a substitute, Josep Torner Tutusaus, Latin surgeon, with nine exams and with two years experience of care. The intrigues of Pedro Custodio, first Chamber surgeon and president of the College, and perhaps also Francisco Puig, caused the substitution not to be accepted and not recorded as vacant until 1787 (Usandizaga, 1964). The surgeon Gimbernat left wife and children under the tutelage of his father in law, Carles Grassot, and with Ribas he started a four-year journey to Europe.

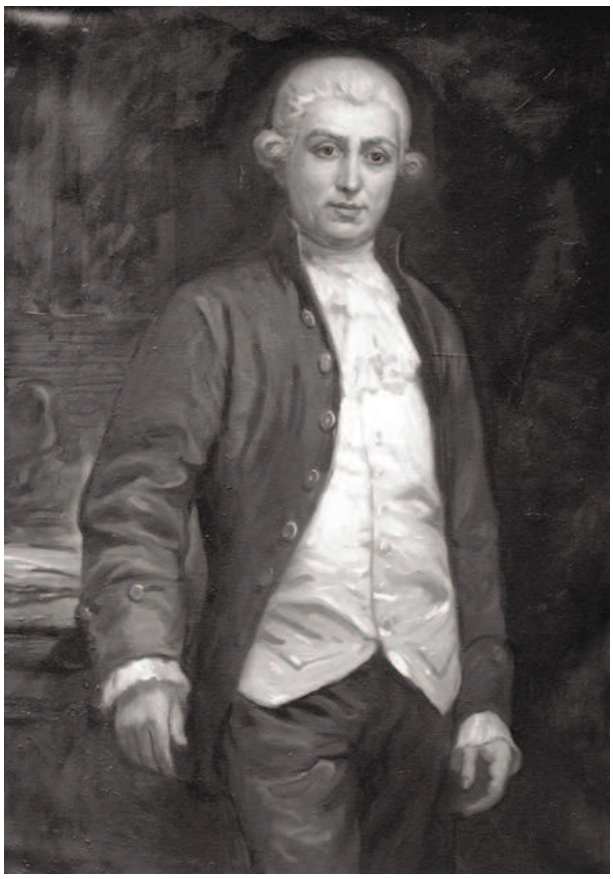

Fig. 3. Picture representing Gimbernat in the stage of fullness.

In Paris, they stayed at the Hôtel Dieu, La Charité and became involved in the work of Petit, Louis, Desault, Chopart and others. In London, they visited the hospitals Saint Thomas, Guy, Saint Bartholomew and Saint George, and received lessons of the great masters Hunter, Pott, Sharp, Lucas, Smith, Els, Crane and Young. In a lecture by the famous Hunter, Gimbernat presented his new intervention method of the femoral hernia and received Hunter's approval; from this moment the technique was known everywhere. In Edinburgh he saw where Boerhaave taught and worked with Cullen. In Leiden, he observed the work of the most renowned surgeons and at the same time knew Camper, naturalist, pioneer of biological anthropology and other disciplines of anatomical basis.

At this time the local surgery watches what succeeded in Europe , and through Gimbernat makes Barcelona one of his most important contributions to international surgical knowledge (Corbella, 2016).

Meanwhile, in 1776, the relationship between Pedro Custodio and Puig gave another turn, and the first forced the second to deduct 6,000 *reales de vellón* (Spanish coins from an alloy of silver and

copper) from the annual regular budget of the RCCB for their own benefit, justifying these expenses as management trifles. This less clean maneuver with centralist background, committed some services of the College.

In October 1778 Gimbernat returned to Barcelona, to his teaching at RCCB and to the care of the HSC, enriched with acquired experience and knowledge, which he explained to students and applies the patients.

In February 1779, however, the King claimed his presence in the Court and moved to Madrid with his son Carlos. His wife, pregnant, remained in Barcelona with the rest of the children until the birth of their sixth son; later the family got together in the capital of the kingdom.

In 1780 the King approved the creation of the Royal College of San Carlos in 1787 and, by Royal Certificate, its Ordinations; opened in 1788 and the so-called "*Juntas literarias*" (clinical meetings) were initiated with a discourse by Gimbernat on "New methods to operate the femoral hernia." Pedro Custodio, First Chamber Surgeon, was president of the College. Gimbernat and Ribas were appointed perpetual directors of the College (Salcedo, 1926); also as teachers, the first as professor for Surgical Operations and Algebra (Traumatology) and Ribas for Mixed Damages and Clinical Lessons. During 1787 - 1788 there were only three students inscribed: one of them was Gimbernat's son Carlos Gimbernat Grassot (Aparicio, 1956). The inaugural lecture pronounced by Antonio Gimbernat dealt with surgical sutures and how to prevent their abuse by bandages (Gimbernat, 1987). This dissertation ends with a wise and lapidary recommendation: "Ne videantur chirurgia carnifices esse, sed studiosi humane naturae conservatories".

Gimbernat was until 1786 listed as fourth master of the RCCB; in the following year this position appears listed as vacant, and in 1788 it was adjudged to Domenec Vidal, born in Vilaller (Alta Ribagorça), who also became librarian and a prolific author. In the period 1764-1794 the total number of graduates in the RCCB was 914 (Massons, 2002).

In 1793 Gimbernat finally published the text "New methods operate in the femoral hernia", a quarter of a century after practicing it for the first time in Barcelona. Joseph Townsend included Gimbernat's procedure in his book "A Guide to Health" (1795) and also various authors mentioned Gimbernat and his method (Sprengel, 1815), for instance, Jaume Bonell and Ignatius Lacaba in his work *"Curso completo de Anatomia del cuerpo humano"* (Full course of Human Anatomy), published later in 1820. In 1795 he published the new royal Ordinations of the RCCB (Carreras, 1968) carefully supervised by Gimbernat.

In some RCCB "juntes literaries" (clinical sessions) after the Great War (1793 - 1795), Gimbernat is remembered in 1796 and 1797 as a referent on the occasion of presentation of cases of separated fracture (pseudo- arthrosis), liver abscesses and hydrocele (Perez, 2007)

1799 Gimbernat succeeded in unifying the studies of surgery and medicine and created the Royal Colleges of Medicine and Surgery, including that of Barcelona, but this situation only lasted for two years, until 1801. Then returns the authority of the Protomedicato (chief physician organization), recovering teaching functions always had the RCCB, but this will vary with the curriculum of 1804.

In 1802 the government agreed that the King would visit Catalonia accompanied by Gimbernat as first chamber surgeon. For the anatomist this was an exceptional opportunity to return to the scene of his academic backgrounds. He was 68 years old and his prestige was very high (Chinchilla, 1846). Gimbernat visited the College of Barcelona and missed the memory of the pioneer: following his request, a bust of Pere Virgili was placed in all colleges of surgery, which was carried out immediately.

Almost a century later, in 1893, the Department of Anatomy the Faculty of Medical Sciences of Barcelona was reformed, creating a new room for dissection and anatomy practices. In the inaugural session the academic dean, Joan Gine i Partagàs proposed to dedicate the new dissection room to the great anatomists who worked among those venerable walls, Antoni Gimbernat and Josep Letamendi, and the agreement was made to place medallions with busts of both carved in high relief. At a meeting of 28 May 1894 these busts were discover in a ceremony, in which Carles Silóniz presents the biography of Gimbernat and Marià Batlles that of Letamendi (Siloniz and Batlles, 1894).

When in 1906 the Faculty moved to Casanovas Street, the old RCCB building had various uses until 1929, in which it was assigned as the new headquarters at the Royal Academy of Medicine of Barcelona (RAMB). This institution paid new tribute to Gimbernat on 24 March 1974; on that occa-

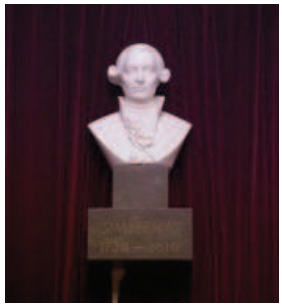

Fig. 4. Gimbernat's bust, located in the room that bears his name at the Royal Academy of Medicine of Catalonia.

sion the speeches recalled his brilliant career and a marble bust, by sculptor Joan Rebull was placed in the anatomical amphitheater that today bears the name of the surgeon. On following May 19 in the city of Cambrils, birthplace of Gimbernat, the RAMB developed a similar academic program and delivered to the City Council a copy of the same bronze bust. It also calledfor an award on the occasion of the bicentenary of the beginning of his European tour.

Currently, the anatomical amphitheater of the Royal Academy of Medicine of Catalonia (formerly RAMB), one of the best preserved in Europe, displays the name of Gimbernat at the dome glitters, and his bust (Fig. 4) housed in a niche, a short distance from the Pere Virgili, observes, static and careful, those academic activities that are carried out, and the dissection table at the center of this noble space.

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Gimbernat's travel towards a new enlightened model of scientific anatomosurgical medicine

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SUMMARY

The 18th Century has been a period of time when the Enlightenment meant a change in science development in many issues. One of them was surgery and, under its influence, medicine and all the arts involved in the cure of diseases. Many surgeons, especially in Europe, were protagonists in this revolutionary time; one of them, Antoni de Gimbernat, travelled around Europe to learn and compare his own knowledge with that of the more famous colleagues in France, Great Britain and Holland. He was a pioneer in anatomic description, especially the inguinal region, and, through it, he was able to recommend safer new operations, like that of femoral hernias, a serious and frequent problem with an unsatisfactory solution by then. John Hunter, after knowing the new Gimbernat's method, helped to its diffusion around the world, while Gimbernat contributed to the reform of the studies of surgery and medicine, mainly in Spain but in other countries, too.

Key words: Gimbernat –18th Century – Anatomy – Surgery – Medicine

INTRODUCTION

Evidence-based medicine, or evidence-based surgery, is the new scientific model of thinking nowadays in health management. Although it has spread at the end of the past century, becoming the main medical paradigm of our times, it is a point in the evolution of the state of art in scientific medicine.

The Enlightenment, at the end of the 18th Century, was another important inflection point in this process (Pelayo, 2013). In Spain, the court of the King Carlos III (1716-1788) was an example of what has been called the enlightened absolutism or benevolent despotism, defined by Emperor Joseph II of Austria as "Everything for the people, nothing by the people". Some main ministers had ruled the country during Gimbernat's time, but in the period before his European journey the influential man was the Count of Aranda (1719-1798), who lost the king's confidence in 1773, and was sent to Paris as Ambassador.

Maths, physics, chemistry and natural sciences in general were completely transformed during this period, beginning a new era of scientific thinking beyond the mythical and religious beliefs, or even the philosophical speculative trends disconnected from reality. In surgery and medicine, the study of anatomy, directly from corpses, had led to a more real and practical knowledge of the human health problems (Loukas et al., 2007). Meanwhile, many of the classical philosophical concepts that had ruled medicine until that moment showed their incapability to solve them.

The empirical essence of surgical practice was the best field to approach the new model and, for instance, better prepared surgeons were able to lead it (Montiel, 1999). John Hunter in Britain, Jean Louis Petit in France, Pieter Camper in Holland, Pere Virgili and Antoni de Gimbernat in Spain, with many others in Europe, had been responsible for the change that drove the modern medical evolution (Cardoner Planas, 1974).

The purpose of this study is to analyze the roll of Gimbernat in this process, travelling around Europe for 4 years in order to experience directly

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some of the more advanced models of scientific surgical and medical practice (Arráez-Aybar and Bueno-López, 2013).

THE FIRST GIMBERNAT'S CAREER IN SPAIN

Antoni (or Antonio) de Gimbernat i Arboç (or Arbós) was a Catalan surgeon born in February 15, 1734, in Cambrils, a small fisherman's town near Tarragona, the capital city of the roman province of Hispania (Albiol Moliné, 1998). Educated in a Franciscan Convent in Riudoms, went to the University of Cervera, where he became and expert Latinist (Orozco, 1999). Probably influenced by another Catalan surgeon, Pere Virgili, born not far away from Tarragona, too, who founded the first Royal College of Surgeons in Spain in 1748, in Cadiz, in the opposite part of the Iberian Peninsula, Gimbernat decided to go there in order to become a surgeon (Pi-Sunyer Bayo, 1936).

When Virgili was authorized to develop a new Royal College of Surgeons in Barcelona, in 1762, he called Gimbernat as a professor of anatomy and surgeon of the *Hospital de la Santa Creu* where the College had been settled (Anonymous, 1945). He was not easily accepted by the surgeons trained in Barcelona, but finally he achieved certain successes (Pérez-Pérez, 2004).

It was during those years, from 1762 to 1774, that Gimbernat had the opportunity to practice anatomic dissections to the point that made him say: "the more important book to read is the human body, even when it is in contradiction with the classical and venerated books of medicine" (Menacho, 1915). And, thanks to his practice on human corpses, he was able to demonstrate, in some patients, the better results achieved when applying new methods to treat surgical problems, femoral (crural) hernias for example (Silóniz and Batllés, 1894).

At this time, since 1768, Gimbernat was an expert anatomist and a trained surgeon (Puig-Lacalle and Marti-Pujol, 1995). Hei had the opportunity to study the inguinal region, and was able to differentiate the inguinal hernia from the femoral hernia. He had learned the importance of a new ligament, he called: "*ligamentum lacunare*" in Latin, a significant landmark in the internal side of the femoral or crural hole through which the femoral hernias protrude. Even more, he realized that the inguinal ligament described by Falloppio in 1606 and by Poupart in 1702, as a ligament fixed to the external oblique muscle, was in fact and aponeurotic ending of this muscle that divides into two pillars to form the inguinal external foramen (Lytle, 1974). The inferior pillar or ligament he called for the first time the crural arch, although this name was later attributed to Meckel. He had discovered too the iliopectineal band that was later attributed to Cooper (Cooper's ligament). He had also discovered, and described too, a lymph node in this region that was later known as the Cloquet or Rosenmüller lymph node.

With this empirical knowledge, he was able to propose a new operation for the crural hernia based on the section of this *lacunare* ligament (Lunn, 1948), instead of the classical operation of the inguinal ligament section that was more dangerous, for the risk of a serious haemorrhage, and it caused significant morbidity that could be avoided with the new technique. He presented this new proposal in Barcelona in 1768 and performed two operations in 1773 and 1774, just before he left the Catalan capital to travel to France (Fresquet, 2016).

The success of the two Colleges in Cadiz and Barcelona moved Virgili, in that moment surgeon of the king Carlos III, to create a new college in Madrid. And with the increasing advances developed in different countries of Europe, Gimbernat was commissioned, with his colleague Marià Ribas, to travel to the main European centres of surgical knowledge at this time, in order to learn as much as they could and design the new College. Both of them were properly funded, according to the wages of that time (Piulachs, 1971).

His prestige in Barcelona was remarkable. He became famous as a surgeon with a large customers list that made him a successful man with a family to take care of. As a responsible surgeon, he accepted the orders of the king and left his wife, one daughter and three sons, to join his colleague Marià Ribas in an otherwise amazing academic adventure. For a scientifically curious man of his time, this opportunity was not easy to ignore.

Marià (or Mariano) Ribas (or Rivas) i Elias (or Trias) (1730/35-1800) was another Catalan surgeon, born in Esparraguera, near the holy mountain of Montserrat and not far away from Barcelona. He went to the University of Cervera and to Royal College of Surgeons in Cadiz too. In Cadiz he had important managerial responsibilities on the direction of the College until he was sent as surgeon with the navy to South America (Calbet and Corbella, 1982-3). At the end of 1772, he had gone by himself to Paris. Both Gimbernat and Ribas had completed their careers in Cadiz, where probably they have initiated a friendship relation, but although it is not clear from the historical data available, they met in Paris after they have been commissioned by the royal order, a few months later than Ribas has gone there by himself.

THE LONGEST STAY IN PARIS

Forty-year-old Gimbernat left his family with some degree of sadness and began his travel to Paris following the King's orders. He was expecting to find new unknown wonders to feed his curiosity. He was also concerned with the responsibility that such an important political mission represented.

At the end of October 1774, travelling on horseback and chariots, it would have been hard to get Paris. But probably, such an effort was worth it.

In the Middle Ages Paris had become an important capital of Europe. Its university attracted many scholars from everywhere for centuries. Surgeons like Guy de Chauliac (1290-1368) and Ambroise Pare (1510-1592) were widely known, and continued so in the XVIII century. Anatomists like Pierre Dionis (1643-1718), professor of anatomy in the *Ecole de Chirurgie,* performed public and free demonstrations of anatomy and surgery in the Royal Gardens of Louis XIV.

During the eighteen century, a new movement known as the Enlightenment had become paradigm of a modern society, marked by curiosity and stimulated by the ascent of the middle class bourgeoisie as the driver of the industrial era. The French Bourbon dynasty had taken the reigns not only of France but the Spanish Empire too, so the influence of French culture upon Spain was clearly significant for at least over the Academia of the country. Most French surgeons that have been enrolled in French/Spanish king Felipe V's army had brought to Spain the new scientific ideas originating in Paris.

Pere Virgili, educated at the University of Montpellier, had travelled to Paris too, where he had acquired good concepts, which he applied in the new Royal College of Surgeons of Cadiz. In Paris, Virgili was influenced by the best surgeons of that time like: Jean Louis Petit (1674-1750) who had described the triangle and lumbar hernia with his name (Petit's triangle and Petit's hernia), Henry François Le Dran (1685-1770), researcher in cancer and creator of the term shock (*choquer*) and Claude Nicolas Le Cat (1700-1768), who described a new technique for the urinary calculi.

Two surgeons, Georges Mareschal (1658-1736) and François Gigot de la Peyronie (1678 – -1747), had influenced, first the king Louis XIV and after his son Louis XV, to create the *Académie Royal de Chirurgie* in 1731, a new institution that separated the surgeons from the barbers. As a consequence, in 1743, a new school of surgery was created.

There were some famous hospitals in Paris at that time. The older and probably unhealthy hospital of Paris was called *Hôtel Dieu*, sadly burned in 1735 but finishing its rebuilding in 1772. Another famous hospital was the *Hôpital de la Charité*.

Not many references can be found over the three years that Gimbernat spent in Paris, but it seems that he could have assisted to the lessons of some famous surgeons, like Antoine Louis (1723-1792), who was the secretary of the Royal Academy of Surgery since 1764. He also had described the anatomical angle in the lower part of the sternum or breastbone (angle of Louis). Louis had also participated in the design of the guillotine (called sometimes *louisette*) as a "more humane method to apply death penalty". Another surgeon was Pierre Joseph Dessault (1738-1795), who wrote about the treatment of aneurysms and fractures; surgeon of the *Hôtel Dieu*. Dessault's patron, Germain Pichault de La Martinière (1697-1783), who had just inaugurated the amphitheatre of the *Ecole de Chirurgie* in 1774, was state consultant of the kings Louis XV and Louis XVI, who achieved to free the surgeons of the need to work under the control of a physician. They could have also met Antoine Petit (1722-1794), member of Royal Academy of Surgery and professor of anatomy and surgery in the Royal Gardens, which had participated in the edition of the *Encyclopédie*, the great project of updated, open access, knowledge, droved by Diderot and D'Alembert.

In fact Gimbernat's interest was not only surgery, although it was of course the most important issue, but other aspects of science too. For example, it is known that he assisted in classes of a physician and chemist, Pierre Joseph Macquer (1718-1784), whose opposition to Lavoisier was famous at that time.

The Enlightenment was a very rich period from many points of view, and Paris was full of their main representatives, like the thinkers and philosophers Jean Jacques Rousseau (1712-1788) or François Marie Arouet, called Voltaire (1694-1778); science researchers like Georges Louis Leclerc Comte de Bouffon (1707-1788); an actual polymath or the chemist, Antoine Lavoisier (1743-1794); financiers and politicians like the Swiss Prime Minister of the king Louis XVI (1774-1793) during three periods, Jacques Necker (1732-1804); or the political and scientific American ambassador, Benjamin Franklin (1706-1790). In this ambience of intellectual boiling, the new ideas had surely influenced Gimbernat's way of thinking. In fact, the recent American Revolution and, a few years later, the French revolution, marked the new world order and the western trend to democracy, not without its troubles.

Gimbernat was mainly a scientist and, although there had been wars between France and even Spain and the United Kingdom, it was the interest in knowledge that prevailed in his decisions. So, as he was aware of the great advances in surgery in London, he decided to leave France and go there too.

THE WORTH STAY IN LONDON

The king of Great Britain and Ireland at that moment was George III (1738-1820), a member of the House of Hannover. The Prime Minister, Frederick (Lord) North (1732-1792), had to manage war conflicts with France, Holland and Spain with some relevant success, like the conquest of the Falkland Islands (*Islas Malvinas* in Spanish) in 1770. But his big problem was probably the cost of the war in the United States, after them, in 1776, had proclaimed their Independence Declaration.

The most relevant hospital of London was the St. Bartholomew's Hospital, which had been rebuilt recently, finishing its new form in 1766. One of the older and famous hospitals was St. Thomas, a charity hospital but with some private practice too. St. Thomas had been renewed by the creation of the Guy's Hospital in 1725. That name comes from Thomas Guy, patron and governor of St. Thomas Hospital. Guy had the permission to add a new building for patients with incurable diseases, with the help of public funding. Other hospitals were Westminster Infirmary, St. George's Hospital, London Hospital or Middlesex Hospital, to mention the nearest ones.

In the middle of the 18th Century, London had a population of about ¾ of a million inhabitants, almost the tenth part of the whole England and Wales population. The noise of traffic in the cobblestoned streets, the shouts of people selling or buying goods in the markets, the scarce light in the streets, the shadowed houses and pubs, lightened only with a few candles, the crowded squares, dirty and rowdy, was probably not too different from Paris, but it had surely impressed Gimbernat and forced him to learn a new language, new habits in addition to the new ways of hospital practices and surgical acts (Morgan, 1967).

Although food was cheap and plenty, malnutrition was very frequent. Rich people used to eat more than necessary. Intemperance, immorality and excessive alcohol consumption flourished. London was a melting pot of cultures and people from different origins around the world. They lived together, especially in some districts near the port. Diseases like malaria were not rare at all.

Poor districts were overcrowded. Children's work was usual. Criminal gangs with any kind of felonies and cruelties reigned. Global mortality was high, especially among children under 5 years old (almost 50% of mortality). Sanity controls were uncommon and although plagues of typhus and smallpox had taught the Londoners to be aware of the spread of infections, no measures of protection were adopted for most of the population.

However, things had started to change. James Lind (1716-1894), an English epidemiologist, had been fighting typhus with both body and environment cleaning. Although he was mainly known for the first clinical trial of modern times by which he demonstrated the importance of citreous fruits in the treatment of seamen scurvy. Some people consider the really first clinical trial known was performed by the Persian surgeon, physician and polymath: Muhammad ibn Zakariya al-Rhazi (854-925) in Baghdad who compared two groups of patients with symptoms of meningitis as had been described by himself, one group treated with bloodletting and the other group intentionally neglected to bleed. While the first group was saved, all members of the second group contracted meningitis. Although forgotten for many years, this comparison of groups had been a pioneer one. But Lind's trial was methodologically better designed and its results were successfully reproduced and saved many lives.

Edward Jenner (1749-1823), a surgeon pupil of John Hunter until 1773, had studied the use of cowpox pustule secretion as a more benign form of disease that prevented the more serious smallpox. After many observations and search of the better form of inoculation, he published his results in 1798. Vaccination against smallpox has really been an important achievement that had impressed Gimbernat. He had helped to promote it some years after, not only in Spain, but in South America and the Philippines too, supporting the expedition of Xavier de Balmis (1753-1819) three years after Jenner's writings (Matheson, 1948).

The surgeons and the barbers were separated a bit later than in Paris, in 1745, after the end of the "Barber – Surgeons Company", and the creation of the "Surgeons Company", promoted by William Cheselden and John Ranby. Although the rules were created in 1748, they were not published until 1778, so the process was not quick.

John Hunter (1728-1793) taught in the school of anatomy placed in 16, Windmill Street, and was called The Great Windmill Street School of Medicine. Hunter began his classes in 1776, adding a big Library and a Museum. Gimbernat assisted in classes of the 49 years old Scottish surgeon who had gone to London 19 years earlier to work with his older brother, William Hunter, who had created a school of anatomical dissection and surgery, and John continued and improved this school. During this time, William described the arteriovenous aneurysm. Later he came back to Scotland and, with his collection of anatomical preparations, he created the Hunterian Museum of Glasgow University. His brother John, fellow of the Royal Society in 1767, worked in St. George's Hospital until 1768. He then became King George III's surgeon, as well as general surgeon of the British army, William Pitt being the Prime Minister. Known as "the father of modern surgery", the Hunterian Society and the Museum of the Royal College of Surgeons of London were created in his honour.

John Hunter worked and studied with William Bromfield in St. George's Hospital, with whom he had some problems that were finally solved, working together since then. Bromfield had said: "hypotheses are not very useful in surgery, only until they are confirmed by experiments that make the impartial research of results and methods unnecessary". This way of thinking does not match very well with nowadays scientific methodology but reflects the empirical surgical thoughts as opposed to those of theoretical and philosophical medicine in use.

It was really Hunter that developed new concepts of a scientific and empirical surgery. This new way

of thinking attracted to his school many good surgeons from the whole Europe and America. Later this students would spread his methods throughout the Old and the New World, and in turn helped surgery to become more close to a science, beyond a simple technique or applied art.

William Shippen (1736-1808), an American surgeon from Philadelphia who was a pupil of Hunter, describes the life during those years saying: "I wake up in the morning at 6 o'clock, operate till 8 a.m., have breakfast at 9 a.m., practice dissection till 2 p.m., have lunch at 3 p.m., again dissection till 5 p.m., classes till 7 p.m., operations till 9 p.m., dinner and go to bed at 10 p.m." And that was every day, even on Sundays. While he was in London, as the bells rang every day to celebrate the British victories over the French army (The 7 Year's War), like that of Quebec conquer. He remembered the city as a noisy place. Sometimes he used to go to the theatre to see "King Lear" of William Shakespeare, performed by the famous actor David Garrick.

Although Gimbernat was early impressed by Hunter, he took profit from other experiences: surgeons Pott and Saunders, for example. He worked at St. Thomas's Hospital - Guy's Hospital and St. Bartholomew's Hospital where, not only attended to the classes and courses of experienced surgeons, he participated in the clinical discussions and even operated on patients demonstrating his experience and skills.

Percival Pott (1714-1788) has been considered one of the fathers of orthopaedics. He was also the first to demonstrate that some cancers can be caused by environment's carcinogens: the soot that produced scrotum cancers in chimney sweepers. But he is mainly known for the Pott's disease or vertebral tuberculosis. He was master of the company of surgeons in 1765 and helped in promoting The Royal College of Surgeons of England. He said: "the target of a good surgery is to help nature, but nature could get sometimes the best even from the worst". John Hunter had been one of his pupils. Gimbernat, in his book about the femoral hernia, recognizes the Pott's advice to be extremely careful in hernia surgical treatment.

William Saunders (1743-1817) was a Scottish physician of the Guy's Hospital since 1770, with whom Gimbernat, during his stay in London, participated in the edition of different writings on fever and other pulmonary and rheumatic disease. Saunders, member of the Royal Society in 1793, was the first president of the Royal Medical and Chirurgical Society in 1807 (Ferrer, 1964).

William Cruikshank (1745-1800), a Scottish surgeon, anatomist and chemist, continued the study of lymphatic vessels and nerve regeneration. He demonstrated the importance of *perspiratio insensibilis*, including skin and pulmonary, in fluid balance. As assistant of John Hunter, he replaced William Hewson (1739-1744), a surgeon of St. Thomas who had replaced John Hunter in the Seven Years' War, becoming then his partner. He wrote about paracentesis and pneumothorax, and began the studies of lymphatic vessels in animals. He discovered fibrin as an important element of clotting process. Unfortunately, he died too young of septicaemia.

Benjamin Bell of Hunthill (1749-1806) was described as the scientific surgeon of Scotland and father of the surgical school of Edinburgh. He studied with Alex Monro *secundus* and with Cullen who recommended him to go to London and learn from John Hunter. Bell recognizes that Hunter was the best acquaintance he could have ever done. He visited Pott, too. In 1778 he published "The Theory and Practice of Ulcers", considered a classic in the physiology of the XVIII century. In 1783 and 1788 he published his six-volume treatise "A System of Surgery", an international success, translated into many languages. He said: "The success of surgical operations depends more on the attention in every moment and every circumstance than of the any special skill in a part of the intervention". Gimbernat cited his technique to operate the femoral hernia and recognized his way to avoid damage to the epigastric and spermatic vessels.

The spirit of enterprising and enduring that moved Gimbernat led him to put his interest in any issue that could help to improve the practice of surgery, especially the medical knowledge in general, as well as other disciplines like chemistry, physics or botany, too. His open-minded attitude to modern humanism allowed him to become a really important promoter of the new scientific surgery and medicine in Spain.

Gimbernat discovered in the British empirical way of thinking, based mainly in utility, the classical spirit of Catalonia emphasized by another Catalan surgeon, Josep Trueta, professor at Oxford, where he was exiled after Spanish Civil War in the 22th Century (Trueta, 1946, 2007).

The death in Barcelona in 1776 of his master, patron and friend: Pere Virgili, was received by Gimbernat and Ribas with a deep feeling of sorrow (Ferrer, 1963). But they had to continue their mission and decided to follow with the research and training.

Probably the most impressive story of his travel happened in 25 April 1777. Gimbernat, aged 43, attended a class of John Hunter, aged 49 at the time. In the 80th lesson of his course on righteous hernias, John Hunter, following the current practice or "state of the art" in that moment, explains the need to cut the inguinal ligament trying to avoid the injury of the femoral vein and artery (Read, 2005a). Once he had finished his exposure, Gimbernat asked for permission to expound his own criteria. With the professor's permission, he began to show in the same corpse, the *lacunare* ligament anchored in the pubic tubercle (Rogers et

al., 1961). Hunter was impressed. He said he would mention this ligament in their classes from that moment, and that it would be named Gimbernat's ligament. But Gimbernat added that the utility of knowing the existence of this ligament is that in the case of a strangulated crural hernia, the best way to liberate the crural ring was to cut this ligament internally, in the opposite sense of the femoral vessels, avoiding injury and even that of the spermatic vessels or the epigastric artery, which can be wounded when the inguinal ligament is sectioned vertically or even obliquely (Aréchaga, 1977). Hunter, satisfied with the discussion, put his hand in the shoulder of Gimbernat and said: "Yes Sir, you are right", adding that from that moment he would show this method in his classes and would use on his patients quoting the name of Gimbernat's operation (Pera, 1998). He eventually did it and this was the way Gimbernat's name became famous around the world (Read, 2005b).

As his son Agustí tells in his biography, Gimbernat had acquired certain prestige in London. He worked in St. Thomas and Guys Hospitals and St. Bartolomew, and he could probably have stayed in London successfully (Gimbernat i Grassot, 1828).

Not yet satisfied, and probably following the advice of Hunter or other Scottish surgeons, Gimbernat and Ribas decided to continue their journey north to Edinburgh.

A SHORT VISIT TO EDINBURGH

Roads at that time were not paved and very dirty. Horse's carriage journey was very uncomfortable. To get to Edinburgh from London it could take between 10 and 22 days, although an experienced cart driver could do it in 73 hours, or a trained horse rider could achieve a speed of 60 miles a day. However, to cross the whole of England was not a problem for two persons who crossed the whole Spain and the whole France before.

The Scottish Enlightenment was represented at that time by three important thinkers: the philosopher David Hume (1711-1776), who had contributed to the evolution of empiricism promoted by the philosopher, the physician and surgeon John Locke (1632-1704). The other two were Adam Smith (1723-1790) considered one of the fathers of economy as a science, and Adam Fergusson (1723-1816) considered a pioneer in sociology.

In Edinburgh, Gimbernat visited William Cullen (1710-1790), who founded the School of Medicine of Glasgow and had been the president of the Royal College of Physicians of Glasgow first and that of Edinburgh later. He had written *Synopsis nosologiae metodicae*, and probably transferred, with his strong personality and his open-to-progress scientific character, the interest for the problems of natural classification of disease to Gimbernat, who was really impressed by the power of his master.

At that time in Edinburgh, Alexander Monro the second (1733-1817), son of the Alexander Monro the first and father of the Alexander Monro the third, was, as the middle member of Monro's saga, one the most famous surgeons in Scotland. Monro had described the lymphatic system. He had gone to London to learn from John Hunter. He also went to Leiden to work with Camper and to Berlin to work with Meckel, who described the diverticulum known by his name.

Little is known about this stay in Edinburgh, but it would have probably lasted much less than that of Paris or London. Anyway, Gimbernat and Ribas decided to leave the United Kingdom and go to Holland.

LEIDEN: THE FINAL STATION OF THE JOURNEY ABROAD

The Dutch Republic of the seven united provinces, after their independence from Spain, had become a rich empire. When Gimbernat and Ribas got there, the government of the republican regents had been substituted by the Stadtholder Wilhelm Batavus or Wilhelm V Prince of Orange (1748-1806).

Amsterdam was at that time the first financial centre of Europe, as the arrival gate of the Eastern and Western Indies. Its university was situated in Leiden, an old centre where still could find traces of the great anatomical school and clinical followers of Boerhaave in the XVII century. Petrus (Pieter) Camper (1722-1789), professor of anatomy, surgery, medicine and philosophy, was the shining figure at that time. Considered de predecessor to Cuvier, Camper probably transmitted to Gimbernat his interest in compared animal anatomy (Lunn, 1948). An interest Gimbernat revealed after his travel to Holland, and he never expressed before. Camper described the abdominal fascia with his name (fascia of Camper), not to be mistaken with the fascia of Scarpa, a bit deeper one described later on by the Italian anatomist Antonio Scarpa who had visited Camper in Holland (Frank et al., 2009).

Finally, after almost four years abroad, Gimbernat and Ribas decided come back home.

BARCELONA: THE RETURN

They probably arrived to Catalonia in October 1778. It is a supposition, because Gimbernat, a 44 years old man, had a new son in August 1779. He resumed his activities in the Royal College of Barcelona, where he had the opportunity for a short period of time, to transmit a good part of his experience abroad and mature the new ideas and concepts he acquired in his travels (Massons, 2002). He also started to search for new conceptions in the health sciences, mainly in his own field as a surgeon but unavoidably, in medicine and even,

according to their growing interest, in botanic, chemistry and pharmacy. It was a heavy struggle with their own colleagues firstly but with physicians and pharmacists too (Riera, 1999). It was only after different unsuccessful attempts, during Gimbernat's life and long later, that Gimbernat's wish became partially achieved, when surgery and medicine became unified in Spain in 1828.

Of course, it was not only Gimbernat's dream. Medical principles of surgery had been kept into account by Virgili since the beginning of the new College of Surgeons in Cadiz and had been adopted by Gimbernat more strongly after his European experience (Cid, 1999). The links he had established with the most important European surgeons and physicians give him the force to afford the challenges of his mission.

The fact is that he had always recommended to his students a strong medical education, especially that related to the new empirical conception of medicine rising in different countries across Europe (Pi-Suñer, 1934). The main references that Gimbernat liked to follow in surgical tuition were:

Herrman Boerhaave (1668-1738): professor of the Dutch university of Leiden, famous for his description of spontaneous perforation of oesophagus that takes his name (Boerhaave's syndrome), but was especially successful for his new concepts in physiology and medical principles.

Jacob Winslow (1669-1760): the Danish born but French-adopted anatomist whose book of descriptive anatomy was full of physiologic references. He was known for his description of the *foramen omental* commonly named Winslow's hiatus.

Jean Astruc (1684-1766): Professor of medicine in Montpellier, expert in syphilis and venereal diseases, of whom Gimbernat followed his childbirth treatise.

Johannes de Gorter (1689-1762): Dutch pupil of Boerhaave in Leiden, whose treatise of surgery liked specially to Gimbernat. He had described the *perspiratio insensibilis*, demonstrated important in hydro electrolytic balance. Also their studies in nosological classification following the botanic rules had probably interested Gimbernat later.

Albrecht von Haller (1708-1777): Swiss physician, anatomist, botanist and poet, professor at the university of Göttingen, whose books on physiology where recommended by both: Virgili and Gimbernat. He founded the anatomical theatre of Bern.

The records of his journey were partially published. The most important, and probably the part that marked his life, was his experience in England. He has written his account there with the title of: *Notas prácticas de las operaciones de cirugía en los hospitales de San Tomás Guy i de San Bartolomé de Londres en 1776 i 1777* (Practical notes on surgical operations at St. Thomas Guy and St. Bartholomew's Hospitals of London in 1776 and 1777).

Gimbernat promoted the study not only of human anatomy and physiology, but he emphasised animal comparative ones too, he recommended the introduction of basic experimental sciences, like mathematics, experimental physics, chemistry and botany in the training of the new surgeons and doctors in general (Pérez-Pérez, 2007). This meant a complete change in the paradigm of his time. And, following the new trends in medicine, he helped in the development of clinical sessions where to discuss concrete cases, criticising and censoring diagnosis, prognosis and treatments (Pérez-Pérez and Sitges Serra, 2010). Finally he defended the learning of Latin as the common scientific language of his time. All that configured the basis of the new concept of surgery, beyond the simple routine practice of barbers but also free of the limiting prejudices of the scholastic philosophy.

THE MAIN TARGET OF THE TRAVEL: MADRID

In February 1779, Gimbernat had to leave Barcelona and go to Madrid to prepare the New Royal College of Surgeons of St. Charles (*San Carlos*) where he tried to apply all his acquired knowledge during the European trip (Burke, 1978). That was a cultural revolution not easily adopted by the establishment (Pérez-Pérez, 2010). Gimbernat created an anatomosurgical museum, supposedly based on that of the Hunter brothers, (Marco-Cuellar and Aréchaga, 2009) and sent to London the technician Tomàs Maseras, in order to improve his skills in surgical instruments design and manufacturing.

Finally, in 1793 he published his most famous book: New Method of operating for the femoral hernia *(Nuevo método de operar en la hernia crural)* (Fig. 6). It was translated into English in 1795, into German in 1817 and into French in 1827 (Gimbernat I Arbós, 1793). In this book he describes the anatomy of the inguinocrural region, with most of their anatomical components (Vázquez-Quevedo, 1994). He also talks about the epidemiological characteristics of hernias that affect a large number of persons of different ages, sex and conditions. He takes into account problems related to the quality of life not only of the person himself or herself, but the social impairment representing as a limitation of the working force. He advocates for the important role of surgeons, in helping to avoid these kinds of problems and looking for the best solutions based on real anatomical and physiological principles, instead of old mythical or even philosophical untested prejudices.

The London experience of Gimbernat was not only important for himself, it led him to have an influence on his contemporaries (Martín-Duce, 2000). Joseph Townsend (1739-1816), and English theologian and vicar, who came to Spain and other countries in Europe, often cites Gimbernat as a reference in his book: "A Guide to Health; being

cautions and directions in the treatment of diseases".

Some London surgeons asked him about the rules of the new college, and maybe some of his ideas could have influenced the principles of the Royal College of Surgeons of London in 1800.

But not everybody had lived the experience of international relationships and could not have understood about scientific and ethical issues (Zarzoso, 2003). Conflicts were difficult to solve and, not only Gimbernat, many people had to pay for it (Saiz Carrero, 2016).

Few months following the return of Gimbernat and Ribas, France, Spain and Holland were involved in a war against the Great Britain; this was during the American Revolution and the war of Independence. A few years later, the French Revolution and Napoleon government led to a war of France against Spain, Holland and Great Britain. But those were political affairs. The scientists, through the language of knowledge and truth, had been always been able to share, collaborate and relate for the good of the people everywhere.

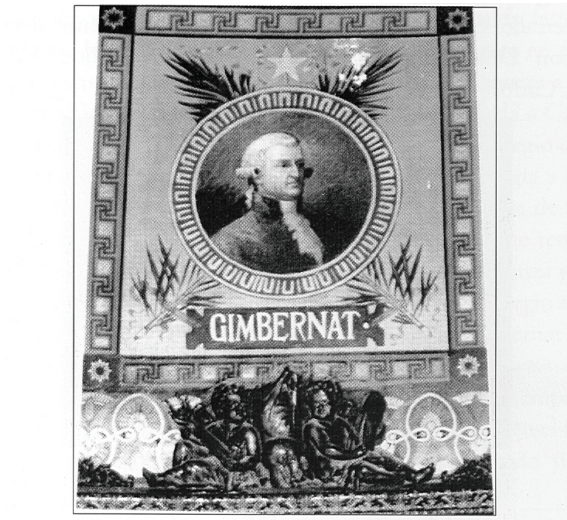
Unfortunately, Gimbernat, 82 years old, died in November 17, 1816, blind and poor (Pérez-Albacete, 2002). Political questions influenced his retirement and became forgotten by the establishment of the new King Fernando VII (Martínez-Vidal, 1999).

As the ancient Greek philosopher Plato had said many centuries before, the main values of humankind were truth, goodness and beauty (Penrose, 2004). All become the hallmarks of modern surgery. Truth, by means of science and scientific method, evolved since the old Greek philosophers and scientist, till the modern times. Goodness, as the objective of ethics, also born in Greek philosophy, becomes an unavoidable need for mankind, considering their different cultures, religions and interests, but with common principles of respect and tolerance, always remembering that there is no goodness without truth. And beauty as the target of art but also present in the surgical work, keeping in mind that there cannot be beauty without goodness and truth.

Maybe this sharing of information and experience, cooperation and search of truth, goodness and beauty, makes the difference in a world where, as the English poet John Done had said, "we are all involved in (hu)mankind". The enlightenment was not the definitive step in human progress but many people, under its influence, helped to prepare a brave new way of thinking for our world. Gimbernat, although pitifully forgotten for some years, was one of them.

Fig. 1. Drawing of Antoni de Gimbernat Arbós as cited by his son Agustí Gimbernat Grassot: The Asclepius of the XVIII century.

Fig. 2. Picture of Antoni de Gimbernat.



Pintura de Ramón Padró y pequeña escultura de Eduardo Barrón. Situadas en el Anfiteatro de San Carlos

Fig. 3. Picture of Antoni de Gimbernat in the ceiling of the amphitheatre of the Royal College of Surgery of San Carlos, in Madrid.

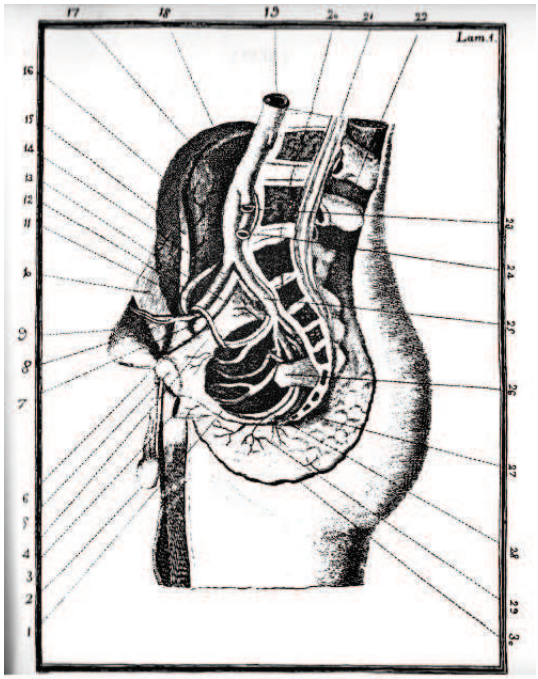


Fig. 4. Anatomy of Gimbernat's ligament as described in his book: A new method of operating for the femoral hernia.

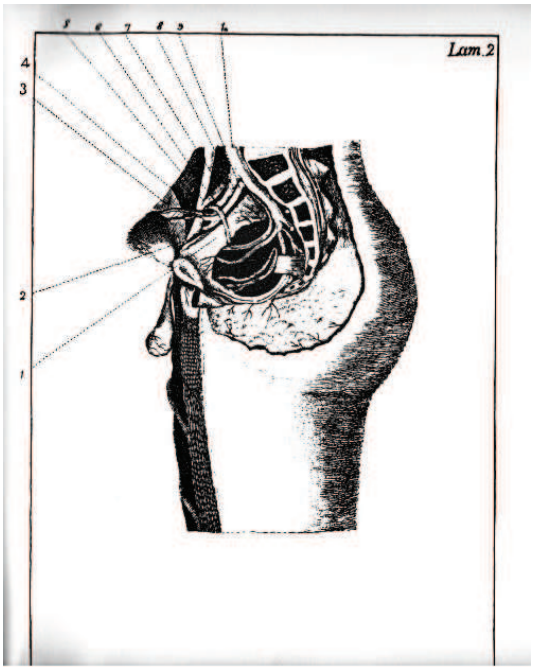
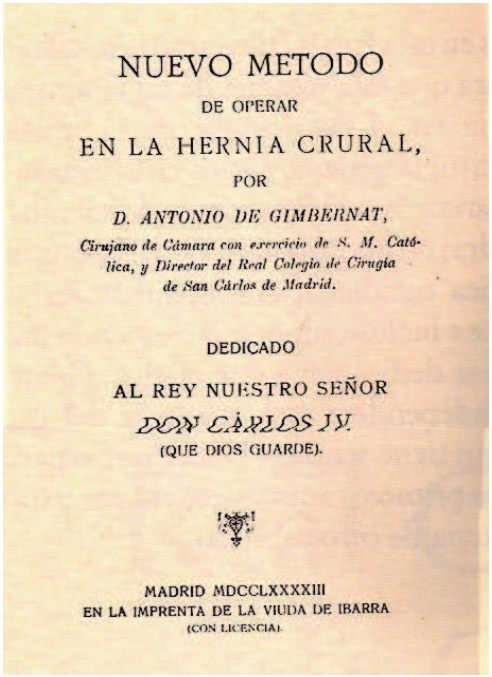


Fig. 5. Gimbernat's operation for femoral hernia as described in his book: A new method of operating for the femoral hernia.



NUEVO METODO

DE OPERAR

EN LA HERNIA CRURAL,

POR

D. ANTONIO DE GIMBERNAT,

Cirujano de Cámara con exercicio de S. M. Católica, y Director del Real Colegio de Cirugía de San Cárlos de Madrid.

DEDICADO

AL REY NUESTRO SEÑOR

DON CÁRLOS IV.

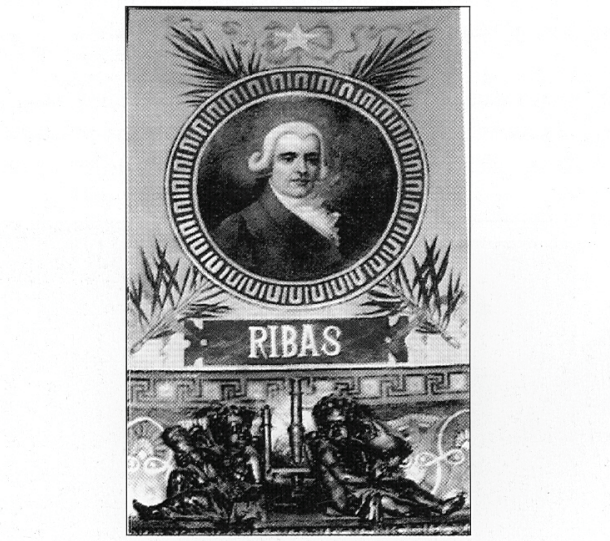
(QUE DIOS GUARDE).

MADRID MDCCLXXXXIII

EN LA IMPRENTA DE LA VIUDA DE IBARRA

(CON LICENCIA).

Fig. 6. Gimbernat's book: A New Method of Operating for the Femoral Hernia.



Pintura de Ramón Padró y pequeña escultura de Eduardo Barrón situadas en el antiguo Anfiteatro de San Carlos.

Fig. 7. Picture of Marià Ribas in the ceiling of the amphitheatre of the Royal College of Surgery of San Carlos, in Madrid.

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Antonio de Gimbernat and his time in Madrid: The Royal College of Surgery of San Carlos

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SUMMARY

The transformation of Spanish Surgery in a modern scientific discipline takes place within the Royal Colleges of Surgery, and in all of them the figure of Antonio de Gimbernat and Arbós stands out over the rest. After completing his studies at the Royal College of Surgery of Cadiz (Real Colegio de Cirugía de Cádiz), under the tutelage of Pedro Virgili and his teaching and surgical work at the Royal College of Surgery of Barcelona (Real Colegio de Cirugía de Barcelona), it is in his almost forty years of stay in Madrid when the surgeon reaches his highest scientific and professional achievements.

In these years, he is responsible for the creation, operation and development of the Royal College of Surgery of San Carlos (Real Colegio de Cirugía de San Carlos), and it is then when most of his rare but important publications were released, such as the "New method for operating the crural hernia", whereby Gimbernat is considered the father of the modern surgery of this pathology.

Unfortunately, the socio-political circumstances, the state of international isolation of the country and the unfair treatment received by Antonio de Gimbernat in the last years of his life diminished the impact of the work and studies of the man who for many has been the most illustrious surgeon of this country.

Key words: Antonio de Gimbernat – Royal College of Surgery of San Carlos – Surgery – Anatomy – Crural Hernia

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INTRODUCTION

Despite its anatomical and surgical relevance and despite his being known by students of Medicine (Gimbernat ligament) in general and until relatively recently, there has been a strange bibliographic silence about Antonio de Gimbernat (Cambrils, 1734 - Madrid, 1816) (Fig. 1), and somehow a lack of recognition of the man whom many consider the first Spanish surgeon. His contribution to the consolidation of technique and the transformation of Surgery into a job with academic status are undeniable, as well as his pioneering work in modern inguinal hernia surgery. In fact, in Spain, the Colleges of Surgery contributed in a fundamental way to the beginning of modern surgery. In the three most relevant ones (Cadiz, Barcelona and Madrid) Antonio de Gimbernat performed his work at different levels.

When in 1774, King Carlos III calls Antonio de Gimbernat to Madrid to send him into different European cities, with Mariano Ribas, the prestige of Gimbernat is the one of a solid surgeon, after overcoming initial misgivings by his youth and possible inexperience in the Royal Colleges of Surgery of Cadiz and Barcelona under the guidance of his teacher Pedro Virgili and Bellver (1699-1776), who died during their stay in Europe (Arráez-Aybar, Bueno-López, 2013; Comenge Ferrer, 1914; Garcia Real, 1921, 1934; Martin Duce, 2000; Matheson, 1948).

Meanwhile, Mariano Ribas Elias (Esparreguera, 1730 - Madrid, 1800) is a remarkable military surgeon, who after his stay in the Royal Colleges of Surgery of Cadiz and Barcelona in 1772 was appointed Master of the Royal College of Surgery. He is co-organizer with Antonio de Gimbernat of the Royal College of Surgery of San Carlos, of which he was appointed perpetual president. Later

Fig. 1. Antonio de Gimbernat y Arbós. Image Archive of the Spanish Medicine. Royal National Academy of Medicine.

he was appointed physician of the Royal Chamber of King Carlos IV of Spain, a position he held until his death in Madrid on 3 September 1800 (Garcia del Real, 1921, 1934; Massons, 1981; Usandizaga, 1948).

The city of Madrid witnessed the years of maturity of Antonio de Gimbernat and his greatest scientific and professional achievements, but also surgeon's unjust fall from grace and his sad ending. We discuss in the following lines the main events of the nearly forty years that the illustrious surgeon spent in Madrid.

ROYAL COLLEGE OF SURGERY OF SAN CARLOS

Antecedents

As in the rest of Europe, the reform of studies in Spanish surgery occurs within the Royal Colleges of Surgery (Cádiz, 1748, Barcelona, 1764; Madrid, 1780). Although it is the last to be founded, the first project of a Royal College of Surgeons in Madrid corresponds to Fernando VI, shortly after the commissioning of the Cadiz school. In fact, different regulations which were shaping the final project were elaborated until its final creation (Burke, 1977; Sánchez Ortiz et al., 2012; Usandizaga, 1948).

It was those Colleges of Surgery that enabled exercise in practice teaching based on "how" rather than "why", while responding to a growing demand for training in natural sciences and a proper balance between theory and practice. In fact, this meant a break with the established order, as it was thought that the best solution was to remove all surgical training from the university and establish special schools of surgery, independent of universities and other medical government bodies.

Beginning (1774-1778)

During the stay in Europe of Gimbernat and Ribas, on 29 August 1774, at the request of Professor Pedro Custodio Jimenez and Rector Martínez de Bustos, the Council of Castile approved the establishment in the General Hospital of Madrid of the Royal College of Surgery of San Carlos. From the beginning, the College was opposed by the Confraternity of San Cosme and San Damián, the Protomedicato and some universities which defended the classical teaching method, especially the University of Alcala de Henares (Alvarez Sierra, 1955; Costa Carballo, 1991; Usandizaga, 1948).

The Protomedicato ruled, in theory ensuring standards of medical practice in Spain, between the fifteenth and eighteenth centuries. Without a doubt, its main activity was to define requirements and privileges of doctors, surgeons, barbers and pharmacists (Burke, 1977; García del Real, 1921).

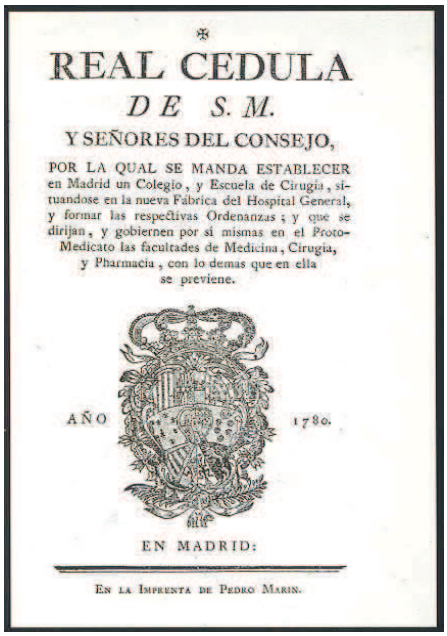
Establishment (1778-1787)

Gimbernat and Rivas returned to Madrid from their stay in Europe in 1778, although the family of the former will definitely not move until a few years later, when the surgeon has clear his appointment as director of the Royal College. The Royal Resolution of March 21, 1778 (endorsed by the Royal Order of May 26 and July 13, 1779) entrust them with the creation of the Royal College of Surgeons, and the establishment of regulations for its performance. After several years of planning, they presented the project to the Crown along 1780 and 1781 (Burke, 1977; Comenge Ferrer, 1914; Loukas, 2007; Matheson, 1948; Puig-La Calle et al., 1995).

On 13 April 1780 (Fig. 2) a Royal Decree was published for the creation in Madrid of a College and School of Surgery (ratified in 1783). The College will be devoted to the training of professionals to meet the needs of the civilian population, as stated in the text of the Royal Decree. In that the King states his wish to establish a Surgery College in Madrid analogous to the one in Barcelona (Álvarez Sierra, 1955; Real Cédula, 1780).

The aim was to put the anatomy and surgery in Madrid at the same level of pestige, reaching the perfection and esteem that it enjoyed elsewhere, such as in the court of Paris. Not in vain Gimbernat was an outspoken admirer of French surgery (Costa Carballo, 1991; López Piñero, 1998).

A Royal Order of 29 June 1783 establishes the curriculum to follow, where the influence of Antonio de Gimbernat is evident. The studies have a duration of five years, with theoretical and practical teaching for both basic and surgical sciences; incoming students should be proficient graduates of



REAL CEDULA
DE S. M.
Y SEÑORES DEL CONSEJO,
POR LA QUAL SE MANDA ESTABLECER en Madrid un Colegio, y Escuela de Cirugia, situandose en la nueva Fábrica del Hospital General, y formar las respectivas Ordenanzas; y que se dirijan, y gobiernen por sí mismas en el Proto-Medicato las facultades de Medicina, Cirugia, y Pharmacia, con lo demas que en ella se previene.
AÑO 1780.
EN MADRID:
En la Imprenta de Pedro Marin.

Fig. 2. Royal Decree of his majesty and lords of the castile council which orders the stablish in Madrid of a surgery college (Aranjuez, 13 de abril de 1780). Madrid. Press of Pedro Marín (1780).

REAL CEDULA
DE S. M.
Y SEÑORES DEL CONSEJO,
AÑO 1787.
EN MADRID

Fig. 3. Royal Decree of his majesty and lords of the castile council in which the ordinances for the economic government and scholastic of the surgery college were approved (El Pardo, 24 de febrero de 1787). Madrid. Prees of Pedro Marín (1787).

Latin and other disciplines. As follows from this curriculum and projects drawn up by Gimbernat for the creation of other schools of surgery, such as the Mallorca school, the basis of teaching was the anatomy of Jacok Winslow, the physiology of Albrecht Haller and Hermann Boherhave and the surgery of Joannes Garter. There were also clear influences of "Theoretical and practical course of surgery operations", published in 1763 by Diego Velasco and Francisco Villaverde (Aparicio Simon, 1956; Costa Carballo, 1991; García del Real, 1934, Memorial Literario, 1786).

The College began its teaching activities in the course of 1787-1788, although in the early years featured a small number of students (Ribera Casado, 2013).

Ordinances and inauguration (1787)

On 24 February 1787 (Fig. 3) a Royal Decree was made public approving the Ordinances of the College of Surgeons established in Madrid with the name of San Carlos (Real Decree, 1787). In them the role played by Gimbernat and Rivas stand out. Both had been appointed directors a month earlier (January 27, 1787) (Loukas, 2007; Matheson, 1948).

Ordinances put the school under the protection of the Council of Castile, regardless of the Board of Hospitals and the Protomedicato, although expenses related to the patient were paid by the Royal Hospitals (Aparicio Simon, 1956; Loukas, 2007; Usandizaga, 1948). Ordinances also make explicit reference to the study of anatomy and the provision of corpses from the General Hospital, as well as the characteristics of the anatomical amphitheater (Alvarez Sierra, 1955, Royal Decree, 1787). Already in 1780, Gimbernat and Ribas had requested the construction of a passageway between the two buildings to prevent the movement of corpses in the street (Sanchez Ortiz et al., 2012).

The College is located in the basement of the General Hospital and the ground floor of the side pavilion as defended by the Board of Royal Hospitals and against the opinion of Gimbernat and Ribas, who preferred to place it in the Hospital of the Passion. It is not until much later (1798) when the transfer to the site of the Hospital of the Passion was decided, but transfer did not became effective until 1831 thanks to the efforts of Pedro Castelló and Ginestá (1771-1850) (Alvarez Sierra, 1955; Costa Carballo, 1991).

According to the Ordinances, the government of the College should be conducted by a Board of Teachers, presided by the Chairman. College teachers should be elected by competition, although this was not true for the first appointments. So Gimbernat was appointed Professor of Operations and Surgical Algebra (Traumatology) and Ribas was appointed Professor of Joint Affections and Injury Clinics. Other positions, including the Department of Anatomy for Rodriguez del Pino and the title of Master dissector for Ignacio Lacaba (Burke, 1977; Usandizaga, 1948; Alvarez Sierra,

1955) had also materialized.

The Royal College of Surgeons of San Carlos was inaugurated finally in the premises of the General Hospital, on October 1, 1787, with the assistance of Ministers of the Council of Castile and the Duke of Hijar, who was Brother of the Board of the Royal Hospitals (Garcia del Real, 1921, 1934; Loukas, 2007).

The opening day, Antonio de Gimbernat read a lesson on the use of sutures and its abuse, although its publication is delayed until 1801 (Gimbernat, 1787). In it, Gimbernat lectures on the proper use of sutures and the serious damage caused by the abuses introduced in its practice and describes the main types of sutures. Although in reality the fundamental purpose of the text is to show that a good grasp of the bandages technique can avoid bloody suture and achieve better results with less pain (Arechaga, 1977; Gimbernat, 1787; Salcedo and Ginestal, 1927).

NEW METHOD FOR OPERATING CRURAL HERNIA

After an initial description in 1772, while staying at the Royal College of Surgery of Barcelona and demonstrations on his European tour, on October 9, 1788, in a Literary Board of the Royal College of Surgeons of San Carlos, Antonio de Gimbernat disserts about the "New method for operating the crural hernia" (Loukas, 2007; Rutkow, 2003), although the publication, delayed as on other occasions, does not occur until 1793 in a book dedicated to Charles IV (Gimbernat, 1793).

This treaty can be divided into three parts. In the first, a review and critique of previous surgical techniques of inguinal hernia is made. In the second a detailed anatomical description of the femoral canal and lacunar ligament (ligament Gimbernat) is made, which Gimbernat said to have discovered in 1768 (Arechaga, 1977; Costa Carballo, 1991; Ferrer, 1964; Loukas, 2007; Salcedo and Ginestal, 1926). The term Gimbernat ligament remains in official anatomical terminology until its disposal in the Paris Anatomical Terminology (Lokachlik et al, 2008; Radojevic, 1969). Finally, in the third part the surgical treatment of strangulated hernia by the section of the ligament, much less invasive than those used previously (Beddoes, 1795; Gimbernat, 1793; Loukas, 2007) is addressed.

In his detailed anatomical study, Gimbernat first described the presence of a large ganglion in the vicinity of the femoral canal, ganglion later described by Jean Germain Cloquet (1790-1883) and Johann Christian Rosenmüller (1771-1820), when the Gimbernat book had not been yet translated into other languages (Arechaga, 1977; Loukas, 2007; Rutkow, 2003; Salcedo and Ginestal, 1926).

The book was translated into English in 1795 (Beddoes, 1795) and after long delay into German (1817), three years after the wonderful monograph by Hesselbach and into French (Journal des Progress des Sciences Medicales, 1827), ten years later that Cloquet published his book (Arechaga, 1977; Loukas, 2007; Massons, 1981; Rutkow, 2003; Salcedo and Ginestal, 1926).

Shortly after (1794), Antonio de Gimbernat publishes a small surgical Form for its use in the General Hospital of Madrid (Ferrer, 1964; Massons, 1981; Zaragoza Rubira, 1963).

THE ANATOMICAL AND PATHOLOGICAL CABINET

Although the first news of the Anatomical Cabinet date back to a Royal Order of Fernando VI (13 November 1752), related to the acquisition of material for the Cabinet, it is not until the Ordinances of the Royal College of Surgeons of San Carlos (1787) when it is given authentic entity to the Anatomical and Pathological Cabinet, noting its operating rules and the order to create anatomical sculptures in various materials to study anatomy at times when they could not practice dissection (Burke, 1977; Comenge Ferrer, 1914; Matheson, 1948; Sanchez Ortiz et al., 2012).

Since his appointment as Director of the Royal College of Surgery of San Carlos, one of the main objectives of Gimbernat was the development and growth of the Anatomical and Pathological Cabinet up into a unique museum, unrivaled in Europe (Comenge Ferrer, 1914; Matheson, 1948). Impressed by the large wax collection of John Hunter, Gimbernat directed (with Mariano Ribas) the creation of a dozen sculptures in wax, whose dissector was Ignacio Lacaba y Vila (1745-1815), his impulse was definitive for the creation of exceptional sculptures in polychromed wax that are part of the Museum of Anatomy "Javier Puerta" of the Faculty of Medicine at the Complutense University of Madrid (Figs. 4, 5), clearly heir to the work of Antonio de Gimbernat (Burke, 1977; Sánchez Ortiz et al., 2012; Usandizaga, 1948).

In the report Gimbernat delivered to the king in 1787 he explains to him that the formation of the Anatomical and Pathological Cabinet is very advanced, both simple and elaborate natural pieces and artificial pieces of wax. Of the latter exist fifty seven, all of them worked superiorly (Burke, 1977; Sánchez Ortiz et al., 2012). The polychrome wax sculptures were made under the direction of the anatomist Ignacio Lacaba, by the sculptor Juan Chaez (Malaga, 1750-1809) and the Italian modeler Luigi Franceschi from the Museum of the Specola of Florence (Sanchez Ortiz et al., 2012; Usandizaga, 1948).

SURGEON OF THE ROYAL CHAMBER AND PRESIDENT OF THE COLLEGES OF SURGERY OF SPAIN (1788-1808)

Fig. 4. Polychromatic wax sculpture of a human torso with special reference to the superficial venous vascularisation and lymphatic. Juan Chaez, Luigi Franceschi and Ignacio Lacaba (at the end of the XVIII century). Museum of anatomy "Javier Puerta" (Stock nº 171). Faculty of Medicine. Complutense University of Madrid.

Fig. 5. Polychromatic wax sculpture, called the seated venus. Juan Chaez, Luigi Franceschi and Ignacio Lacaba (at the end of the XVIII century). Museum of anatomy "Javier Puerta" (stock nº 138). Faculty of Medicine. Complutense University of Madrid.

In 1789, Antonio de Gimbernat is appointed Surgeon of the Royal Chamber, to which is added the nobiliary title of Privilege and Grace Nobility of the Principality of Catalonia and later in 1801 is ratified as Prime Surgeon of the Royal Chamber of His Majesty and appointed President of the Surgery Schools of Spain (Loukas, 2007; Matheson, 1948). In the following years, he continues to accumulate appointments such as Surgeon with Honors of the Counselors of Finance or Mayor Examiner of the Protomedicato, and he was even appointed member of the Royal Academy of Medicine, but he rejected the appointment, because acceptance was under the category of physicist and non-medical (Comenge Ferrer, 1914; Matheson, 1948; Puig-La Calle et al., 1995).

He was a strong advocate of the unification of medicine and surgery, which cost him enmities and even accusations of nepotism (Massons, 1981), he devotes much of his efforts to achieve this, although the resistance of an ignorant medical community prevents this definitive unification until after his death and delays the incorporation of Spanish medicine into the most advanced European medicine (Costa Carballo, 1991; Aparicio Mendez, 2007; Usandizaga, 1948).

On 16 May 1795 the Royal Decree of Charles IV was published by which the Royal Studio of Practice Medicine is created to alleviate the problem of lack of doctors and on 3 December of the same year the Royal College of Medicine is created in Madrid, located on the top floor of the General Hospital (López Piñero, 1998; Royal Decree, 1795).

Later the Protomedicato is suppressed and the Royal Decree of 12 May 1799 envisages the binding of the Royal Study of Practical Medicine and the Royal College of Surgery of San Carlos and on September 20 the Governing Board of the Gathered Faculty meets (Mendez Aparicio, 2007; Usandizaga, 1948). The goals pursued by Gimbernat and Ribas were achieved, but not for long, the fall of the liberal Marquis de Urquijo and the return of Godoy does away with the above, dismissing the union and the Protomedicato is restored

(López Piñero, 1998; Mendez Aparicio, 2007).

In the following years different binding attempts occur, as the so-called Special Healing Science School (1821), until the final union in 1827, under the direction of Pedro Castelló and Ginestá (Loukas, 2007; Matheson, 1948; Mendez Aparicio, 2007).

As Royal Director, Antonio de Gimbernat promotes the Balmis expedition. (The Royal Philanthropic Expedition of the vaccine or Balmis Expedition, 1803), captained by the surgeon Francisco J. Balmis (1753-1819), who led the smallpox inoculation to the Spanish colonies in America and the Philippines, reaching Cantón (China). It is considered one of the first expeditions of humanitarian aid in history (Costa Carballo, 1991; Franco Paredes, 2005; Matheson, 1948).

During these years, Gimbernat was involved in projects for the creation of new Colleges of Surgery, not all carried out, as in Santiago de Compostela, Burgos, Salamanca, Mallorca and Zaragoza (Loukas, 2007; Matheson, 1948; Massons, 1981). It also describes, over these years, different surgical instruments applicable to the techniques of these times (hernia, hydrocele, aneurysms, ophthalmology, urology) (Comenge Ferrer, 1914; Matheson, 1948).

It is also in these fruitful years when the most important (within the small total number) publications of Antonio de Gimbernat appear, as those already mentioned with regard to sutures and inguinal hernia surgery and their translations into other languages, some of them after his death. Altogether Gimbernat publications denote a great orientation and surgical control, but are not exempt from pathophysiological gaps.

Interested in eye surgery, he describes the intervention of 47 cataracts between 1766 and 1788. In 1800, reads in French before the Paris Society of Medicine his "Dissertation on the eye ulcers affecting the transparent cornea" which would not be published until 1803 (Arechaga, 1977; Loukas, 2007; Puig-La Calle et al., 1995). He distinguished two types of ulcers, superficial and deep or sordid and defended a conservative treatment with eye drops, as the so-called Gimbernat eye drops, which spent considerable time in the pharmacopoeia (Arechaga, 1977; Salcedo and Ginestal, 1926, Zaragoza Rubira, 1963).

NAPOLEONIC INVASION AND SAD ENDING

During the Napoleonic invasion and the reign of Joseph I, Gimbernat, a deep admirer of the French surgery, chairs the Higher Council of Public Health, following the merger (January 28, 1811) of the Faculties of Medicine and Pharmacy and the Surgery Schools (Aparicio Simon, 1956; Loukas, 2007; Massons, 1981).

The Bourbon restoration and the return of Fernando VII (1813) mark the beginning of both personal and professional decline of Antonio de Gimbernat: labeled as "Frenchified" for his responsibility at the head of the Superior Council of Public Health, he is dismissed from all his positions and titles and relegated of academic life. To the subsequent economic hardship joins the rapid deterioration of his mental faculties and an almost total blindness, since his cataract surgery done by Josep Ribes, Gimbernat, who knew very well eye surgery, prematurely removed his blindfolds the same night of the operation (Loukas, 2007; Usandizaga, 1948).

Finally, on 17 November 1816 he died in Madrid: it is unclear whether his death took place in his family home in the capital (Fuencarral street, corner of San Onofre, 20, principal), abandoned institutionally and academically (Loukas, 2007; Usandizaga, 1948). In this way one of the most distinguished Spanish surgeons disappeared, disowned by politicians, but recognized by surgery professionals.

CONCLUSIONS

The figure of Antonio de Gimbernat is key to understanding the beginning of modern surgery in Spain, mainly for his work in the Schools of Surgery of Cadiz, Barcelona and Madrid. His contributions to the consolidation of the surgical technique, through the detailed study of topographic anatomy and surgical strict regulations are the basis for the transformation of Surgery in a job of university level.

He can and should be considered the father of modern inguinal hernia surgery, although contemporary political and social circumstances, which isolated Spain from the rest of Europe, prevented extensive knowledge of his contributions, which not only revolutionized hernia surgery. In fact his contributions were ahead of the important technical advances of modern surgery.

Since his very beginning in Cadiz, he knew very clearly the role that by both anatomy and surgery had to played, considering the body as his "favorite author" and the human body as "a natural book that we should never give up." His life is full of efforts to show that anatomy is the basis of surgery and that the best method for its study is dissection.

The legacy of Antonio de Gimbernat reaches us all, anatomists and surgeons. His heritage is an example to follow in the early twenty-first century. The legacy is institutional too, as the Faculty of Medicine and the Clinical Hospital are direct heirs of the Royal College of Surgery of San Carlos. In the Museum of Anatomy "Javier Puerta" of the above-mentioned faculty we can still see many of the works boldly directed and nursed by the famous surgeon in the Anatomical and Pathological

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An analysis of the *Oraciones inaugurales* of Antoni de Gimbernat

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SUMMARY

It was a tradition in the Spanish universities of the seventeenth century that the start of academic activities included a ceremony in which an outstanding teacher of the institution delivered an address, an oration. This lecture had the name of *Oración Inaugural* and its aim was to allow the professor to instruct the students in the importance of the profession they were studying. In some way, these lectures can be also used in order to understand better the personality of each professor. In the present review we have used this approach to know other facets of the personality of Antoni de Gimbernat from those of anatomist and surgeon. We have analyzed two *Oraciones* and a *Disertación* that he delivered at the Royal Colleges of Surgery of Barcelona and Madrid in 1768, 1773 and 1787. These lectures, especially the first two, are good examples of Gimbernat's interest in training the best surgeons he could. Even when the activities of Gimbernat in founding new colleges of surgery and preparing syllabi and study curricula are well-known, the careful reading of the *Oraciones* allows us to know how surgeons should be in technical, intellectual and moral abilities. We believe that the aptitudes drawn by Gimbernat still maintain their full value.

Key words: Antoni de Gimbernat – Teaching – Surgery – Inaugural addresses – *Oraciones inaugurals* – Royal College of Surgery of Barcelona – Royal College of Surgery of Madrid – History of Medicine

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INTRODUCTION

The name *Oración inaugural* defines the address that was traditionally delivered at the beginning of each academic year as a part of the activities that universities used to celebrate the beginning of academic activities. With different names, this practice has remained in Spanish universities since medieval times. It is still common that the academic year starts with a ceremony where a professor or a successful professional from outside the university delivers a lecture on a subject of his specialty. The analysis of such discourses has a historical interest and allows for the understanding of the topics that were important at each time, as well as the personality of those delivering it. People chosen for this activity always are considered the best in their area of specialization and generally try to deliver a very good address. Some authors have analyzed these discourses in Spanish universities to have a better knowledge of how the institutions were at the time (Echeverría, 1977; Domínguez, 1998; Hernández, 2012). In this respect, Hernández (2012) has studied the University of Salamanca and has established that the *Oraciones Inaugurales* were already in use in 1719. The Tridentine Profession of Faith by teachers and a mass followed the ceremony. The first was a requirement of the Catholic Church for professors of canonically-erected universities and was carefully explained in the papal bull *Iniunctum nobis* of 13 November 1564 (Bettenson and Maunder, 2011). It was compulsory after the Council of Trent held in 1545-1563 as a response to the Protestantism. It seems that the *Oraciones* were first used in the universities of the Kingdom of Aragon and later came to Castilian universities, such as Salamanca (Hernández, 2012). The professors could follow a reasoning based on an education plan while others preferred to explain scientific advances of their time. Still, a few tried to explain their own contribution to science (Hernández, 2012). Gimbernat and Ribas (1781) stated in a report related to the re-

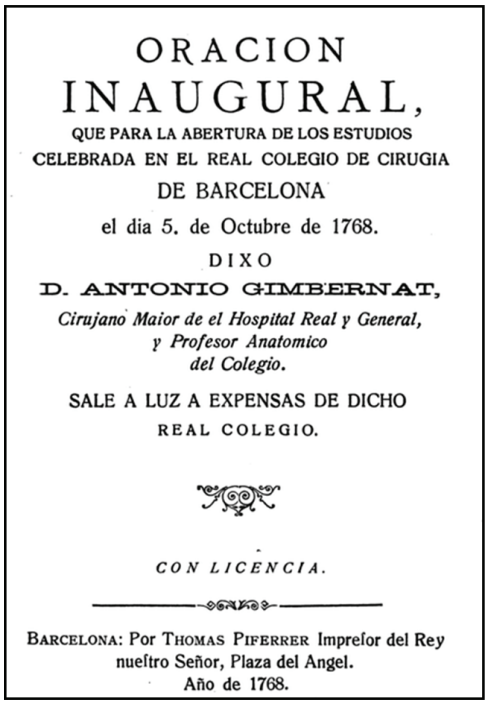
gime and government of the new Royal College of Surgeons of Madrid, under the title: *Oración inaugural a la apertura de clases*: "*The first of October, at the eve of the beginning of teaching classes, it would very useful to deliver an inaugural address* (oración inaugural) *by one of the teachers every year. This would allow for stimulating the interest of the youth in literary issues, and every teacher would have the opportunity to practice in turns. They, and also the Surgery, will gain many profits.*"

Even when the colleges of surgery were not in the universities at the time, they followed some of their habits, like the use of these addresses, the *Oraciones,* at the beginning of the academic activities around the month of October. In the present paper we review three contributions of Antoni de Gimbernat to these dissertations that were also delivered in the colleges of surgery. The first two were from the College of Surgery of Barcelona in 1768 and 1773, where Gimbernat was professor, and that still maintained the name of *Oraciones*. The third is the first delivered in the College of Surgery of San Carlos of Madrid, with the name of *Disertación*, in 1787, the first year of its creation.

As long as we know, Gimbernat was not a prolific writer (Arráez-Aybar and Bueno-López, 2013). In the biography written by his son Agustín, the list of published works included those already cited, as well as "Nuevo método de operar en la hernia crural" (1793) that described his well-known surgical technique to treat strangulated femoral hernias, a "Disertación sobre las úlceras de los ojos que interesan la córnea transparente" (1802) and a "Formulario quirúrgico para el uso del Hospital General de Madrid" (1794). In the two volumes of the collected works of Gimbernat published by Salcedo y Ginestal (1927), we can also find some unpublished works, such as "Oficio a los señores Gimbernat y Ribas, para que informen sobre la erección del Real Colegio de Cirugía de Madrid", "Primer informe, de fecha 14 de Julio de 1780", "Segundo informe, de fecha 31 de diciembre de 1781" and "Censura sobre el paso de cuerpos líquidos y sólidos desde el estómago a la vejiga" (1789). Given the small number of published works, the analysis of the *Oraciones* may be important to understand the thinking and works of Gimbernat. Some authors (Rueda, 2013) have considered another *Oración inaugural* dated 5 October 1793, but this is a mistake as it refers to the same *Oración* of 5 October 1773.

THE *ORACIÓN INAUGURAL* OF 1768 IN THE ROYAL COLLEGE OF SURGERY OF BARCELONA

The Royal College of Surgery of Barcelona was created in 1760 and was the second oldest of Spain after the College of Cadiz, where Gimbernat was educated and got his degree in Surgery in 1762 (Baños and Guardiola, 1999). Soon after,



ORACION
INAUGURAL,
QUE PARA LA ABERTURA DE LOS ESTUDIOS
CELEBRADA EN EL REAL COLEGIO DE CIRUGIA
DE BARCELONA
el dia 5. de Octubre de 1768.
DIXO
D. ANTONIO GIMBERNAT,
Cirujano Maior de el Hospital Real y General, y Profesor Anatomico del Colegio.
SALE A LUZ A EXPENSAS DE DICHO
REAL COLEGIO.

CON LICENCIA.

BARCELONA: Por THOMAS PIFERRER Impreſor del Rey nueſtro Señor, Plaza del Angel.
Año de 1768.

Fig. 1. Front page of the *Oración Inaugural* delivered in 1768 at the Royal College of Surgery of Barcelona (taken from Salcedo y Ginestal, 1927).

Pere Virgili nominated him as a professor in the College of Barcelona but, due to his young age, he was appointed to the chair of anatomy in 1764 when he was only thirty years old (Puig-LaCalle and Martí-Pujol, 1995), the same year that the buildings were finished. Four years later, he was asked to deliver the *Oración Inaugural* of the College, as a part of his duties as professor (Gimbernat, 1768). Finally, Gimbernat carried out this work on 5 October 1768.

The *Oración* (Fig. 1) (Gimbernat, 1768) starts with an analogy that compares the spring season with the arrival of the students to start the new academic year. Later, he goes on with a reminder of the main objective of the school: to protect "*the most precious jewel, that is, the health of men*". To illustrate this aim, he invokes the value of surgeons to extract stones from the urinary bladder, to drain the blood from a brain hematoma, to eliminate the cataracts in the eyes or to perform a laryngotomy in a patient with diphtheria. He uses historical references to illustrate the social recognition of surgeons with the examples of the Greek Podaleirios, the French Jean Pitard and the Italian Guido Lanfranchi. He also recognizes the work of François Gigot de la Peyronie and his master, Pere Virgili. This reference is used to introduce the birth of the first Royal College of Surgeons in Spain after a long time in which this profession was not socially recognized. This lack of appreciation had had the consequence that incompetent people were working as surgeons, a fact that contributed even more to an increased discredit. Gimbernat then reviews the creation of the College

with a great recognition of the role of the King Charles III and of Pere Virgili. The *Oración* ends by requesting the hard work of the students to show their gratitude for the role of the King in the creation of the school where they are trained.

THE *ORACIÓN INAUGURAL* OF 1773 IN THE ROYAL COLLEGE OF SURGERY OF BARCELONA

This lecture has 33 pages (Fig. 2) and contains interesting clues to understand the personality of his author (Gimbernat, 1773). It starts with several thoughts on the loss of health that leads the disease and includes some citations of classical thinkers like Thales, Planudes and Erasmus. Later, Gimbernat analyzes the desired qualities that students of surgery need, i.e. the 'natural disposition", defined as "the presence of the corresponding qualities in your persons that allows the profit of the seeds of teaching". Next, he explains which these qualities are. First, the students should be in good health, with well-organized extremities and quickness in responses. This is important because the work is tough and full of disgraces, grieves and sorrows, as a consequence of the diseases. For Gimbernat, surgeons should be able to cope with these situations and avoid those that can influence their professional choices also feel the patients' pain.

At a time when the availability of complementary methods of diagnosis was non-existent, the judicious use of the senses was especially important.

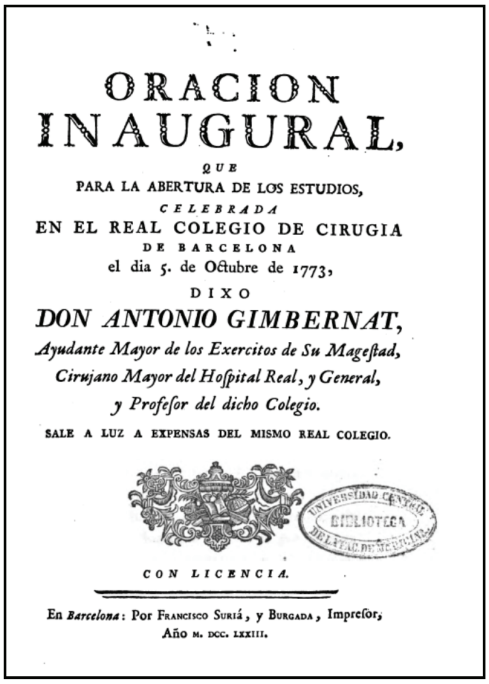

ORACION
INAUGURAL,
QUE
PARA LA ABERTURA DE LOS ESTUDIOS,
CELEBRADA
EN EL REAL COLEGIO DE CIRUGIA
DE BARCELONA
el dia 5. de Octubre de 1773,
DIXO
DON ANTONIO GIMBERNAT,
Ayudante Mayor de los Exercitos de Su Mageſtad,
Cirujano Mayor del Hoſpital Real, y General,
y Profeſor del dicho Colegio.
SALE A LUZ A EXPENSAS DEL MISMO REAL COLEGIO.
CON LICENCIA.
En Barcelona: Por Francisco Suriá, y Burgada, Impreſor,
Año M. DCC. LXXIII.

Fig. 2. Front page of the *Oración Inaugural* delivered in 1773 at the Royal College of Surgery of Barcelona.

Gimbernat asks their students to have perfect abilities to hear, to touch, to taste, to smell and to see. For instance, the absence of good eyesight makes impossible to recognize many diseases and impedes the performance of surgical operations. A reduced hearing will make difficult the knowledge of some bone fractures whereas the lack of a good sense of touch will prevent the detection of pulse, the finding of some veins, the knowledge of several diseases and the application of adequate surgical procedures. Besides these physical abilities, he also considers the intellectual ones as very important in the training of the surgeon: "*The darkness in judgment, the clumsy talk, the slow memory and the ineffectiveness in the work are faults so important that each of them may exclude the possibility of progressing in the school*".

However, this list of sensorial qualities and intellectual abilities is not enough. Gimbernat gives special importance to the personality of the surgeon. This professional should be bold but also act with fear and respect to maintain moderation and carefulness. These virtues should avoid that the feelings of the patients have a negative influence in his choices. Gimbernat also recommends maintaining a good doctor-patient relationship as it 'influences a lot their healing and the recovery of health". He summarizes the personality of surgeon as follows: "*Finally, the surgeon should be daring and brave in the safe, timid in the danger, cheerful with the patients, respected among the friends, cautious in the diagnosis, and chaste, virtuous and God-fearing*." This part of the address finishes with a strong recommendation to work on corpses to learn the important practical skills needed for their professional life and to visit often the hospital to habituate their ears to the sad screams of patients and to allow the familiarity with them. This will impede in the future that the suffering of patients will move the spirit and will allow the surgeons to make adequate decisions when these are more strongly needed.

The second part of the address is devoted to introducing the value of Anatomy for students of surgery. A panegyric quote of the science is the following; "*Not only Anatomy should be recommended as they try to maintain their life and health of men, but because it is also the greatest and noblest of all Sciences and Arts, as it makes all of them great and illustrated. For these reasons, as it gives them grandeur and knowledge,* [*Anatomy*] *will be the greatest and noblest*". In the next lines, Gimbernat also give reasons for the importance of Theology, Jurisprudence, Medicine, Physics, Chemistry and Plastic Arts like painting and sculpturing. Notwithstanding, he still considers Anatomy as the most important because its main objective is the study of the man. He uses some examples of how the anatomy may assist the other sciences in many ways, which results in a still increased value of the discipline. For instance, Gimbernat

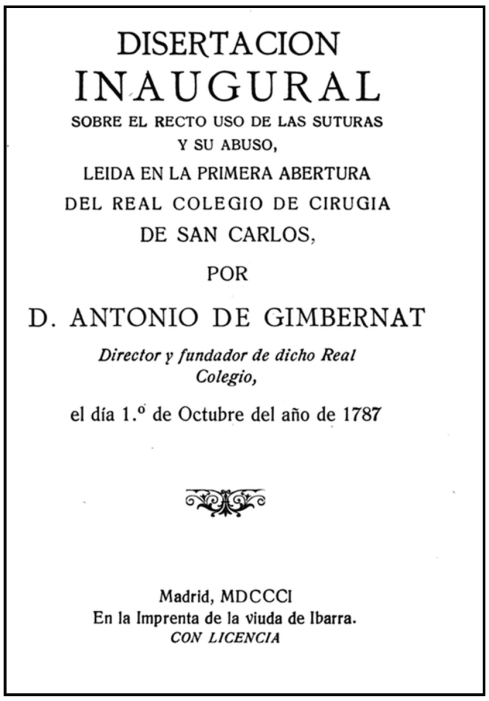
explains how anatomy may help the judges in discovering the cause of a death using a discipline that he names Legal Anatomy. It is important to outline that his interest in Anatomy is mainly related with the importance in the training and practice of surgery. This objective is clearly related with the exposed in the first part of the lecture, i.e. the best education of surgeons. For this reason, this *Oración* is a good example of the interest of Gimbernat for the education, as he repeatedly demonstrated during his all life (Ferrer, 1964; Arráez-Aybar and Bueno López, 2013).

The third and last part of this *Oración* was devoted to the benefits that can follow from surgery. Gimbernat illustrates them by commenting on the use of trepanation, cataract extraction, the treatment of the jaw dislocation, the drainage of a chest empyema or the treatment of a strangulated hernia. These examples are used by Gimbernat to justify the need of a good training, as only good surgeons can provide the needed treatments to heal the patients. In some way, similar examples were used in the *Oración* of 1768 to illustrate the social value of surgery. Gimbernat finished his *Oración* with the following words in recognition to the help of the King: "*This art that works nonstop for the conservation of men should acclaim to Your Highness, who best knows how to enrich it, and that it has no other ambition that deserves your protection, that will confirm its stability, assure its progresses and take advantage of its works*."

THE *DISERTACIÓN INAUGURAL* OF 1787 IN THE ROYAL COLLEGE OF SURGERY OF MADRID

In the late 1780s a new College of Surgery was set up in Madrid. Gimbernat was highly interested in being the director, so he moved to the city with his family (Loukas et al., 2007). Finally, he was appointed in January of 1787 and the activities of the new college started in October. This institution had a different objective from that of the colleges of Cadiz and Barcelona. As his son remembered, the new Royal College of Surgery of San Carlos should train surgeons who worked in the cities of Spain and not in the army, like those of the Cadiz and Barcelona colleges (Gimbernat, 1824). Only two years later, Gimbernat was appointed Royal Surgeon and left the teaching activities, although he was named as a perpetual director and professor of Anatomy and Surgical Algebra, a science similar to the current orthopedic surgery (Puig-LaCalle and Martí-Pujol, 1995).

The College opened in 1787, the 1st October, as was traditional in the colleges of surgery of the country. As teacher and director, Gimbernat delivered the inaugural address and talked about the surgical sutures and the risk of its wrong use in the common practice (Gimbernat, 1801). The full text was not published until fourteen years later (Fig. 3). He introduced the address with the traditional rhetoric about the important of the new College and with references to the classical authors that Gimbernat had used in previous inaugural lectures. The second part had more interest. It included a historical consideration on the use of sutures and remembered some inadequate procedures of them in the past. He added how the procedure should be carried out and the correct method that assured the healing of the injuries. These recommendations were based in his own experience. This aspect was especially important, as he avoided a theoretical discourse that was not inspired by his personal practice. In fact, this dissertation cannot be considered as a traditional *Oración*, except in his introduction, as Gimbernat gave an excellent lecture on the different types of sutures that could be used in each clinical situation (*sutura entrecortada, sutura entortillada, sutura emplumada, sutura fibulada*). The dissertation was full of references to other surgeons, from Celsus to the modern French ones, who were friends of Gimbernat. The talk finished with a list of ten useful conclusions recommending a type of suture for every injury. Again, as in the previous *Oraciones*, he had a very teaching-oriented approach to improve the future work of the students as the final quote showed: *Ne videantur chirurgi esse carnifices, sed studiosi hominum conservatores* (Surgeons should not be considered butchers but zealous caregivers of men).



DISERTACION
INAUGURAL
SOBRE EL RECTO USO DE LAS SUTURAS
Y SU ABUSO,
LEIDA EN LA PRIMERA ABERTURA
DEL REAL COLEGIO DE CIRUGIA
DE SAN CARLOS,
POR
D. ANTONIO DE GIMBERNAT
Director y fundador de dicho Real Colegio,
el día 1.º de Octubre del año de 1787

Madrid, MDCCCI
En la Imprenta de la viuda de Ibarra.
CON LICENCIA

Fig. 3. Front page of the *Disertación Inaugural* delivered in 1787 at the Royal College of Surgery of San Carlos of Madrid (taken from Salcedo y Ginestal, 1927).

CONCLUSIONS

Antoni de Gimbernat was an extraordinary anatomist and surgeon. His works are still remembered and recognized after two hundred years of his death, but we would like to outline his work as a teacher during all his life. This activity was clearly stated with the creation of several colleges of surgery under his auspices but this was not all. In the three inaugural dissertations reviewed in this article, he appears as a man who was actually interested in training good professionals in the field of surgery. This aspect of his life has not been analyzed in detail, perhaps because the work on anatomy and surgery overshadowed it. However, the reading of the *Oraciones* allows for the understanding of his interest in teaching and the strict way he considered the education of the surgeons. We hope that this review may help to outline his work as a professor, as well as anatomist and surgeon.

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Surgeons – Anatomists of the "camp de Tarragona". Soldiers equipped with an academic plan

Joan Ramon Benítez i Gomà

Private medical activity

SUMMARY

At the end of the 17th Century the university training of surgery in Spain depended on the traditional faculties of medicine in the universities. In these faculties "teaching continued to be conceived as an oral apprenticeship based on memory, and the theoretical principles of the Renaissance" (Granjel, 1979). Training in surgery was dependent on the badly equipped Departments of Anatomy, where anatomy and surgery were taught. The work "Institutions of Surgery" of Luis Mercado, published in 1599 by order of Felipe II, continued to be recommended. Felipe II prohibited "*foreign travel to study or learn or reside in foreign universities or the study in their colleges …"* (Ferrer, 1968). These Departments trained many university surgeons – so called "Latin surgeons" because they spoke Latin – who were ill prepared (Massons, 2002), with the result that the greater part of the population were treated by barbers or romance surgeons – surgeons without university training who had learnt from another surgeon (Vallribera i Puig, 1987). There was also much "practice" with no training at all (Bustos Rodriguez, 1983).

The evolution of a surgery eminently practical at the beginning of the 18th Century to surgical practice based on a solid training programme and scientific principals cannot be explained in Spain without the participation of an interrelated group of surgeons, all of them from the same birthplace, the "Camp de Tarragona".

Key words: History – Spain – Virgili – Gimbernat – Anatomy – Surgery – 18th Century navy – Royal College of Surgeons

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INTRODUCTION

The evolution of surgery during 18th century was related with the figure of Pere Virgili i Ballvé. He was born on the 15th of February, 1699 in Vilallonga del Camp (Tarragona AHAd), a small village in the meridional region of the province of Tarragona.

In the first half of the 18th Century the teaching of surgery at the university faculties was in a state of abandonment. The Chairs of Anatomy of the majority of the Universities remained vacant during large periods of time, and it was not necessary for the students to attend classes to receive a university degree (Astrain Gallart, 1996). Big cities like Barcelona, Madrid and Seville were more exposed to external influences, and it was in these that the changes, in Departments of Anatomy, began. In these Departments a minimum number of annual dissections was established, under the supervision of an "*Anatomic Demonstrator*," to be carried out in purpose-built "*Anatomic Theatres*".

The Faculty of Barcelona, the nearest to Virgili's birthplace, had rules governing surgical practice at the beginning of the 18th Century, published in 1658 "*Primeras ordinations del nou redrés del Collegi del Chirurgians de la present Ciutat de Barcelona, tant en orde a sos examens de tentatiuas com en lo demes de son govern politich*". There "ordinances" stipulated the required conditions for the training of surgeons in the framework of a guild grouping barbers and surgeons, maintaining the figure of apprentice, just like any other skilled job, for aspiring master surgeons.

To be matriculated and examined in the guild college surgeons had to present the correspondent certificate of their knowledge of Latin. They also needed to have attended three years of surgery classes at the university, and have completed

eight years of practice with a master surgeon in operations, and to have attended patients in hospital (Vallribera i Puig, 1990). A certification of having assisted at the 12 autopsies which had to be realised each academic year was also obligatory. Once completed these conditions, the aspiring master surgeons had to pass a practical and a theoretical exam (Vallribera i Puig, 1987) before the "protomedicato" (the official institution of doctors in medicine) (Astrain Gallart, 1996). The theoretical exam required knowledge of a basic treatise on surgery, with a question and answer format (Massons, 2002).

In the Department of Anatomy at Barcelona University the refurbishing of the anatomic amphitheatre was finished with the active support of Joan d' Alos i Serradora (Moiá, 1617 – Barcelona, 1695), "protomedico" of the Principality of Catalonia and Professor of Anatomy from 1659 (Cardoner, 1962). The regulated exposition which had to be followed in anatomic dissection was: 1. animal cavity; 2. vital cavity; 3. natural cavity and the parts contained within it; 4. arm muscles; 5. leg muscles; 6. the rest of the body's muscles; 7. all the veins; 8. all the arteries; 9. the 29 pairs of nerves in the spinal column; 10. the sixth pair of nerves of the brain; 11. male and female genitalia; 12. eyes and other sensory organs; 13. the complete bone history (Danon Bretos, 1971).

Carles Pallejá i Pinyol, born in Tarragona in 1678, was a traditionally trained surgeon in the Barcelona University. He wrote "*Materias de Cirugia*" (1726), a manuscript with a question and answer format, in which he described the teachings of the master surgeon Josep Roig in the Chair of Anatomy and Surgery of Barcelona. The text retains the traditional teaching model but leaving the Latin – the habitual language – in favour of Catalan, so its contents would be of use to apprentices of romance surgeons who did not speak or read Latin (Vallribera i Puig, 1987).

In Madrid, immersed in the changes previous to the imminent Spanish War of Succession, the new king, Felipe V, arrived on the 18th of February 1701 (Albareda Salvadó 2010). The surgeons of Felipe V's court created, in 1701, the Chair of Anatomy in the General Hospital of Madrid and, in 1703, the position of "Anatomic Dissector" (Astrain Gallart, 1996). Florencio Kelly, of Irish origin and trained in Paris, was the anatomist in charge of performing dissections in the "*Amfhitheatrum Matritense*". In the department 12 anatomical demonstrations were carried out to which aspirants to master surgeon attended (Massons, 2002). To give an idea of the importance and novelty of these demonstrations, even King Felipe V attended one of them (Fig. 1).

In 1697, in Seville, the "*Royal Society of Medicine and other Sciences*" was founded, and in 1700 Carlos II (Granjel, 1979; Hermosilla Molina, 1970) approved the first "Ordinances". These

Fig. 1. Illustration of the book "Complete Anatomy of Man" Martin Martinez 1728. Edition 1758. Ph.D. Javier Puerta Museum. Chair of Anatomy. Complutense University of Madrid.

"Ordinances" made three annual sessions of anatomy in hospitals mandatory, and allowed the use of animals when human corpses were not available. In this way the Society organized training of Anatomy and gave courses on surgical operations. The Frenchman Blaise de Beaumont, moved from the court in Madrid to Seville, as resident academic and anatomic demonstrator (Granjel, 1979; Santamaría Laorden, 2010).

PERE VIRGILI

Pere Virgili grew up in a small village surrounded by walls with a population of 299 neighbours and 173 houses, after the Spanish War of Succession (Riera i Fortuny, 2005). His first contacts with medicine and surgery must have occurred under the supervision of the village doctor, Jaume Esteve (Ferrer, 1968), at the rural hospital which had existed in Vilallonga del Camp from the end of the 16th Century, dedicated to the attention of local patients, and patients from nearby villages and farms (Albiol i Molné, 2000).

The War of Succession (1701-1714) brought surgeons accompanying the troops, from all over Europe. The training acquired by some of these sur-

geons in French and European Faculties, where students were taught anatomy with corpses in clinics and operation theatres next to the sick, contrasted with the training of Spanish surgeons and had on inevitable influence. Many of these surgeons stayed on after the campaign had finished in the service of the navy and Spanish army, and of the civil population (Granjel, 1979; Massons, 2002).

In the scientific sphere, in Spain, an effort was made to incorporate the recent conquests made in Europe and among Spanish professionals of medicine, who began to take into account the iatromechanical theories of Herman Boerhaave (Granjel, 1979). The writer and Friar Benito Geronimo Feyjóo, in the "*Teatro Critico Universal*" (1726), wrote "*Experience must always take precedence over any kind of reasoning.*" The Spanish doctor and philosopher Martín Martinez, general practitioner and examiner of protomedicatos wrote in the prologue of "*Anatomia Completa del Hombre*" (1728), "*Truly all over Europe the true application of Anatomy is cultivated*" (Ferrer, 1968). Blas de Benamont in 1728, in "*Exercitaciones Anatomicas*," wrote … "*Anatomy is no less key to Surgery than it is to Medicine …. and above all he who registers and dissects corpses … must be the most classical author, the greatest and most erudite master*" (Beaumont, 1728). In France the surgeous Georges Mareschal and François Gigot de la Peyronie – the traditional chief surgeon of the Hotel – Dîeu de Montpellier – surgeons of King Luis XV and of the hospitals of "Saint Come" and "De La Charité" succeeded in founding the "Academic Royale de Chirurgie" in 1731 (André, 1994).

Like all the apprentices of surgery of that time, Virgili began his training as an assistant to the owner of an operating theatre of surgery and haircutting. A contract exists, dated 12th of January 1721, between Pere Virgili´s father and the master surgeon Gabriel Riera, for the apprenticeship of surgery in the trienium 1721-1724. Virgili began his training programme as a non university romance surgeon without latin (Albiol i Molné, 1992).

Troop movements and military camps of longer or shorter duration were habitual at this time. In 1724, in a cavalry regiment of Calatrava of the royal armed forces, Virgili became surgeon. In Tarragona in 1726 the regiment marched to Valencia and three months later to San Roque (Cadiz) to take part in the siege to retake Gibraltar in 1727 (Massons, 2002). In 1728, now Head Surgeon of the Army in the Military Hospital of Algeciras, he come in contact with the Head Surgeon of the Navy, a Frenchman Juan Lacomba – Jean Temouillet de la Combe. On Lacomba's insistence Virgili was transferred from service in the army to service in the navy (Ferrer, 1968).

Fig. 2. Cádiz 1741. Anonymous in Dutch. Spanish National Library.

ROYAL COLLEGE OF SURGERY OF CADIZ

During the Spanish War of Succession the city of Cadiz assumed the economic cost of its defence, in support of King Felipe V. Once the war was over, the royal authorities in gratitude for its efforts, allowed Cadiz to increase its volume of mercantile traffic and the number of ships destined for New Spain (Mexico). In 1717 the "House of Contraction and the Consulate of the Indies," the administrative instrument of commerce with the Indies was transferred from Seville to Cadiz (Garcia Baquero Gonzalez, 1976). It must be remembered that 15th Century Cadiz was the most cosmopolitan and commercial city of its time: ship, mercantile and human traffic was intense and continuous (Fig. 2).

Once the War of Succession was over, Jose Patiño Rosales, Governor General of the Navy was ordered to reform the Navy and reconstruct the Indies Fleet by Felipe V (Garcia Baquero Gonzalez 1976). In June of 1717 Patiño dictated an "*Instrucción*" (Ordinances of Patiño) which described the obligations of naval health workers (Astrain Gallart, 1996). The improvement of naval medical assistance was delegated to Juan Lacomba, chief Surgeon to the Navy since 1718 (Cabrera-Afonso, 2008; Massons, 2002).

In 1727 Pere Virgili and Juan Lacomba moved to Cadiz, where the Royal Marine Hospital was to be found. In 1716 in this hospital there was an anatomy School directed by Casimiro Garcia, "*Profesor and doctor of surgical training*" Spanish protomedico of the Galleys of the Navy (Ferrer, 1983; Orozco Acuaviva, 1976). This school aimed to train skilful surgeons, according to the needs of the navy, who could substitute the surgeon-barbers, prohibited on ships from 1703 onwards (Astrain Gallart, 1996).

In 1728 Patiño signed the "*First Ordinances for first and second surgeons of the navy,*" redacted by the chief surgeon Lacomba. These ordinances

definitively implanted the teaching of surgery in the Marine Hospital of Cadiz. Lacomba pursued an education based on practice in the service of surgery, and was critical of the position of the Protomedicato who defended a theoretic teaching model in the lecture theatres (Ferrer 1983). The post of "*Anatomic Demonstrator*" was created and the teaching of Anatomy was consolidated, with the obligatory attendance for all disembarked surgeons at anatomical demonstrations. Gregorio Condomina, a secondary school formed student from Montpellier, was named "*Department Demonstrator*" with the obligation of realising twenty annual anatomic demonstrations. The "*Ordinances*" also made surgeons responsible for carrying boxes and bottles of medicines duly approved by therapeutic studies. In 1730 the amphitheatre of anatomy was constructed (Astrain Gallart, 1996; Ferrer, 1983; Massons, 2002).

Lacomba's tutelage did not make Virgili exempt from service in the Navy. For 20 years (1728 to 1748) Virgili worked intensely both practising and teaching. From 1729 to 1730 he made his first sea voyage to La Habana as first surgeon. He embarked again in 1732 with the fleet under the command of General Francisco Cornejo in the conquest of Oman; during the periods 1735 to 1737, 1738 to 1739 and 1744 to 1745 he made three voyages to New Spain (Mexico) (Corbella i Corbella, 2011; Ferrer, 1968; Massons, 2002).

In 1733 Virgili moved to Paris and stayed with the surgeon and anatomist, expert in urulitiasis, Claude Nicolas Le Cat (Massons, 2002), and founder in Roman of the "Académie Royale des Sciences, Belles Lettres et Arts". Virgili was now ranked "Assistant to the Head Surgeon of the Navy" and was recognised for his broncotomy intervention (tracheotomy) performed on a Spanish soldier of the Cantabrian Regiment (Frau, 1843; Orozco Acuaviva, 1976).

The "Académie Royale de Chirurgie", based in Paris had been established in 1731, directed by Jean Louis Petit, with the authority to name its teachers, who distributed the surgeons in the hospitals and rewarded the pupils for academic merit. Said institution also named the military surgeons for the army and navy, after rigorous theoretical and practical examinations (André, 1994).

During his residence in France he almost certainly had the opportunity to learn of the existence of the formative programme "école de Santé navale" in the surgical and anatomical school, founded between 1715 and 1722 in the Maritime Hospital of Rochefort by the chief surgeon of the army Jean Cochon Dupuy (Massons, 2002; Yannick, 2001).

While staying in Paris, Virgili not only confirmed his training as a surgeon and anatomist. He also came into contact with the models of military and civil organization of French surgeons.

After 7 years of absence, when Virgili returned to Cadiz in 1745, the Naval Hospital was under the direction of Juan Lacomba. Virgili took control of surgical services and the teaching programme alongside another Assistant to the Head Surgeon, Gaspar Pellicer (Massons, 2002; Astrain Gallart, 1996). In 1747 the secretary for the Navy, Marquis of Ensenada (Zenon de Somodevilla and Bengoechea) accepted Lacomba's recommendation, by now an old man, to name Virgili as his substitute in the post of Head Surgeon to the Navy (Ferrer, 1968).

In May 1749 Virgili presented the project for the creation and organization of a "*Royal College of Surgery in Cadiz*" to the Marquis of Ensenada," … *a College in which surgery will be taught with a method requiring physical experiment, observation and experimental practice to deduce its doctrines…*" The Marquis of Ensenada informed King Fernando VI of the necessity" *to create skillful Surgeons which Spain lacks...; this is obtained having* ***two*** *schools like those famous ones in Paris and Montpellier…*" (Ferrer, 1968; Orozco Acuaviva, 1976). The Marquis of Ensenada saw the need from his first report to the King of more than one College of Surgeons in Spain.

The statutes "Ordinances for the establishment of a Royal College of Surgeons" of Cadiz were published in the Royal document of the 11th of November, 1748. The college was assigned to the Hospital of the Navy of Cadiz (Granjel, 1979). The "Academic Programme" was yet to be defined, a responsibility of the Head Surgeon of the Navy

Fig. 3. Bust of Pere Virgili i Ballvé. School of Medicine. Complutense University of Madrid.

(Astrain Gallart, 1996). On the 4th of January 1749 Virgili was named Head Surgeon of the Navy and in consequence Director of the Royal College of Surgery (Ferrer, 1968; Astrain Gallart, 1996).

In accordance with the military character of the College of Surgeons, Virgili had at his disposal a residential regime for 60 pupils, whose daily activities were totally regulated. The students received board and lodging and a salary, and could be punished for indiscipline (Fig. 3).

The first study programme that Virgili prepared foresaw a three-year course, and included the teaching of anatomy, general surgery and specialised clinical knowledge, among which were obstetrics (Granjel, 1979). Knowledge of anatomy was acquired through practice and included Osteology, Dissection, Surgical Anatomy and Operations on corpses and Anatomic Knowledge. Daily attendance for two and a half hours (6.30 to 8.00 am) of Surgery and Medicine insisted on the practical character of the training. The acquisition of medical knowledge, in addition to surgical, was completed by the obligation of having the Protomedico – since 1737 – teach two determined days a week, formation which included "internal medicines" (in Spanish "medicamentos internos") exclusively for doctors. The Head Chemist had to inform the Head Surgeon of when they created medicines in order to permit the attendance of students (Cabrera-Afonso, 2008). The attendance of all naval surgeons on land at the "Literary Assemblies" on Thursdays was obligatory where a surgeon or advanced pupil presented a clinical or doctrinal case. The ambition of Virgili is significant in including obstetrics in a training programme for military surgeons.

On the 20th of September 1749 the Library was opened and Francisco Canivell i Vila was named librarian for his knowledge of French and Latin (Ferrer, 1968; Massons i Esplugas, 1994). Already in the "*Ordinances of the Royal College*" it was proposed that "*books, maps, instruments and other necessities for the instruction and Operation of the studies and demonstrations could be bought.*" The library was founded thanks to the obligatory, economic contributions of all naval surgeons, and contained, among others, and from the beginning, all of the publications to date of the Royal Academy of Sciences of Paris, the collected works in anatomy of Ruyschio, Blancard, Albino Morgagni and Eustachio, the complete works of Galeno, the Anatomy of innards of M. Garengeot … This library continued to expand throughout the existence of the Royal College (Astrain Gallart, 1996; Cabrera-Afonso, 2008).

Virgili ordered the printing of "Method which should be followed to make observations in Surgery." This is the guideline for what we now call clinical history (Ferrer, 1968). The systematic outline for the realisation of a clinical history had been described by Herman Boerhaave in "*Medical Institutions*" and "*Aphorismi de Cognoscendis et Curandis Morbis*" in 1708 and 1709 in the Dutch University of Leyden (Lain Entralgo, 1978).

In 1750 the new building to house the Royal Academy of Surgery in Cadiz was inaugurated (Orozco Acuaviva, 1976). Once the building was finished in appended terrain a Botanical Garden of medicinal plants was established; the first in Spain (Cabrera-Afonso, 2008; Ferrer, 1983).

The Royal College of Surgery of Cadiz was constituted with "Ordinances," its own building, anatomic amphitheatre, library and botanical garden. The study programme was above all based on practice on corpses and patients in the hospital, and included its own exclusive teachings of doctors of the moment.

ANTONI GIMBERNAT I ARBÓS

Antoni Gimbernat i Arbós was born on the 15th of February of 1734 in Cambrils (Tarragona AHAd[2]), a small fishing and agrarian village with a seaport situated in the south east of the county Camps de Tarragona (Fig. 4).

Gimbernat's training was correspondent to the son of a comfortable family of the time. He studied Latinisation in the Convent of the Franciscan Orden of Recoletos, in the neighbouring Riudoms (1747-1748). In 1749 he studied Philosoply in the University of Cevera, where he obtained a High School Diploma in Humanities (Ferrer, 1968; Gimbernat, 1828). This University had been established by order of Felipe V in 1717, in which the studies of the five universities in existence before the War of the Spanish Succession in Catalonia

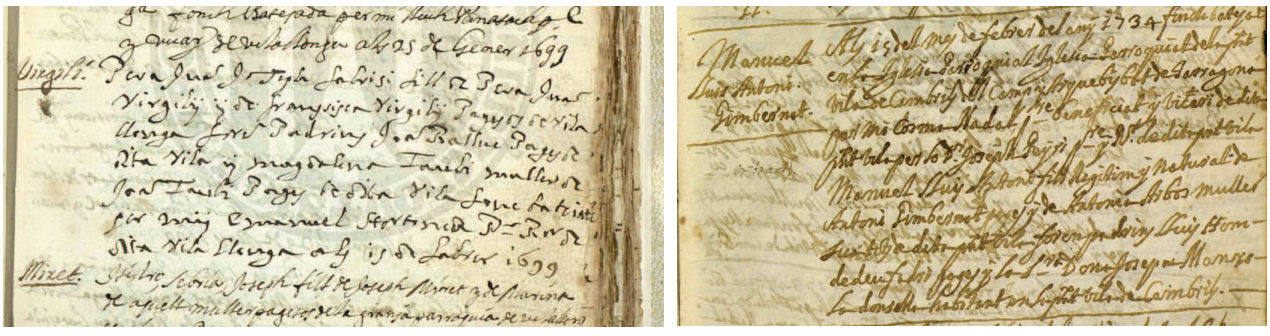


Fig. 4. Birth registration of Virgili and Gimbernat in the parish book. Historical archive archdiocesan of Tarragona.

were unified (Prats Cuevas, 1993).

There is no record of Gimbernat studying Medicine in the University of Cervera. Although in this University the studies of Humanities was at the level of the best cultural centres of Spain, the anatomic studies were concentrated in 20 brief sessions with practicals on animals. The academic programme was: First year – Bones and muscles; Second – Animal cavity and the nerves in the vital cavity and arteries; Third – Natural cavity and veins, Fourth – "De compositone medicamentorum: de simplicium medicamentorum facultatibus." The surgical training was imparted in the first 3 years and the contents were based on texts from the XVth and XVIth centuries of Guy de Chuliac "*Grand Chirigie*" (1326) and recopilations of the texts of Galeno, Avicena y Abulcasis. It was distribured as follows: First year – "*De Tumoribus*"; Second – "*De Uiceribus*"; Third – "*De vulneribus et operationibus Chirurgicas*". The classes were in latin and did not include surgical demonstrations. (Ferrer, 1968; Gil Vernet and Gómez Gómez, 1974; Massons, 2002).

In the royal College of Surgery of Cadiz, in 1751, Pere Virgili succeeded in convincing the Court to assign a pension – the first student grant in Europe – to a group of surgeons and students of the Royal College of Surgery of Cadiz permitting them to study in Leyden, Paris and Bolonia. These surgeons had to answer to the head of the group and complete a strict programme, which included the obligation to inform every month of newly appeared books and instruments. These students and surgeons were encouraged to specialise in surgery, or the knowledge of Physics and Chemistry. The sending of grant students to Paris was repeated in 1754 (Cabrera-Afonso, 2008; Ferrer, 1968; Gimbernat and Piferrer, 1768; Massons, 2002), and was to be a constant in the story of the Royal Colleges of Surgery.

In 1752, as part of the activity of translating and printing books kept by the College during its existence, "The Formulary of the surgical doctor" was published for the use of the Royal Naval Hospital of Cadiz and of naval surgeons. This was the first of its kind edited anywhere in the world (Cabrera-Afonso, 2008).

In recognition of his trajectory and merits Virgili was conceded the Priveleges of nobility and in 1758 the honours and practice of Head Surgeon to the Royal Chamber of Fernando VI (Ferrer, 1968). In 1757 the Royal College received the Royal Patent by which it could issue the degree of "Bachelor of Philosopy" (Astrain Gallart, 1996; Ferrer, 1968; Granjel, 1979).

The register of students and incident book (*Processus Collegiarum*) included Antoni Gimbernat from 1758 (Ferrer, 1968). Gimbernat entered the Royal College of Surgery of Cadiz when some of the grant students attending Leyden and Paris had returned; the first at the Boerhaave School and the second at the school Sauven – François Morand, anatomist and chief surgeon of the hospitals "La Charité and "Les Invalides" (Astrain Gallart, 1996). The consolidation of the College and the influence of the returning grant students permitted the modification of the 1757 study programme of the Royal College. The subjects were grouped as following: 1. Anatomy and Physiology; 2. Pathology and Therapeutics; 3. Operations; 4. Medical Material, Practical Medicine and Chemistry. The study programme, initially four years, extended to six years in 1758, contained: Osteology, Anatomy, Operations of Bones and Dressing; Women's illness and birth; Natural things, non-natural and pre-natural to our animal economy; Analysis of medicines and botany (Cabrera-Afonso 2008). In the first year there were also classes in: Principles of Mathematics and Drawing, to which end a teacher had been appointed in 1754 (Ferrer 1968). In many of these subjects modern texts in Spain, or in Spanish did not exist, so they had to be translated by naval surgeons (Cabrera-Afonso, 2008).

Gimbernat remained at the Royal College of Surgery in Cadiz until between 1760, and in 1761, he moved to Barcelona as faculty colleague to Lorenzo Roland, the "Anatomic Demonstrator of Cadiz" (Ferrer, 1968; Pérez Pérez, 2004).

ROYAL COLLEGE OF SURGERY OF BARCELONA

In the year 1759 Carlos III was crowned King of Spain, and with the Court changes Pere Virgili was dismissed as first surgeon to the chamber of the palace. Virgili began a collaboration with Pedro Perchet, of French origin, and surgeon to the chamber of the new King, to create a Royal College of Surgery of the Army in Barcelona in the image of the then functioning Cadiz College. On the 19th of September, 1760, the King appointed Pedro Virgili Director of the College of Surgery which it had been decided to establish in Barcelona (Ferrer, 1968; Pérez Pérez, 2004), and the regulations designed by Virgili to put the college at the level of the principal Universities of the Kingdom were approved (Pérez Pérez, 2004).

The Royal College was assigned to the hospital Santa Creu of Barcelona. Pedro Perchet, surgeon of the chamber of the King occupied the honorary position of President. Pedro Virgili, second surgeon of the chamber, was the College Director. The rest of the teaching staff included Lorenzo Roland, head Surgeon of the army as first teacher (Pérez Pérez, 2004); Juan Rancé, surgery graduate from Montpellier (Corbella i Corbella, 2004) and surgeon to the Navy; Pedro Maville, Frenchman and head surgeon of the army; Francesc Puig and Josep Pahissa, head surgeons to the hospital of la Santa Creu. Pedro Maville was soon replaced by Diego Velasco, surgeon to the navy, trained in

Cadiz and former grant student in Paris. Antoni Gimbernat was appointed supernumerary teacher with the task of supporting Lorenzo Roland in the "Anatomic Demonstrations" (Massons, 2002). This first teaching staff, more heterogenic than that of Cadiz, included surgeons trained by the navy and army surgeons and civil surgeons supplied by that same hospital and the city of Barcelona.

The new building of the Royal College of Surgery of Barcelona, officially opened on the 29th March of 1764, contained a large, well presented amphitheatre with windows, a central stone table for dissections, which recalled that constructed by Winslow in Paris (Ara y Sarria, 1934).

The didactic objective of the College was to allow both army surgeons and civil surgeons to practice throughout the territory of the Principality of Catalonia (Pérez Pérez, 2004). In the College of Barcelona there was an external regime, and among the rigorous criteria of induction was the requirement to certify two years of apprenticeship with a master surgeon. Consider the graduation of romance surgeons – without a Bachelor degree in Philosophy and Latin – and the Latin surgeons, of higher professional category. The romance surgeons could obtain the qualification of surgeon with one or two exams; the Latin surgeons graduated with two, three five or nine exams. In creating such a varied range of qualification, Virgili allowed the majority of the villages of the Principality of Catalonia to have surgeons while at the same time giving prestige to the training given by the College (Massons, 2002; Massons i Esplugas, 1993).

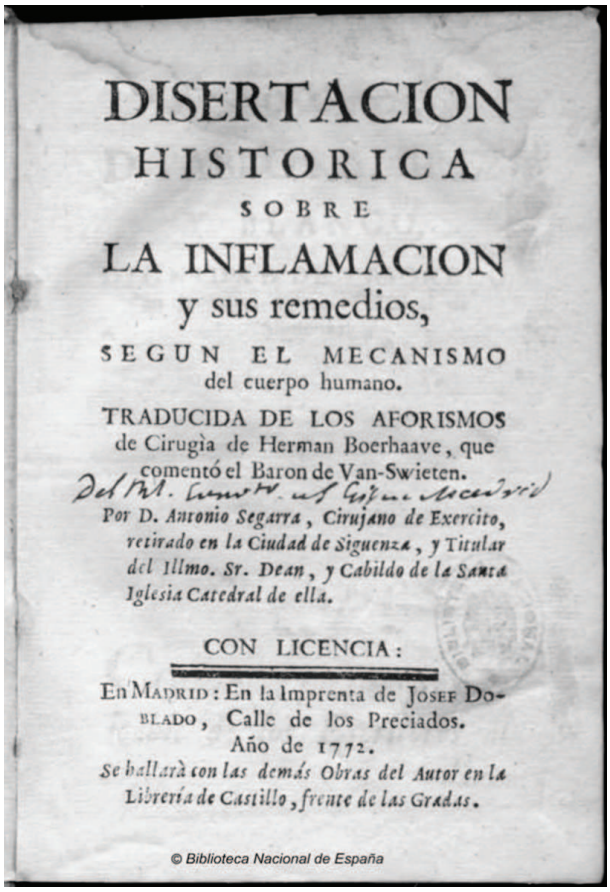

DISERTACION
HISTORICA
SOBRE
LA INFLAMACION
y sus remedios,
SEGUN EL MECANISMO
del cuerpo humano.
TRADUCIDA DE LOS AFORISMOS
de Cirugìa de Herman Boerhaave, que
comentó el Baron de Van-Swieten.
Por D. Antonio Segarra, Cirujano de Exercito,
retirado en la Ciudad de Siguenza, y Titular
del Illmo. Sr. Dean, y Cabildo de la Santa
Iglesia Catedral de ella.
CON LICENCIA:
En Madrid: En la Imprenta de Josef Doblado, Calle de los Preciados.
Año de 1772.
Se hallarà con las demás Obras del Autor en la Librería de Castillo, frente de las Gradas.

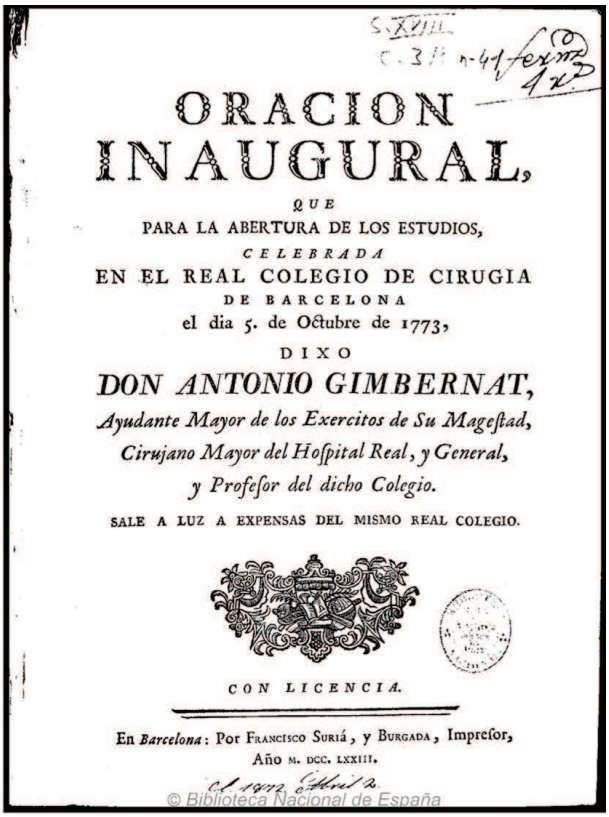
Fig. 5. Translation based "*Aphorismi*" of Boerhaave. Spanish National Library.

The first academic programme of the Royal College of Barcelona, with a duration of 6 years, and an eminently practical orientation, given in Spanish, was structured in the following way: First year: Osteology and Dissection of Corpses; Second year:, Dressing; Physiology, Hygiene, Forensic surgery; Third year: Gunshot wounds; Bone illnesses; Venereal illnesses; Fourth year: Operations, Practical surgery, Obstetrics; Fifth year: Therapeutics, Medical material (Pharmacology), Eye illnesses. It was necessary to pass all the exams, in which the protomedico did not intervene, to practice (Massons, 2002). In the construction of this programme, the first with preclinical training, ideas about university education in medicine of Gerard van Swieten, a disciple of Boerhaave, probably influenced (Matheson, 1949) (Fig. 5).

From the beginning of the creation of the Royal College the acquisition and obtaining of volumes for the creation of a library was organised. Virgili put Diego Velasco in charge of the acquisition of books and surgical instruments in Paris, with the objective of using them for teaching. Among the collected treatises are: "*Miologie*" de Jacques Fabien Gautier d'Agoty (1746), las "*Tabulae scellety et muscularum corporis humani*" de Bernhardus S. Albinus (1747), "Traite de Structure du Coeur (1750) y "*Exposito anatomica*" (1753) de Jacques B. Winslow (Pérez Pérez, 2004).

From 1765 to 1774 Gimbernat dedicated himself full time to teaching and attendance recommending as principal anatomical text the works of Winslow (Gil Vernet and Gómez Gómez, 1974). As surgeon and anatomist he made observations over the crural arch and the Falopian ligament, which he taught in his anatomy classes from 1768 (Arechaga and Menacho, 1977), and which, in 1772 and 1773, permitted him to surgically intervene on patients with a strangled hernia successfully (Ferrer, 1968). When he expounded in the "*Inaugural Speech for the beginning of studies*" in October 1773, Gimbernat had then ascended to Head Surgeon of the Hospital and Chief Aid to the Army. During the speech, which is a programmatic declaration representing the kind of teaching which had installed itself in the College, he said: "*The precise anatomical description of the region or organ intervened is the precise basis upon which to operate with security and success*" (Gimbernat, 1773) (Fig. 6).

In 1774 Gimbernat received orders from the king to begin a journey to Paris, London, Edinburgh and Holland, accompanied by Mariano Rivas, Surgeon to the Army and Professor of the Royal College of Surgery of Cadiz, to observe "*carefully the practice and method to follow of the Teachers of these cap-*



ORACION
INAUGURAL,
QUE
PARA LA ABERTURA DE LOS ESTUDIOS,
CELEBRADA
EN EL REAL COLEGIO DE CIRUGIA
DE BARCELONA
el dia 5. de Octubre de 1773,
DIXO
DON ANTONIO GIMBERNAT,
Ayudante Mayor de los Exercitos de Su Magestad,
Cirujano Mayor del Hospital Real, y General,
y Profesor del dicho Colegio.
SALE A LUZ A EXPENSAS DEL MISMO REAL COLEGIO.
CON LICENCIA.
En Barcelona: Por Francisco Suriá, y Burgada, Impresor,
Año M. DCC. LXXIII.

Fig. 6. Inaugural speech RCC Barcelona 1773. Spanish National Library.

itals in the operations and cures of the sick in the Surgery class" (Ferrer, 1968; Arechaga and Menacho, 1977). The final objective of the journey was the creation of a Royal College of Surgery in Madrid, of a military character along the lines of Cadiz and Barcelona (Arechaga and Menacho, 1977; Arraez-Aybar and Bueno-Lopez, 2013).

Gimbernat and Rivas began their journey in October 1774 with Paris as their destination. They attended the hospitals Hôtel Dieu and La Charité, where they met Pierre Joseph Desault and François Chopart, responsible for the *Academie Royal de Chirurgie* and founders of the *Ecole Practique de Chirurgie.*

In 1776 they stayed in London attending a complete surgical course with John Hunter, ex-military surgeon of the Royal Navy, and a therapeutics course with Saunders, who described the surgical intervention on congenital cataracts. They witnessed the work of Percival Pott at first hand in the hospital of St. Barthomew's, and of Grangeot and Samuel Sharp, apprentice of Willian Cheselden in Guy's Hospital and St. Thomas's.

In Edinburgh they met the generation of surgeons succeeding the Bell brothers. It is possible that they were also instructed by William Cullen, Hunter's former teacher.

In Holland they visited Amsterdam where Petrus Camper lies and the Leyden University. (Arechaga and Menacho, 1977; Granjel, 1979; Lain Entralgo,

Fig. 7. Plaster bust of Antonio Gimbernat. 1768. School of Medicine. Complutense University of Madrid.

1978; Matheson, 1949; Rueda Perez, 2013). In the year 1778, Gimbernat returned to Spain and the Royal College of Barcelona.

THE ROYAL COLLEGE OF SURGERY OF MADRID (FIG. 7)

On the 19th of March 1779 the king recalled Gimbernat and Mariano Rivas to Madrid with the objective of establishing a Royal College of Surgery in Madrid. Gimbernat and Rivas delivered to the King an organizational and didactic model which proposed changing the High School grade in philosophy for three years of logic, algebra, geometry and experimental physics. On the 13th of April, 1750, by Royal Decree, the Royal College of Surgery of San Carlos, was created, which like the preceding colleges of surgery was constituted with independence from the protomedicato (Ferrer, 1968; Saiz Carrero, 1979). The definitive opening of the College was on the 1st of October 1782 in the basement of the General Hospital of Madrid.

Table 1. Thursday "Literary Sessions". RCC of San Carlos. Course 1789-1790

Antonio Gimbernat	New method to cure the crural hernia *"Nuevo método de curar la hernia crural"*
	Abstract arguing that Nature alone is the remedy to cure illnesses *"Extracto haciendo ver que la naturaleza sola es el verdadero remedio para curar las enfermedades"*
	Damage of the compounds *"Perjuicios de los específicos"*
Nicolas Llobera	Why the ducts pass to the bladder from the stomach the swallowed liquids and solids *"Por que los conductos pasan a la vejiga desde el estómago los cuerpos líquidos y sólidos deglutidos"*
Josep Queraltó	Tumor extracted from a woman´s breast successfully *"Carcinoma extirpado con feliz éxito del pecho de una mujer"*
Salvi Jover	Observations concerning the cure of an insane man by music *"Observación acerca de un hombre tarantulado curado por la música"*
Ramon Sarrais	Breast tumor cured by natural causes *"Tumor del pecho curado por resolución"*

Fig. 8. Wax figure polychromed RCC San Carlos. Ph.D. Javier Puerta Museum. Chair of Anatomy. Complutense University of Madrid.

Antonio Gimbernat was named Director of the College and Professor of Operations and Surgical Algebra – traumatology – (Rueda Perez, 2013), and that same year Surgeon of the King's Chamber (Ferrer, 1968).

From the beginning of the creation of the Royal College of San Carlos the incorporation of all the scientific advances in Europe was observable in the configuration and content of the academic programme. This incorporation, albeit with differences, was reproduced in the Colleges of Cadiz, Barcelona and Madrid.

The Royal College of San Carlos gave great importance to the practical study of anatomy and to performing anatomical dissections since its foundation. The study programme was extended to 5 years (Saiz Carrero, 1979). For the theorectical training Gimbernat showed a preference for texts of Winslow, according to Gimbernat "*it is the most methodical, exact and complete among the modern ones*." Physiology studies were ordered to be realised following Boerhaave´s teachings (Granjel, 1979). The "*Literary Sessions*," every Thursday, were maintained to present and discuss clinical cases (Table 1).

At the Royal College of Surgery of Barcelona "*Elementa physiologiae corporis humani*" by Albrecht von Haller was recommended for the study of physiology. A physical experiences room was created and the works of Lázaro Spallanzani and Antoine Lavoiser (Granjel, 1979) along with "Leçons de Physique Experimental " of the French physicist Jean Antoine Nollet were translated. In 1795 "*Ordinances which must be observed in the Royal College of Barcelona*" was published, prepared by Gimbernat, which modified the study programme and were a first intent to unify the education in all the Royal Colleges of Surgery in Spain. The new study programme lasted for 6 years, distributed as follows: First year: Anatomy, Physiology and Personal Hygiene, Experimental Physics and Mathematics; Second: Anatomy, Physiology and Hygiene, Pathology and Therapeutics, Botany; Third: surgical effects, wounds caused by gunshots, eye and ear illnesses, dentistry, gynaecology and childhood illnesses; Fourth: surgical effects, eye and ear illnesses, dentistry; Fifth: Operations; Sixth: Theory and practice in Medicine, Clini-

cal practice and autopsies (Massons, 2002).

In 1791 the Royal College of Surgery of Cadiz had changed its name to the Royal College of Medicine and Surgery, because its graduates received the qualification of Latin surgeons and Bachelor in medicine (Ferrer, 1968).

The unification of all studies at the Royal Colleges of surgery was passed by the Ordinances of 1804. In these ordinances, prepared by Gimbernat, the qualifications of Bachelor and Doctor in Surgery were created. The academic year was fixed as 9 months – September to June – and the complete duration of the studies for 6 years. The academic programme described in the ordinances is the following: - First year: Anatomy, Dressing; Second: Physiology, Hygiene, Pathology, Therapeutics; Third: External Effects, Operations; Fourth: Birth, Childhood Illnesses, Venereal Diseases, Legal and Forensic Surgery; Fifth: Medical Material, Chemistry, Medical Botany; Sixth: Mixed Effects. The importance of attendance at dissection classes was insisted on, as was bedside clinical practice with patients (Real Cedula de S.M. 1804) (Fig. 8).

SURGEONS OF THE "CAMP DE TARRAGONA" TRAINED IN THE ROYAL COLLEGES OF SURGERY

The participation of Pere Virgili and Antoni Gimbernat in the creation and direction of the prestigious Royal Colleges of Surgery, encouraged a considerable number of applicants to be surgeons from the "Camp of Tarragona," who chose these Colleges to realise their training. Among the first 1000 students matriculated in the College of Cadiz, sixty-six were from the Archiepiscopate of Tarragona. Some of these students completed their training as surgeons and became known as teachers in the Royal Colleges of Cadiz, or as army surgeons.

Josep Sabater Massell, was born in 1745 in Tarragona and entered the Royal College of Surgery of Cadiz at the age of twenty, where he reached the position of Chief Practitioner and in 1769, First Surgeon. As a surgeon of the Navy, he travelled on repeated occasions, and created during these voyages a provisional hospital for the Navy in Concepcion (Chile), and contributed to the consolidation of a large hospital with 200 beds in Bellavista (Peru). He finished his travels when he was named first Librarian and later Assistant to the Head Surgeon, Anatomical Demonstrator, Professor, Head Surgeon of the Navy and from 1800 Director of the Royal College of Cadiz. As Director he opposed the unification proposals of Antoni Gimbernat in Madrid. Sabater was one of the 10 Head Surgeons of the Navy trained at the College

Table 2. Surgeons of the RCC de Cádiz Born in the "Camp de Tarragona"

	Place of birth	Year income	
Antoni Guiamet Virgili	Gratallops	1754	student death
Josep Pallejar	Cambrils	1754	Second Surgeon
Gabriel Simó	La Selva	1762	
Nicolas Pallejá	Cambrils	1765	
Pere Gatell	Reus	1765	Botanical-Second Surgeon
Josep Marqués			Established in La Selva del Camp
Josep Oliver			Established in La Selva del Camp

Table 3. Ph.D. of the RCC of Barcelona Born in the "Camp de Tarragona"

	Place of birth	Royal College of Surgery (RCC)	Year Ph.D.
Dr. Francesc Borrás Montanér	Falset	RCC San Carlos	1798
Dr. Adrià Gausa i Creix	Reus	RCC Barcelona	1800
Dr. Josep Maria Vallet i Gatell	Tarragona	RCC Barcelona	1802
Dr. Nicolau Martí I Pallarés	Cambrils	RCC Barcelona	1806
Dr. Josep Guasch Olestia	Porrera	RCC Barcelona	1807
Dr. Francesc Trassera i Puig	Valls	RCC Barcelona	1816
Dr. Rafael Andreu i Montañà	Tarragona	RCC Barcelona	1819
Dr. Josep Artís i Rocamora	Reus	RCC Barcelona	1833
Dr. Joaquim Torroja i Simó	Reus	RCC Barcelona	1842
Dr. Pere Baiges i Torroja	Reus	RCC Barcelona	1842
Dr. Antoni Gomis i Mestre	Reus	RCC Barcelona	1845

of Cadiz (Albiol i Lluis, 2004).

Andres Muntaner Virgili was born in December of 1740 in Falset. He became a student at the Royal College of Cadiz in 1761. In the College of Cadiz he reached the rank of First Surgeon and Master of Anatomy. On the insistence of Pere Virgili, supported by local entrance exams and the protomedicato, he participated in the difficult projects of the foundation of a Professorship of Anatomy in the "Hospital Real de Naturales" in Mexico, from where he solicited official support for the creation of two anatomical amphitheatres in Mexico – "*Plan of the Anatomical Amphitheatres*" (Ferrer, 1968). The relevance of Muntaner's proposal can be deduced from the fact that between 1795 and 1799 11,490 patients were registered as having ingressed in the Royal Hospital of Naturales. Muntaner managed to implant the teaching model of the Royal Colleges of Surgery in the Hospital, based on anatomy and the European system for the development of clinical history (Romero-Huesca, 2003).

Fermin Nadal Valls, from Reus, was born on July 7th, 1759. He entered the Royal College of Surgery of Cadiz in 1777 and in 1798 was named substitute Professor. He occupied the post of Superior Doctor to the Squadron aboard the Prince of Asturias at the Battle of Trafalgar, where he attended Captain General Gravina for his wounds (Ferrer, 1968) (Tables 2 and 3).

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Don Antonio Gimbernat and his involvement in Ophthalmology. A historical view of cataract surgery

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SUMMARY

The present article aims to bring together a modest homage to Don Antonio Gimbernat, who felt a great passion for ophthalmology and devoted part of his life to it. In the second half of the eighteenth century, in the surgical field of ophthalmology a race of technical changes and advances began, which have led to the present situation.

Key words: Antonio Gimbernat – Ophthalmology – Cataract Surgery

DON ANTONIO GIMBERNAT AND HIS INVOLVEMENT IN OPHTHALMOLOGY

Don Antonio Gimbernat i Arbos, who undoubtedly was one of the most important surgeons in the second half of the eighteenth century, had a predilection for ophthalmology, devoting himself to it with great success. As his son Agustin referred in a note of 1828, Gimbernat had some notebooks in which he recounted cataract operations made in the years 1786, 1787 and 1788. He registered the name, age of the patient, as well as the surgery room. In those years 47 operations were performed and, except in 6 cases, all recovered the vision. In relation with the operation that was made on 16/4/1707 in both eyes to Don Jose Navarro (78 years old), Gimbernat says that the patient had extremely narrow pupils, especially in the left eye, and explains that the eye was fixed with an eye ring wrapped with leather of fine glove; without removing the ring, the capsule was opened and the cataract removed, having perfectly operated both eyes in two minutes. The son Agustin also noted that Gimbernat had spent many more years operating cataracts than those listed in his notebooks, restoring sight to a large number of people by means of that intervention (Gimbernat, 1828).

During a stay in Paris in 1775, and when practicing a thorough dissection of a cadaver, he described the finding in an eye of an ossified retina, noting that the rest of the ocular route was intact until the thalamus, and the optic nerve on the other side was healthy, which shows, according to him, that "... the optic nerves do not cross" (Lopez de Letona, 1996).

Speculum oculi or ophthalmoscope (Spanish: *oftalmósfero*), was the name of the instrument that was designed to separate the eyelids and hold the eyeball to facilitate surgery, and d'Acquapendente seems to be the first to have used it. Since then multiple designs were made. Gimbernat designed his own "eye ring" or *speculum oculis* to facilitate cataract operation (above mentioned) (Rufilanchas, 1859). His son Augustine describes it as a kind of silver spoon with a concavity suitable for the eyeball, open circularly at the point of highest elevation, an opening which left the cornea free to operate; at the same time, and without pressure on the globe, it kept the eyelids separated, (a kind of rudimentary speculum) (Gimbernat, 1828). Gabino de Rufilanchas in 1859 published an article in which he explains that he failed to find the report in which Gimbernat makes known his *speculum oculi*, but it was in all cases widespread in Spain. He describes the speculum as a round ring with two circles: a large outdoors and another small, which allows you to see the transparent cornea and being possible to maneuver on it. The ring was concave at this ocular side (to accommodate the eye), and convex in the opposite direction. In its upper part there was a "ridge" to hold the upper eyelid. This ring was attached to a flatted haft. In his arti-

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cle Rufilanchas also describes a second modification of this instrument, made by Gimbernat, in order to practice depression. The modification consisted of placing the handle attached on the inside in order to have two "crests", one for the upper eyelid and one for the lower; and to add a recess on the outside of the ring to pass the needle. Furthermore the ring had several holes to improve the grip of the conjunctiva, thus improving also eye fixation. After this modification was made, the instrument was named shed speculum oculi (Spanish: *oftalmósfero calado*) (Rufilanchas, 1859) (Fig. 1). From the description of these rings it can be deduced that Gimbernat preferably used the technique of extra-capsular extraction for cataract surgery and in certain circumstances also practiced depression (dejection).

However, his main published contribution was his "Dissertation on the eye ulcers interesting the transparent cornea", presented at the Society of Medicine of Paris in 1880 (translated into French by his son Carlos), without written record but published later in Madrid in 1802 (Gimbernat, 1828).

There he provides a reminder of the eye anatomy, especially of the cornea, which contains many sheets joined together by a very firm, dense and fine cellular tissue. The outer surface is convex, smooth and glossy. He also provides a description of a connection ring between cornea and sclera, which leaves many vessels: peri-limbic ring. The inflammation of this ring allowed Gimbernat to predict correctly venereal infection.

He emphasized the need of an optimal visualization of the cornea, if necessary with a lens, in order to differentiate between a true ulcer and a walleye, avoiding possible confusion. In the walleye, or clouds, the cornea loses its transparency but retains its natural polish and luster, unlike in ulcers, where a lack of luster, opacity and roughness of the cornea in the affected area is evident.

Gimbernat classified the ulcers as follows:

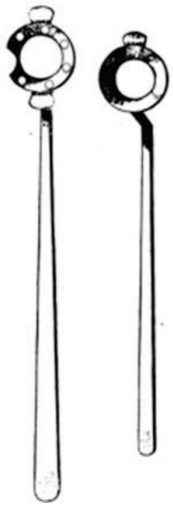

Fig. 1. Gimbernat rings as described by Rufilanchas in 1859.

- Slobbery surfaces: usually painless, without suppuration, and with good long-term tolerance, only with visual difficulties depending on their location, size and density. Moreover, they may or may not present mammilla or hillocks.
- Deep and sordid: they tend to be deeper and less extensive, with a central cavity, because of the loss of tissue, filled with a white and purulent substance, often accompanied by pain.

He described his own treatment for surface without swellings based on few warm drops of a potash solution (a grain of potash in an ounce of water), twice daily increasing the dose a grain every 3 or 4 days for the eye to become accustomed without irritation. An aqueous solution of gum arabic to calm inflammation, and finally, adding myrtle infusion of gum arabic to improve the firmness of the new organization.

When swellings were present, sulfates (vitriol) were not effective; one must move the corneal surface, using the cautery stone (infernal), then apply eye drops as described above.

In the sordid forms treatment began with an aqueous solution of gum arabic to reduce inflammation and continues with tartar salt (potassium carbonate solution). Finally, the gum arabic infused with myrtle was applied. The surgical option would be restricted to cases where a small cyst appeared between the layers of the cornea, making a small incision in the front sheet to output lymph formed, and always after proper medical treatments have failed to foster absorption (Salcedo-Ginestal, 1926).

This dissertation was about the injury suffered by his son Carlos who, being in Paris in 1778, and affected by a chronic corneal ulcer in the right eye, was about to be operated, the French ophthalmologists believing (Grandjean, Demours and Wenzel) that it was a walleye. When the father was consulted, he opposed prescribing medical treatment (described above), which was meticulously applied by his brother Agustin, who mentions complete healing of the lesion at 40 days after starting treatment, leaving no mark or scar (Gimbernat, 1828).

In the Dictionary of Medicine (Littre and Robin), 1878 edition, an eye drops solution is mentioned (5 centigram of potassium hydroxide in 30 gr of water) by the name of Gimbernat eye drops. Townsend in his Health Guide (p. 354) also quotes Gimbernat for many cures performed in cases of hernia of the cornea, called staphylomas, by means of strong cold infusion of myrtle leaves (Salcedo-Ginestal, 1926).

Gimbernat suffered a process of cataracts. Operated by Don José Ribes in 1810, a few hours after surgery, eager to know the outcome he removed the bandage. Possibly he did so because of deteri-

oration of his mental faculties, an action which contributed to complicate the surgery, partially preserving the vision of one eye (Gimbernat, 1828).

In 1904 the prestigious ophthalmologist M. Menacho writes to Gimbernat, on his dissertation on corneal ulcers, the following: "... in the clear corneal ulcers he employs sulfates (vitriol), which is a treatment of these times for such ulcers, when they have bacillus of Morax-Axenfeld"; in this case he would say "multa renascentur quae iam occiderant", because many ancient knowledge, dressed with costume of the time, again merit the favor of the common people and even of the learned. He was considered a good observer, and although he reports that Gimbernat was been considered as ophthalmologist, he credited hum as such because of his writings and his 40 years of practice in corneal ulcers, as well as his invention of the eye ring to facilitate cataract surgery. Moreover, Menacho says at the end of his letter, referring to the misfortunes suffered by Gimbernat, that "despite the hazards of various fortune and envy, the true merit prevails and finally he will be recognized by future generations" (Menacho, 1904).

EVOLUTION OF CATARACT SURGERY UNTIL TODAY

For more than 2000 years, the technique of cataract surgery was the dejection, which dates back to ancient texts of Indian medicine. Sushruta (circa 1000), described in "Uttara Tantra" different varieties of cataracts, its causes and the technique of dejection; he is credited with being the first surgeon to operate a cataract (Medín Catoira, 2014).

In the eleventh century ibn'Ali Ammar al-Mawsili describes the technique as follows: we proceed to a scleral incision with a scalpel or lancet, and the introduction of a needle (miqdah) to impinge on the cataract and swing by slow elevation of the handle of the needle (pushing back and down the vitreous space). He reports that the needle should be triangular for two reasons: first, the healing is better; and second, it improves the contact surface of the needle with the cataract facilitating its dejection. He is rightly convinced that the treatment of the eye requires knowledge, skill, caution, courage and a lot of practice and a steady hand (Meyerhof, 1937).

Dejection remained almost unchanged until the mid-eighteenth century, and in 1789 it became obsolete, although its knowledge was considered useful in certain circumstances (Pellier of Quengsy, 1789).

In the mid-eighteenth century two new techniques arose. On one hand, the French optician Jaques Daviel (1669-1762) made the first unplanned extra-capsular surgery, being the solution for a complicated dejection, and published it in 1753 (Simon Guilleume, 1943). This new technique seemed a good choice, and it was improved until it became the technique generally used to operate the cataracts. The anterior chamber was opened with a small triangular knife, and with scissors the incision was expanded on both sides; an incision with a sharp needle of the anterior lens capsule was practiced; then with a teaspoon dislocation the nucleus of the cataract followed, and, with a slight finger pressure on the eyeball, the remaining crystalline remains were removed (Daviel, 1753). This change relatively easy in the dejection technique to an extra-capsular more complex technique has conditioned its realization to remain restricted to ophthalmologist surgeons excluding the surgical barbers. On the other hand, at the same epoch Samuel Sharp is the first surgeon to perform a planned intra-capsular surgery, removing the cataract through a lower corneal incision and exerting pressure on the eyeball with the thumb, to cause the expulsion of the same (Barry, 2003).

In 1865 Von Graaefe designed a small knife, thin and long, to perform linear and limbal incision (usually higher), which turned out to be a great contribution to the surgical technique (Fig. 2). The main problems of the intracapsular were two:

1) How to take out "in toto" the lens without tearing the anterior capsule, and
2) How to overcome the resistance of the Zinn zonula to such extraction.

Dr. Arruga designed a clip bearing his name to take the anterior lens capsule with lateral move-

Fig. 2. Box for surgical instruments XIX century of Dr. M. Menacho.

ments, to break the zonula and remove the cataract. He circulated this technique in Spain (Casanovas, 1973).

In 1917 Ignacio Barraquer invented the erysophake to perform "facoeresis" (lens extraction). It consisted of gripping on the anterior capsule through a platinum suction cup connected to a pneumatic vacuum machine, which in turn was connected to power lines with a switch pedal. This made a wider catch and therefore safer handling (Barraquer, 1958) (Fig. 3).

Joaquin Barraquer in 1957 discovered enzymatic Zonulolysis causing the destruction of the Zinn zonula, thus facilitating the extraction "in toto" of the lens; procedure reported in 1958 (Barraquer, 1958).

Fig. 3. Erisifac Dr. I. Barraquer (Courtesy of Institute Barraquer for Ophthalmology. Barcelona).

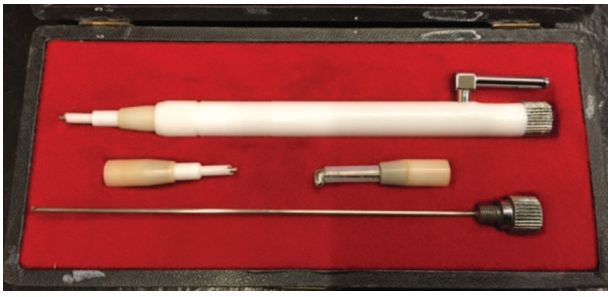

Fig. 4. Cryo-Jet of Dr. Duch.

In 1961 Krwawicz conceived the cryo-extraction, which consisted of a quick freezing apparatus, with a tip acting at -79°C putting it on the anterior lens capsule and getting a freeze of the capsule and the cortex and even part the nucleus, forming a single block, allowing removal of the lens without breaking the capsule (Krwawicz, 1961). In Spain the cryo-jet designed by Duch was mostly used, being more manageable and with interchangeable tips, so that it could be used for both cryo-extraction of the lens, and for retinal cryopexy (Fig. 4).

The cryo-extraction and zonulolisis succeeded the intra-capsular technique, being in the first half of the twentieth century the most common method for cataract surgery everywhere. The technique was performed under general anesthesia and using tele-magnifying glasses, the incision of 180º was sutured and the patient admitted for several days in clinic, with eye bandage. By performing this technique aphakia resulted, which involved a significant refractive error, low vision, which should be corrected with glasses usually between +10 and +12 D, according to the previous impairment of the patient.

Worst in 1975 raises in their work the importance of natural compartmentalization of the eyeball, by the lenticulozonular septum, which makes a return to reconsider the extra-capsular surgery in order to preserve the posterior lens capsule acting as wall for the vitreous mass (Worts, 1975). This was also reinforced by the appearance of intraocular lenses that also correct the refractive error, reinforcing the containment barrier and leading to a decrease in the rate of retinal detachment after surgery.

The extra-capsular technique was performed under anesthesia, first retro-bulbar and later peribulbar, always under previous pharmacologic mydriasis and with a microscope to visualize the structures properly. One proceeded by making an incision of about 120°, anterior capsulotomy (in envelope, tin opener, etc.) and removal of the core, followed by careful cleaning of subcortical masses by irrigation / aspiration, and if necessary, intra-ocular lens implant (rigid with 5-6 mm diameter), suture and occlusion. These incisions were large, so the risk of complications such as induced astigmatism, iris hernias, etc..., was not uncommon. This was the reason why the size of the incisions was diminished. The stay of patients was 24 hours.

Phacoemulsification was born with Charles Kelman in 1958, but was not published until 1967, and popularized in the late eighties. It consisted of emulsification of the cataract nucleus with ultrasound waves through a tube, a titanium needle hollow and removal of fragments with an irrigation system / coupled to the same aspiration catheter, with a system of fluidic adjusting volume irrigation /

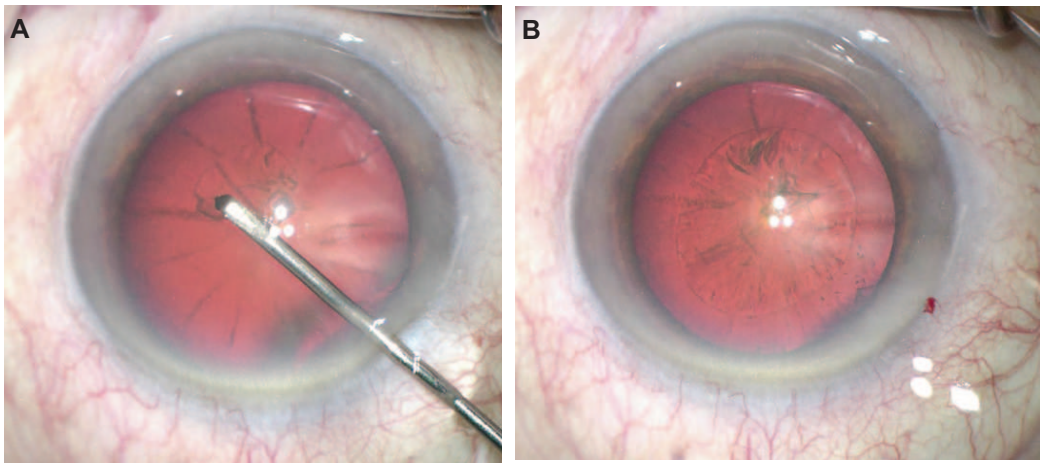

Fig. 5. (A) Starting a continuous circumferential capsulorhexis. **(B)** Capsulorhexis completed.

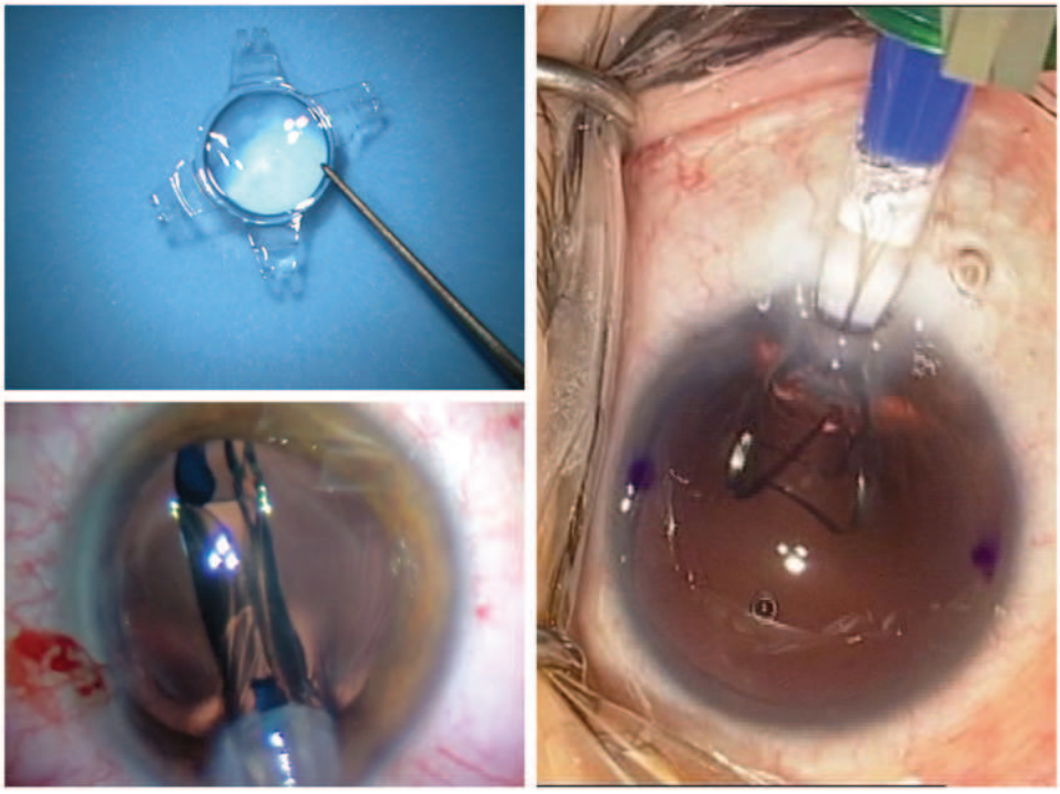

Fig. 6. Intraocular foldable lenses of last generation (injectable by 1.8 - 2 mm).

aspiration, in order to maintain the anterior chamber. All this is done through an incision of 3 mm (Kelman, 1967). This technique was very controversial in its beginnings, because of its complications, such as endothelial decompensation. A great number of detractors emerged, including eminent ophthalmologists.

In 1985 Gimbel and Neuhann described the continuous circumferential capsulorhexis (Gimbel, 1990) (Fig. 5a, 5b), an indispensable requirement for the success of phacoemulsification, as it allows us to make a endosacular technical approach with less risk of endothelial damage, placing the lenses in the ideal place, inside the bag, thus avoiding the displacement thereof.

At the same time viscoelastic products were used (based on sodium hyaluronate with higher or lower molecular weight), very important in facilitating spaces and protect structures, mainly the endothelium.

Coret with Soler Sala published in 1990 the first book in Spanish on phacoemulsification, thus facilitating the disclosure of this technique in Spain.

The improving phacoemulsification equipment, the continuous circumferential capsulorhexis, and viscoelastic along with the appearance of the foldable lenses that allow for implants through incisions of 3-4 mm, make possible the triumph of phacoemulsification (Fig. 6). Advances and small changes continually give maneuvers fracture,

which seek to minimize ultrasound energy and improve efficiency appear. Gimbel, in 1991, proposed to make a central and deep crater in the nucleus for fragmentation with the aid of two instruments: the phaco tip and spatula or manipulator (Gimbel, 1991). At the same time Shepherd in 1988 developed a split technique into four quadrants, plowing two perpendicular deep furrows between them (Shepherd, 1990). These techniques involve significant savings of time and ultrasound energy. Several variants and alternatives to these exist depending on the hardness of the cataract and experience of the surgeon (Fig. 7).

In 1993 Nagahara used a hook-shaped manipulator, and a cutting bevel (chopper Nagahara) to fracture the core, improving efficiency in hard cataracts, and called this type of fracture "phaco chop" (Lorente et al., 2008). Akahoshi introduced in 1992 pre-chopping techniques, valid for any type of cataract, consists of a special clamp, once rhexis is performed, will be introduced into the core, fracturing the same by opening its branches (Akahoshi, 1998). All these techniques are today still valid.

Improvements and advances occur continuously, smaller tips are achieved, going to micro-incision techniques with two variants: micro-coaxial (2-2.2mm) and bimanual (1-1.5 mm) characterized by having separate lines of irrigation and aspiration. Alió in 2003 coined the term MICS to define cataract micro-incision (incisions of 2 mm or smaller) (Alió and Rodríguez-Prats, 2006). These two techniques are commonly used today (most often micro-coaxial).

Phacoemulsification is performed under local or intra-cameral anesthesia and good mydriasis. An incision is made in clear cornea (self-sealing) 2-2.2 mm usually temporary with a calibrated small knife, the anterior chamber is filled with viscoelastic and continuous circumferential capsulorhexis, centered and a diameter of between 5-5.5 mm is performed. Then paracentesis of support (1-1.5 mm) is performed, hydrodissection or hydrodelineation and rotary movement of the core is done, one proceeds to phacoemulsification with or without previous maneuvers of fracture and subsequent irrigation / aspiration of the cortical remnants. Then we proceed to capsule polishing and expansion of the capsular bag with viscoelastic in

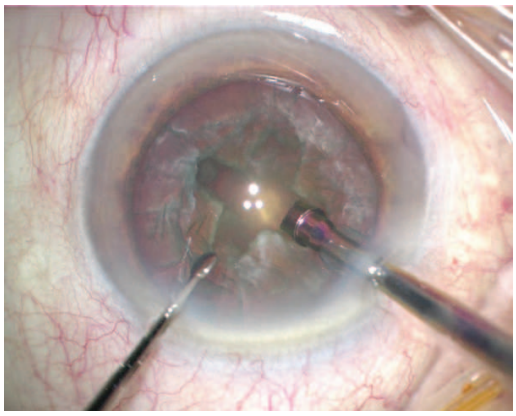

Fig. 7. Grooves to fracture the nucleus.

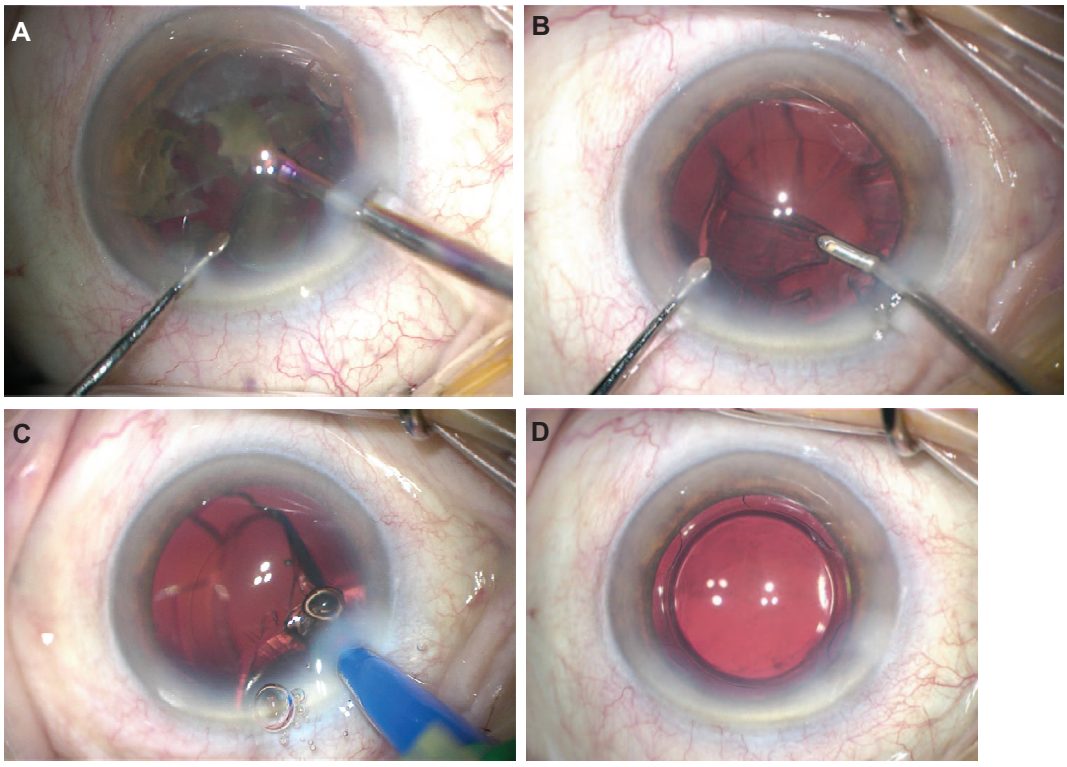

Fig. 8. (A) Fragments phacoemulsification. **(B)** Cortex aspiration. **(C)** IOL pouch implantation. **(D)** Surgery completed.

order to implant, with an injector, the foldable intraocular lens. Viscoelastic anterior chamber as well as behind the lens is removed and the positioning thereof is verified. The main incision is hydrated and finally antibiotic is injected intra-cameral through the support paracentesis (Fig. 8a, 8b, 8c, 8d).

To make the current cataract surgery is essential to high-quality microscope with coaxial light and good depth of field. The incisions are not sutured, merely hydrated, no inducing in general astigmatism. It is an outpatient surgery, resulting not necessary occludes the eye but if necessary protection glasses or small shell. The visual recovery is very fast.

For many ophthalmologists, the move from extracapsular to phacoemulsification, was not just a change of technique, but of mentality: view with microscope, control of phacoemulsification device parameters, to have both hands full occupied, manipulative and hand piece and feet, pedal microscope (zoom, x / y) and pedal phacoemulsificator (control irrigation / aspiration / ultrasound) (Fig. 9). Although this technique is spectacular and very satisfactory, it is not without risks and possible complications: endophthalmitis, posterior capsule rupture, with consequent increased risk of retinal detachment, endothelial damage, etc.

Fig. 9. Performing surgery during phacoemulsification.

As already said, technological advances and technical innovations in the field of cataract surgery are continuous; and thus in 2009 the first results of femtosecond laser in cataract surgery appeared. The femtosecond laser works with a wavelength near infrared, in pulses with ultra-short duration (10-15 seconds). Its energy is absorbed by the tissues, forming a plasma which expands, resulting in cavitation bubbles generating cleavage planes tissue (photodisruption). This energy can be focused precisely at a given depth and size with the help of high-resolution systems. This technique offer the possibility of a scheduled basis, accurate and effective, with closed eye, to perform one of the important steps of cataract surgery such as the incision, capsulorhexis and nucleus fragmentation. It would be aimed at achieving standardization and reproducibility of programmed surgical technique (Arias, 2005) (Fig. 10).

However, its use is not widespread, it has a high cost, and equally has to be emulsified / aspirated / irrigated and the lens implanted. At the moment it could be considered as a surgical assistant useful in certain circumstances (narrow chambers, introduction to surgery, ...). Partial solutions with femtosecond laser have also appeared in small format only for capsulorhexis.

The cataract surgery has been throughout the history of ophthalmology the "star" operation (being the cataract one of the most common diseases), by the spectacularity of their techniques and satisfaction and rewarding their results in the vast majority of cases. The cataract surgery has gone from being a technique intended to restore transparency media, to a refractive restorative vision surgery in which the patient not only recovered his vision, but can correct any previous refractive defect, avoiding as far as possible the use of corrective glasses (although promised should not be made!). This facorefractive surgery is possible thanks to the wide range of possibilities offered

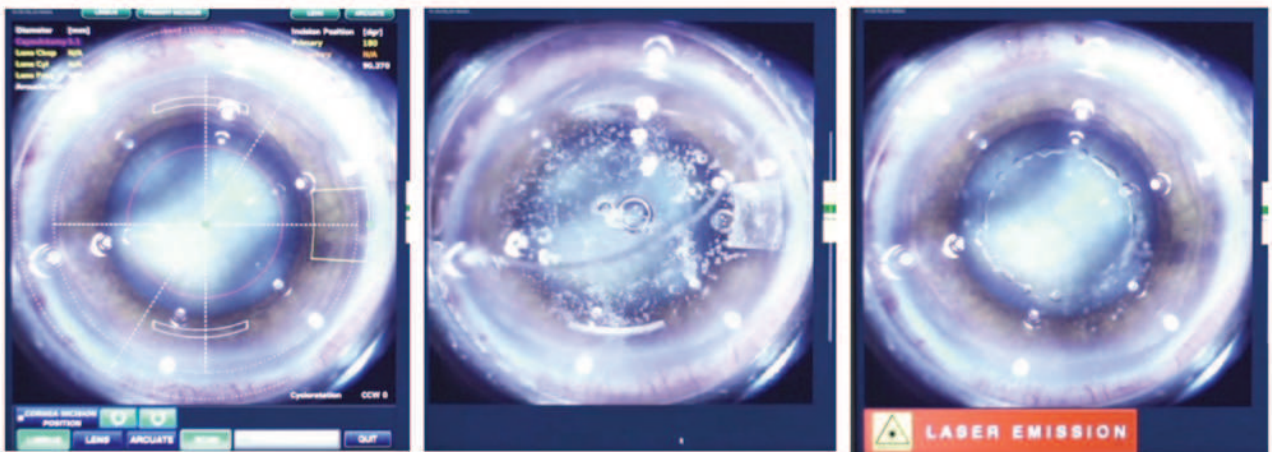

Fig. 10. Making incisions and capsulorhexis with a femtosecond laser.

by current IOLs (Premium), multifocal, trifocals, bifocals, toric, customized, some of which can be implanted through incisions of 1.5 mm, although the vast majority need incisions of 1.8-2 mm minimum. It is also necessary to emphasize that a lens Premium requires Premium surgery, and it is possible that new technologies such as femtosecond laser with standardize parameters are of great help; although this goes to the detriment of any manual technique, the most important aspect is the efficacy and safety of the technique for the patient's benefit.

All these advances would not have been possible without the existence during centuries of great master ophthalmologists with a great desire to learn, investigate, create, innovate and overcome the difficulties of every day. To them we owe the beginning; the culmination, although very promising, is still far. Future spectacular contributions in this field can be expected, developments that today still seem impossible.

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Components separation. Back to back: From Anatomy knowledge to Surgery and from Surgical experience to Anatomy

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SUMMARY

The reconstruction of the abdominal wall is one of the paradigms of how anatomical knowledge is applied to surgery and how from surgical experience can go back to anatomy to apply it in new and more effective techniques.

The fundamental basis of hernia repair procedures has been always the restoration of the regional anatomy, achieving it by simple closure till myoplasty. The introduction of prostheses seemed to be the solution to almost all problems related to the closure of pathological defects in the abdominal wall. Surgical experience has shown that the isolated use of prosthesis is often insufficient to resolve all situations. Therefore, in recent years the use of prosthetic material has been associated to myofascial plasty with the aim of redistributing the tension in the abdominal wall, facilitating closure and at the same time preserving its integrity and full function.

These autoplasties, called "anatomical separation of components" in their anterior and posterior versions, have been established as the method of choice in the surgical treatment of complex incisional hernias in which the simple use of prosthesis may be insufficient.

In this article the anatomical basis of such repairs are described as well as the most relevant technical aspects to be taken into account in performing them.

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Key words: Components separation – Abdominal wall hernia – Abdominal wall defects – Abdominal wall anatomy

INTRODUCTION

The study of human anatomy has always been related to surgery, in order to rebuild structures in the treatment of wounds or applying this knowledge to surgical techniques. It was customary to pass from the anatomical dissection of corpses to its application in surgical technique. Antonio de Gimbernat (1734-1816) claimed that: "My favorite author is a cadaver" and that "the human body is naturally the book which I shall never renounce and I will always prefer it to any other" (Martin Duce, 2000).

Thus, the same Antonio de Gimbernat describes his surgical technique to repair the femoral hernia by sectioning of the lacunar ligament, and his is one of the first demonstrations in which anatomical knowledge has been applied to a surgical technique.

Gimbernat's scientific approach can be applied in a similar way to surgery of the abdominal wall. The arrangement of the muscle layers, fasciae and aponeurotic expansions of the abdominal wall is apparently simple, so initially surgeons were satisfied only reconstructing anatomical planes by sutures. In more complex situations anatomical techniques have been described in which the repair was managed by altering or simply by using anatomical structures, although it was shown that these techniques were insufficient to solve all cases, and even they were subject to a high incidence of recurrences (Welti and Eudel, 1941; Young, 1961;

Vidal-Sans, 1986; Ramirez et al., 1990).

All this changed with the introduction of repair procedures with prostheses. This type of intervention seemed to be simple. Even anatomical knowledge seemed less necessary: one simply had to plug the hole with the mesh. Unfortunately, it is not as simple as that and surgeons needed to recover these anatomical resources, and deepening in morphological and topographical knowledge describes new techniques in conjunction with prostheses allowing more durable repairs (Chevrel, 1979; Pauli and Rosen, 2013).

In this article we describe how with knowledge of the anatomical disposition of the muscle layers of the abdominal wall it is possible to advance in the application of surgical techniques and repair complex defects of the abdominal wall. Taking advantage of anatomy to change and facilitate the restoration of the integrity of the muscle wall is the paradigm of the use of anatomy in clinical practice.

DESCRIPTIVE ANATOMY

The most outstanding feature of the anterolateral abdominal wall is the presence of fascial extensions of the lateral muscles (external and internal oblique and transverse) to the rectus fascia that binds to this and form the so-called rectus sheath (Skandalakis et al., 2009).

The rectus sheath is a common tendinous element of all abdominal muscles, as it also inserts in his lamina anterior the tendinous intersections of the musculus rectus abdominis (Ahluwalia et al., 2004). As already mentioned, the rectus sheath is arranged to form two sheets: anterior and posterior in three quarter tops of the rectus muscles and only one anterior sheet in the lower part thereof.

In the upper abdomen a previous sheet is formed by the aponeurosis of the external oblique muscle and the anterior half of the aponeurosis of internal oblique, and is divided into two aponeurotic sheets at the side edge of the rectus muscle. The backsheet has been formed by the posterior half of the aponeurosis of the internal oblique and aponeurosis transverse muscle (Skandalakis et al., 2009; Pereira et al., 2013). These data are of great importance for creating incisions in any technique that involves separation of components for the reconstruction of the abdominal wall.

From the midpoint between the navel and the pubis, all aponeurotic extensions of the lateral muscles are placed in front of the belly of the recti muscles, so that the sheath only has a front sheet. In this area is characteristic the absence of tendinous intersection in the rectus muscles, so that after the section of the midline the retraction of the sheath at this level can be greater at the top (Pereira et al., 2013). The transition zone between the top and bottom of the sheath adopts characteristically arc shape receiving the name of arcuate line (FCAT, 2001).

These data, seemingly simple, well-known and readily reproducible by any first-year student, are essential for the design and implementation of surgical techniques of components separation.

ANTERIOR COMPONENTS SEPARATION

In the components separation surgery the surgeon has gone from simply applying prosthesis for sealing the defect, to the need of applying anatomical knowledge to facilitate reconstruction of the abdominal wall. The section of muscle attachments to relieve stress and achieve tissue elongation is not a new surgical technique. In the surgery of musculoskeletal system and in plastic and reconstructive surgery find many examples, but not in the general and digestive surgery.

The most common indications for these procedures are: impossibility of reconstruction without tension midline; major defects in 10 cm wide; complex incisional hernias; incisional sub-prosthetic recurrences; large abdominal wall defects after resection or after open abdomen (Heller et al., 2012).

Although the recognition it has received by Ramirez (1990), muscle plasties have been already previously described facing the difficulties to close the abdominal wall or in the treatment of ventral hernias. These techniques, such as those described by Albanese (1951), Zavaleta et al. (1965), Lazarus da Silva (1971) and Vidal-Sans (1986) offered a good immediate repair. However, they did not prevail due to diffusion of repairs with prostheses that apparently allowed solving complex cases by sealing the defect with synthetic mesh. This, coupled with the easiness of use, caused other technical resources to be almost forgotten.

After many years of experience with synthetic prosthesis, by demonstrating a high incidence of recurrences, new resources were introduced. Chevrel in 1979 describes the splitting of the previous sheet of the rectus sheath associated with a supra-fascial mesh.

The anterior separation of components (SAC) described by Ramirez (1990) in an anatomical work with ten cadavers and subsequently applied in eleven patients is based on the fact that the partial release of the aponeurotic insertion of one or more muscles in the rectus sheath can cause a release of tension in the midline, allowing their approximation to be partially free of lateral tension. The presence of three muscle layers theoretically ensures the integrity of the lateral abdominal wall.

This initial description did not include the use of prostheses of reinforcement, without their use SAC had clear disadvantages: the lateral bulging on the space between the external oblique and rectus sheath and the high rate of recurrence. Both drawbacks can be improved by using a mesh.

The technique initially described by Ramirez is

based on two maneuvers with various combinations that configure this technique in four types (I-IV). Other authors (Carbonell et al., 2010) simplify this classification and have described only two levels. The level 1 of SAC is the crucial maneuver of this technique: the section of the aponeurotic insertion of the external oblique muscle two centimeters from the insertion into the rectus sheath. In some papers and textbooks this aponeurotic insertion line is confused with the semilunaris line characteristic of the transversus abdominis muscle (Carbonell et al., 2010; Heller et al., 2012; Pauli and Rosen, 2013). In cases in which prosthesis are used it is convenient to separate the belly of the external oblique and internal oblique to facilitate placement of the mesh between them and prevent the bulging effect that can be produced by this maneuver. This release is performed from the costal insertions to the superficial inguinal ring, and allows an asymmetrical advance of the wall: three to five centimeters on each side in the epigastric region; five to ten centimeters on each side in the umbilical region; three centimeters on each side in the hypogastric region (Heller et al., 2012). Level 2 is not always used; it constitutes a maneuver recourse when the midline is not close enough after practicing level 1 in the section of the backsheet of the rectus sheath on each side of the midline and split medially achieving a uniform two centimeters when practiced approach bilaterally.

The association of prosthesis with an anatomical technique of repair offers much better clinical results regarding recurrence. In interventions without prosthesis the recurrence is between 15-35% and when synthetic prostheses are used the recurrences become reduced to 5-15% (Ko et al., 2008; Pauli and Rosen, 2013).

MINIMALLY INVASIVE COMPONENTS SEPARATION

To avoid devascularization, which can occur when the skin flaps necessary for SAC are dissected, some authors have developed minimally invasive techniques. Sukkar and Dumanian (2001) use a limited lateral dissection from the borders of the defect, to expose the insertion of the external oblique muscle in the rectus sheath (which he mistakenly called as lunate line). Maas et al. (1999) use a similar technique, but, to prevent the lateral dissection, insertion external oblique will be transected from separate incisions located in the cranial and caudal part of the zone.

Similarly, some authors (Lowe et al., 2000; Maas et al., 2002) have developed section techniques of the muscle insertions by endoscopy by introducing a balloon of dissection in the plane between the external and internal oblique muscles, and subsequently sectioning the medial border the external oblique with aid of laparoscopic instruments.

All these techniques are effective in terms of preserving the vascular supply, but are limited regarding the obtained advance, a reason why their use is limited to moderate defects or situations such as the presence of a stoma, in which the dissection of lateral flaps can be difficult.

POSTERIOR COMPONENTS SEPARATION

The anterior separation of components is not a panacea, and looking for a safer and wider space for insertion of prostheses have caused new developments, in some cases ignoring the anatomical pathways such as the technique described by Carbonell et al. (2008). This author proposed to address the plane between the internal oblique and transversus muscles from the back of the rectus abdominis, through the insertion of the internal oblique on the back sheet of the rectus sheath. This proposal put at risk the innervation and irrigation of the muscles of the abdominal wall, especially of the rectus muscles, and because of this problem it has not been widely accepted.

The natural plane to place a large-sized prosthesis in pre-peritoneal position is retro-peritoneal space. The main problem is to access this space, which is almost absent in the back of the rectus muscle, in which the peritoneum is in direct contact with the backsheet of the rectus sheath. Instead, on the back of the fascia transversalis this space is large, filled with fatty tissue and a poor blood supply making it ideal for inserting a prosthesis. The TAR technique (Transversus abdominis release) proposed by Novitsky et al. (2012) hit again the target using the anatomical keys. The section of the posterior division of the insertion of the internal oblique in the rectus sheath, addressed by opening the rectus sheath in the midline and following the secure plane of the backsheet, allows to cleave the insertion of the transversus abdominis and to communicate the backside of the rectum with the pre-peritoneal space. Broadening in lateral, cranial and caudal direction allows the insertion of large-sized prosthesis reaching the plane of the psoas muscle and lumbar square and then caudally the iliac muscle and even the underside of the diaphragm cranially, as proposed Blázquez et al. (2016).

CONCLUSION

The knowledge of anatomy is essential for use in surgical technique. The evolution of the techniques used for the reconstruction of the abdominal wall show how the knowledge of a single anatomic surgery system takes advantage to transform it into a magnificent therapeutic tool which, combined with the use of prosthesis, allows for the solution of complex problems.

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Understanding the anatomy of the larynx from the era of Gimbernat to the present day moving towards laryngeal transplantation

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SUMMARY

Knowledge of the gross anatomy of the larynx in Spain throughout the period when Gimbernat was working as a surgeon and anatomist was considerable; very much comparable to our present understanding. However, the lack of aseptic surgical technique, anaesthesia, and antibiotics limited the ability to undertake complex surgery. Nevertheless, it was during that period when for first time it became possible to diagnose some laryngeal pathologies, thanks to the invention, by a Spanish-singer, Manuel Garcia (1805-1906), of a primitive laryngoscope that made it possible to see the laryngeal interior. Only in 1873 was the first major surgery of the larynx was reported when Billroth undertook the first laryngectomy to treat surgically laryngeal carcinoma. It was more than a hundred years later, before the first laryngeal transplantation was attempted by Strome and his team (1998), and though initially meeting with some success, that transplanted larynx had to be removed 14 years later. Based on our current understanding of laryngeal anatomy and surgical technique, we argue that there are four factors that must be addressed if satisfactory transplantation of the larynx to be achieved: 1) psycho-social and ethico-legal aspects; 2) tissue viability vs. rejection; 3) restoration of a vascular, and 4) selective reinnervation of the larynx has to be achieved. The three first factors are being addressed, however, the selective reinnervation remains challenging because the nerve supply of the larynx is now known to be much more complex than many accounts imply. This is because: 1) each laryngeal muscle may receive a variable number of nerve branches; 2) there are multiple connections between the different laryngeal nerves; 3) many laryngeal nerves and connections are mixed conveying both motor and sensory fibres; and 4) the laryngeal muscles may receive a dual nerve supply, from both the recurrent laryngeal and superior laryngeal nerves.

Key words: Recurrent laryngeal nerve – Internal laryngeal nerve – External laryngeal nerves – Laryngeal vessels – Bonells – Lacaba

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INTRODUCTION

The Spanish anatomist-surgeon Antonio Gimbernat i Arbós was born in 1734 in Cambrils (Tarragona), living until 1816 (Salcedo y Ginestal, 1926, 1927). He worked for most of his professional life in the Royal Colleges of Cadiz, Barcelona and Madrid (Salcedo y Ginestal, 1926, 1927). These Colleges were established with the aim of

providing practical teaching of surgery and medicine initially to military surgeons and then subsequently more widely in Spain (Usandizaga, 1948). During the period of Gimbernat's life, knowledge of gross anatomy in Spain was excellent, being largely based, as it was, upon the books published by Bonells and Lacaba, between 1796 and 1800, entitled "Curso Completo de Anatomía del Cuerpo Humano" -Complete Course of Anatomy of the Human Body- (Bonnells, Lacaba, 1796, 1797a, 1797b, 1799, 1800).

The book was organized into five volumes in the classical descriptive plan first proposed in the sixteen century by Vesalius, in his book *De Humani Corporis fabrica Libri septem* (1543). The first volume was dedicated to the study of bones and joints (Bonells and Lacaba, 1796), the second volume to the study of the muscles (Bonells and Lacaba, 1797), the third to the study of the angiology (Bonells and Lacaba, 1797), the fourth to the study of the neurology and the first part of the splanchnology (mouth, pharynx and larynx) (Bonells and Lacaba, 1799), and the fifth volume to the rest of the splachnology including considerations about practical anatomy (Bonells and Lacaba, 1800). The references supporting each volume were based on the writings in a number of classical books of the period. The descriptions of the skeleton and muscles were based on the book of Albinus (1697-1770); the angiology was based on the book by von Haller (1708-1777); the lymphatic system on Mascagni's book (1755-1815); the nervous system and sense organs on Vicq D'Azyr's book (1748-1794) and the splanchnology based on Winslow's book (1669-1760). Not only did descriptions in the volumes by Bonells and Lacaba (1796-1800) draw upon the work of these earlier authors but there was also clear evidence of a scholarly approach being adopted throughout the different volumes as evidenced by the quotations and citations of many other works, for example Morgagni (1682–1771), Eustachio (1500 ?-1574), Astruc (1684-1766), Sabatier (1732-1811), Berengario da Carpi (1460-1530), Estienne (1504-1564), Cheselden (1688-1752), Steno (1638–1686), Walter (1734-1818), to name but a few of the more prominent authors cited. Consequently, despite an absence of illustrations within the Bonells and Lacaba volume, it can be fairly said that the books represent a full and thorough compilation of the knowledge of scientific anatomy in that period (Bonells and Lacaba, 1796-1800).

The knowledge of the gross anatomy of the larynx in the 18th century was extremely accurate, being based on the precise descriptions to be found in Morgagni's early and extensive studies. It is with confidence that we can say that the knowledge of gross anatomy of the cartilages, joints, muscles, vessels, lymphatics and nerves of the larynx at that time was were very similar to our present-day understandings. The evidence to support that assertion can be found simply by an examination of the descriptions of laryngeal anatomy contained in the books of Bonells and Lacaba, notably in the fourth volume of 1799, where a description of the structure of the organ and its nerve supply is to be found, and third volume of 1797 for the descriptions of its vessels and its lymphatics.

The complete absence in this period of any understanding of infection or of the ability to control infection through aseptic methods and the use of antibiotics, the lack of anaesthesia for operative procedures and of analgesia for post-operative pain relief meant that surgeons were limited in the range of surgical procedures that they could perform. The only significant procedure that it was realistic for surgeons to undertake at this time within the cervical region was to perform a tracheostomy. Clearly this was a not unimportant procedure, as it prevented the deaths of many people where an inhaled foreign body was blocking the airways, and it was also used to reduce breathlessness. References to the procedure of tracheostomy have been found on the Egyptian tablets (3600 BC), demonstrating that knowledge of the procedure significantly predates the explosion of anatomical knowledge in the period referred to above (Davidson, 1995). However, the first appearance of the term tracheostomy was in 1718, used by Lorenz Heister (1683-1758) in his manual of surgery (Herrmann et al., 1991).

It should be obvious from this discussion that the ability to undertake definitive surgery of the larynx was simply not feasible but remained instead a prospect that could only be envisaged at some remote point in the future. Before any surgical procedures could be undertaken, it was first necessary to devise a method for observing the laryngeal interior as the first step in establish a working scientific diagnosis of any laryngeal disorder. The first report of such a method was in 1855 with the discovery by a Spanish singing-master living in Paris, Manuel Garcia (1805-1906), of two mirrors arranged in a way that allowed simultaneous transmission of daylight to the laryngeal interior at an intensity sufficient to permit the interior to be observed. Clearly the level of illumination was significantly reduced in comparison to the techniques available today. Nevertheless, even with these relatively crude techniques it was possible to establish an accurate diagnosis of some laryngeal pathology sufficient to provide basis for the first laryngectomy undertaken in 1873, in Wien, by Theodore Billroth (1829-94), in a patient with cancer of the larynx (Weir, 1973).

As the surgical procedures for performing laryngectomies were improved, rehabilitation of the voice remained a constant issue. The earliest attempts at voice rehabilitation were undertaken by Carl Gussenbauer (1842 1903) the pupil of Theodore Billroth, who designed a cannula with the aim of restoring the voice of the patient after laryngeal

surgery (Gussenbauer, 1874). From that initial attempt a variety of different strategies have been employed to try and rehabilitate the voice of the patients who have had their larynx removed; these have included the acquisition of an oesophageal (erigmofónica) voice (Tang and Sinclair, 2015), the construction of phonatory fistuloplastias or the use of a phonatory prosthesis (Lorenz, 2015). However, none of these strategies can be said to provide a good voice quality, comparable to that of a normal human voice, and therefore they do not provide a satisfactory means to overcome the stigma that patients with a laryngectomy have to endure, namely the need for a permanent tracheal stoma.

Therefore, it was in the light of the limitations in voice quality offered by the alternative means that has led to the investigation of laryngeal transplantation in the laryngectomized patient as a possible strategy to achieve a satisfactory restoration of the complete functions of the larynx, both sphincteric and phonatory.

In spite of the fact that the larynx is a non-vital organ, it has been classified as an essential organ and one that is necessary for a good quality of life (Genden et al., 2003). It is the functional importance of the larynx as firstly a sphincter both in swallowing and in the prevention of accidental inhalation of foreign bodies and secondly in speech in the production of voice, and also on occasion, as an articulator that has been the impetus to develop laryngeal transplantation as the best means to restore laryngeal functions. Since 1965, there have been a number of preclinical, animal studies that have investigated the feasibility of laryngeal transplantation using a range of animal models: dogs (Work and Boles, 1965; Boles, 1966; Ogura et al., 1966; Silver et al., 1967; Crumley, 1982; Berke et al., 1993; Anthony et al., 1995; Kevorkian et al., 1997; Jiang et al., 2011), rats (Strome et al., 1992, 1994; Peng et al., 2005; Nakai et al., 2003; Lott et al., 2011), and pigs (Gorti et al., 1999; Birchall et al., 2002; Barker et al., 2005, 2006; Birchall et al., 2011, 2012).

The first laryngeal transplantation in humans was performed by Strome and his team in Cleveland Clinic Foundation (Ohio, USA) in 1998. The patient who had received the transplant was able to speak three days after the surgery and his swallowing was good. His transplanted larynx maintained its functionality for about ten years after surgery, despite there having been two episodes of rejection (one after 15th months and then after 6 years of transplantation). Unfortunately, thereafter, a slowly progressive, chronic rejection process gradually resulted in the organ becoming non-functional. The complications increased giving worsening discomfort to the patient and finally removal his transplanted larynx was carried out 14 years after the original transplant had been performed (Lorenz and Strome, 2014).

The second reported laryngeal transplant was carried out in 2010 in the UC Davis Medical Centre (California, USA). The recipient was a 51-year-old woman who had also been the recipient of a prior kidney-pancreas transplant. She presented with complete laryngo-tracheal stenosis as the consequence of a prolonged tracheal intubation (Farwell et al., 2013). Following transplantation the patient achieved a recovery of laryngeal phonation, but continued to need a tracheostomy for ventilation (Farwell et al., 2013).

There are four considerations that need to be taken into account in any discussions concerning the ability to undertake transplantation of the larynx in a satisfactory and sustainable way. Three of these considerations are biological and clinical. They are: (1), long term viability of the tissue and the possibility of rejection, (2), the establishment of a functioning vascular supply and (3), the selective reinnervation of the larynx to ensure full restoration of function (León et al., 2008). The fourth consideration surrounds the psychosocial and ethico-legal issues that are raised were this procedure to become routinely successful (León et al., 2008).

PSYCHOSOCIAL AND ETHICO-LEGAL FACTORS OF LARYNGEAL TRANSPLANTATION

The voice is an important part of our personal identity. In person we are recognized by our appearance but especially through the unique appearance of our face. The uniqueness of our voice enables us to be recognized as well even when we are not present in person or cannot be seen, much as we are recognized through the appearance of our face. Patients, who have undergone a laryngectomy and have been fitted with, and must speak through, a tracheoesophageal prosthesis or an electrolarynx, have considerable difficulty in identifying themselves through the new voice given to them by either of these devices. It is acknowledged that this difficulty when combined with poor and difficult verbal communication, are major factors limiting the social relations of the patients. The consequences can include the development of psychosocial distress, manifested as social isolation and even depression.

According Clements et al. (1997) reported that only the 33% of patients in their study who had undergone a laryngectomy and managing employing oesophageal voice were satisfied with their voice quality. In their study of patients who had undergone a laryngectomy they were employing either an electrolarynx to produce voice or using tracheoesophageal methods in voice production. In the first case 40% of patients and in the second case the 55% of patients were dissatisfied with resulting quality of their voice Clements et al. (1997).

There are two main groups of candidates for whom laryngeal transplantation might be considered as a long-term treatment for the restoration of

normal laryngeal function. The first group are those patients who have undergone a laryngectomy as part of the treatment for benign or low-grade malignant laryngeal tumour, and who might also have received adjuvant radio- and/or chemotherapy and are either considered cured or are in long-term remission. The second group are those patients who have become very hoarse or mute due to laryngeal trauma and where reconstruction is not a possibility (Narula et al., 2011). Although laryngeal transplantation may seem a good solution to improve the quality of life of these patients, it must be taken into account that the larynx is a non-vital organ and is important to consider if is ethically correct to subject a patient to a complex procedure when it is not essential for their survival (León et al., 2008). The risk of complications is significant and although, in the worst case, the transplanted larynx could be explanted this does mean subjecting the patient to a second operation with its attendant risks alongside the distress caused to the patient by having had to reverse a procedure that had been intended to offer hope (Lorenz and Strome, 2014).

At present, as it was shown in the case of patient from Cleveland, the risk, complications and discomfort derived from laryngeal transplant are bigger than its benefits. Therefore, it is essential to ensure that the patient knows and fully understands the transplantation procedure and all its implications including the risks as outlined above, to ensure they are able to gives us their free and informed consent (Narula et al., 2011).

REJECTION AND LONG-TERM TRANSPLANT SURVIVAL

The main risk of any transplant is rejection. The study of Rees et al. (2003) showed that the laryngeal mucosa is immunologically active as a tissue, with the potential to cause an acute rejection response. With the development of immunosuppressive drugs (methylprednisolone and monoclonal antibodies), this risk may be relatively readily reversed (Narula et al., 2011). Nevertheless, as this treatment has to be administered lifelong, it can produce two important side effects in the patient; drug toxicity and the potentiation of some diseases, as malignant tumours due to constant systemic immunosuppression (León et al., 2008). New immunosuppressive protocols that have been introduced have achieved a reduction of these side effects with graft survivals of 90% after the first year of transplantation, (Narula et al., 2011).

REVASCULARIZATION AND THE ESTABLISHMENT OF A FUNCTIONING BLOOD SUPPLY

The human larynx is supplied by two arteries on each side. The superior laryngeal artery arises from the superior thyroid artery, a branch of the external carotid artery and supplies mainly the laryngeal vestibule (supraglottic area) as far inferiorly as the inferior margin of the thyroarytenoid. The inferior laryngeal artery arises from the inferior thyroid artery, a branch of the first part of the subclavian artery and supplies mainly the infraglottic cavity (subglottic area) (Narula et al., 2011). However, Anthony et al. (1966) demonstrated, by the injection of latex barium and Indian ink unilaterally into the superior thyroid artery, that the injected material was able to spread into the entire larynx and suggested that the blood flow provided by just one superior thyroid artery might be sufficient to revascularize the whole human larynx. The explanation for this is that the superior laryngeal artery is the dominant vessel of the larynx (Anthony et al., 1966) and through the anastomoses it has with the superior laryngeal artery on the opposite side and with the inferior laryngeal arteries it forms a freely communicating arterial anastomotic network that provide channels the allow blood supply to the whole larynx to be maintained even when some branches are blocked (Trotoux et al., 1986). The fact that revascularization of the full larynx can be easily achieved through only a single superior thyroid artery, together with the increasing refinement of microsurgical techniques and tools, means that laryngeal revascularization may no longer be a limiting factor in determining the success of laryngeal transplantation.

SELECTIVE REINNERVATION

The most important problem that has to be addressed if a successful laryngeal transplantation is to be achieved is to ensure that the transplanted larynx is fully functional (Birchall, 1997). For complete restoration of the laryngeal function to be achieved following transplantation it is absolutely essential to get a good sensory and motor reinnervation. The sensory nerve fibres provide local tissue sensation and initiate reflex functions that avoid aspiration into the lungs of food, fluids and salivary secretions, protection against the inhalation of foreign bodies and permit precise sensory control of phonatory movements. The motor axons produce the voluntary laryngeal functions for phonation and breathing as well as the involuntary protective sphincteric functions, creating muscular reflex movements in response to stimulation of laryngeal mucosa (Narula et al., 2011). Autonomic efferent fibres control laryngeal mucosal secretions that protect the vocal folds and increase the mechanical efficiency of phonation. All these sensory and motor fibres are distributed to the larynx through the recurrent (inferior) laryngeal nerve (RLN) and the internal (IbSLN) and external (EbSLN) branches of superior laryngeal nerve (SLN) (Figs. 1-2).

Laryngeal reinnervation techniques may be grouped in two main types: in non-selective tech-

niques the distal and proximal ends from RLN trunks are simply joined together or are joined to other nerves, for example the phrenic or hypoglossal nerves or ansa cervicalis; in selective techniques specific nerve branches for abductor (open the vocal folds) or adductor (close the vocal folds) muscles, are connected directly onto the paralyzed muscle, either by means of the implantation of a muscle-nerve flap or through the direct implantation of an appropriate nerve branch.

In sensory reinnervation the connection of nerves end to end is usually employed. However, in motor reinnervation selective techniques are essential in order to avoid the development of synkinesis (dysynergies, asynchronous and antagonistic muscular contractions) due to the regenerating axons innervating incorrect muscles non-specifically (adductor nerve fibres innervating abductor muscle and vice-versa) (Crumley, 2000).

The results obtained in a range of studies that have investigated laryngeal reinnervation have shown that the recovery of sensory functions is normally incomplete or altered (Blumin et al., 1999). The results from different studies of motor reinnervation of the larynx are very diverse and contradictory. Some studies have reported that it is possible to regain appropriate motor function (Peterson et al., 1998; Lorenz and Strome, 2014) whilst others report the development of synkinesis (Crumley, 2000) and/or the loss of muscular power because the number of motor units has been reduced (Ohyama et al., 1972).

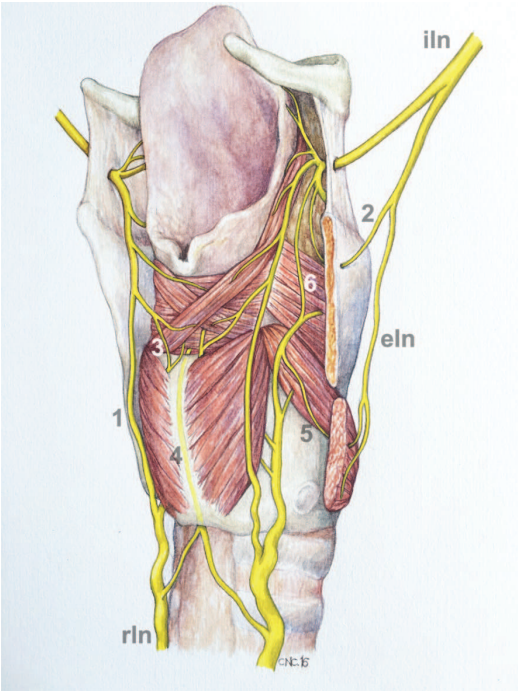

Fig. 1. Drawing of a posterolateral view of the larynx showing the laryngeal neural connections (published by Sañudo et al., 1999). Abbreviations: **eln**, external branch of superior laryngeal nerve; **iln**, internal branch of superior laryngeal nerve; **rln**, inferior laryngeal or recurrent nerve; **1**, Ramus communicans (Galen' connection); **2**, Foramen thyroideum connection; **3**, Superficial arytenoid plexus; **4**, Cricoid connection; **5**, Cricothyroid connection; **6**, Thyroarytenoid connection.

DOGMAS OF THE NEUROANATOMY OF THE LARYNX

All the above-mentioned problems with the laryngeal reinnervation arise as the consequence of four dogmas about innervation of the larynx that persist, despite the fact that evidence from many studies have shown that these dogmas are misconceptions based upon weak or insubstantial evi-

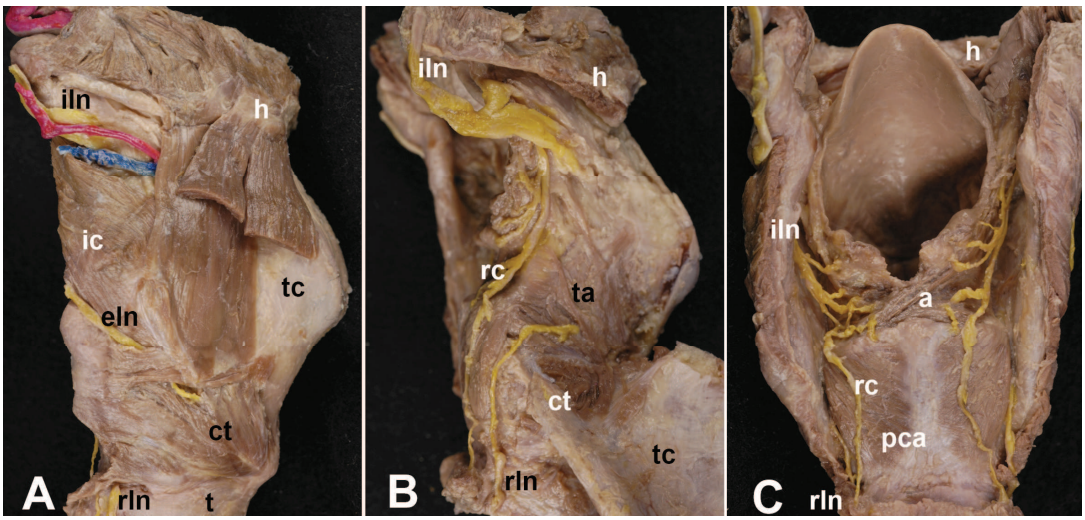

Fig. 2. Muscles and nerves of the larynx. **A**, External right lateral view of the larynx; **B**, the lamine of thyroid cartilage has been reflected back down to show the laryngeal muscles; **C**, Posterior view of the larynx. Abbreviations: **a**, arytenoid muscle; **ct,** cricothyroid muscle; **eln**, external branch of superior laryngeal nerve; **h**, hyoid bone; **ic**, inferior constrictor muscle of the pharynx; **iln**, internal branch of superior laryngeal nerve; **pca**, posterior cricoarytenoid muscle; **rc**, Ramus communicans (Galen' connection); **rln**, inferior laryngeal or recurrent nerve; **t**, trachea; **ta**, thyroarytenoid muscle; **tc**, thyroid cartilage;

dence. These dogmas are: 1) there is only one connection or anastomosis between the superior and recurrent laryngeal nerves; 2) there is only one nerve pedicle for each muscle; 3) the EbSLN supplies exclusively the cricothyroid muscle, while the rest of the intrinsic laryngeal muscles are supplied by the RLN, and 4) the internal branch of the superior laryngeal nerve is exclusively a sensory nerve.

1. There is only one connection between the laryngeal nerves

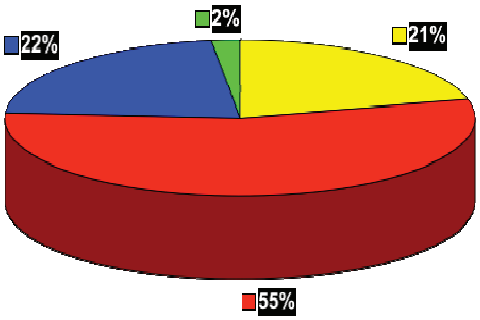

Fig. 3. Diagram showing the incidences of the overall number of connections found in individual larynges (published by Sañudo et al., 1999). Two connections were found in 21% of larynges, three connections were found in 55% of cases, four connections were found in 22% of cases and five connections were found in 2%. The cricoid connection was excluded.

In addition to the classic connection between the IbSLN and the RLN, the Galen's connection (ramus communicans or Galen's loop), a total of seven different connections has been described between the laryngeal nerves. Their disposition and prevalence are variable; with two of them being always present in human larynx while others are variably present (Sañudo et al., 1999) (Table 1, Figs. 1-2B, C). Sañudo et al. (1999) showed that in one hemilarynx there may be from two to five laryngeal connections, with 79% of the hemilarynxes in their study having three or more (Fig. 3). The possible functional roles of laryngeal nerve connections have been widely discussed. Recent studies have shown, for example, that motor axons in the cricothyroid connection (Martin-Oviedo et al., 2011) and in the Galen's loop (Pascual-Font et al., 2016). Other functions are discussed below. The variable prevalence of laryngeal connections may explain the functional differences in the sensory and motor innervation of found in individual subjects (Sañudo et al., 1999).

2. There is only one nerve pedicle for each muscle

The selective laryngeal reinnervation techniques are based on the supposition that each individual muscle receives only one branch from the RLN, with the exception of the cricothyroid muscle, which receives only one branch from the EbSLN (Damrose et al., 2003). However, several studies have reported that each individual laryngeal muscle can be supplied by a variable number of nerve

Table 1. Laryngeal connections between the laryngeal nerves

Connections between the IbSLN and the RLN			
NAME	BRANCHES CONNECTED	LOCALIZATION	PREVALENCE
Ramus communicans (Galen's connection)	Posterior branches of the IbSLN and the RLN	Under the pharyngeal mucosa	100%
Thyroarytenoid connection	Anterior branches of the IbSLN and the RLN	Over the thyroarytenoid muscle	14%
Superficial arytenoid plexus	Posterior branch of the IbSLN and anterior branch of the RLN	Over the interarytenoid muscle	86%
Deep arytenoid plexus	Bilateral branches of the IbSLN and the RLN nerves	Among the interarytenoid fibres	100%
Cricoid connection	Posterior branches of the IbSLN and the RLN	In front of the cricoid lamina	6/10 cases
Connections between the IbSLN and the EbSLN			
NAME	BRANCHES CONNECTED	LOCALIZATION	PREVALENCE
Foramen Thyroideum	IbSLN and ELN branches	Through the thyroid foramen	21%
Connections between the RLN and the EbSLN			
NAME	BRANCHES CONNECTED	LOCALIZATION	PREVALENCE
Cricothyroid	Anterior branch of the RLN and the EbSLN	Throughout the cricothyroid muscle	85%

1) between the internal branch of the superior laryngeal nerve (**IbSLN**) and the recurrent laryngeal nerve (**RLN**); 2) between the IbSLN and the external branch of the superior laryngeal nerve (**EbSLN**) and 3) the RLN and the EbSLN. Details of names, nerves connected location and prevalence based on the articles of Sañudo et al. (1999) and Maranillo et al. (2003b).

branches (Table 2, Fig. 2). In addition, it also needs to be pointed out that any laryngeal muscles can receive a branch from one of the laryngeal nerve connections (Maranillo et al., 2003a, b, 2005; Mu and Sanders, 2009). Therefore, the nerve supply of laryngeal muscles is more complex that described the classical textbooks of anatomy and a thorough knowledge of them is essential when attempting selective reinnervation techniques that aim at a fully a functional larynx.

3. The EbSLN supplies exclusively the cricothyroid muscle while the rest of the intrinsic laryngeal muscles are supplied by the RLN

The common view found in many textbooks regarding the motor innervation of the larynx is that all laryngeal muscles are supplied by the RLN, with the exception of the cricothyroid muscle, which is supplied by the external branch of superior laryngeal nerve (EbLN). Nevertheless, experimental studies in dogs (Nasri et al.,1997) and morphologic (Sanders et al., 1993; Mu et al., 1994; Wu et al.,1994; Sañudo et al., 1999; Maranillo et al., 2003b), histologic (Todd, 1938; Vogel, 1952; Gupta et al., 1959; Wustrow et al., 1988) and electromyographic (Martin-Oviedo et al., 2011) studies in humans, showed that any of the laryngeal muscles may receive a double innervation from the RLN and from the SLN (Table 3).

4. The internal branch of the superior laryngeal nerve is exclusively a sensory nerve

It has also been widely accepted that the internal branch of the superior laryngeal nerve (IbSLN) is exclusively sensory in function. This nerve receives sensory information from the laryngeal mucosa, as well as the proprioceptive information from laryngeal muscles and joints (Onodi, 1902; Lemere, 1932; Winckler, 1948; Williams, 1951; Rueger, 1972; Olthoff et al., 2007). However, as has been referred to above, other studies have suggested that the IbSLN may contain also motor axons, which provide an accessory innervation to some laryngeal muscles (Table 3).

CONCLUSION

Therefore, while the ethico-legal aspects, tissue viability vs. rejection or the vascular supply must not be overlooked as complicating factors when contemplating laryngeal transplantation, the real

Table 2. Correlation between the number of muscular branches to each individual intrinsic laryngeal muscles based on the studies published by Maranillo et al. (2003a, 2005) and Mu and Sanders (2009)

MUSCLE	Number of branches from RLN
Thyroarytenoid	Range: 1-4 Average: 1.4
Lateral cricoarytenoid	Range: 1-6 Average: 3.1
Interarytenoid	Range: 1 Average: 1
Posterior cricoarytenoid	Range: 1-6 Average: 2.6
MUSCLE	**Number of branches from EbSLN**
Cricothyroid	Range: 1-5 Average: 1.9

RLN, recurrent laryngeal nerve; **EbSLN**, external branch of the superior laryngeal nerve.

Table 3. Dual motor nerve supply of the laryngeal muscles reported in humans. Based on the studies published by Wustrow et al. (1988), Wu et al. (1994), Martín-Oviedo et al. (2011), Masuoka et al. (2016) and Pascual-Font et al. (2016).

MUSCLE	MAIN NERVE SUPPLY	SECONDARY NERVE SUPPLY
Thyroarytenoid	Anterior branch of RLN	IbSLN EbSLN
Posterior cricoarytenoid	Anterior branch of RLN	IbSLN EbSLN
Lateral cricoarytenoid	Anterior branch of RLN	IbSLN
Interarytenoid (Oblique and transverse)	Anterior branch of RLN	IbSLN
Cricothyroid	External branch of SLN	IbSLN Anterior branch of RLN

EbSLN, external branch of the superior laryngeal nerve; **IbSLN**, internal branch of superior laryngeal nerve; **RLN**, recurrent laryngeal nerve.

challenge facing those wishing to undertake laryngeal transplants is how to ensure selective and accurate reinnervation of the larynx given the complexity of that innervation. These complications are (1), each laryngeal muscle possibly being supplied by a variable number of neural branches nerves (Table 2, Fig. 2); (2), the frequent presence of multiple connections between the different laryngeal nerves (Table 1, Figs. 1-3); (3), that the frequency with which laryngeal nerves and nerve connections are mixed in nature conveying both motor and sensory fibres and (4), the laryngeal muscles may receive dual nerve supply, from both the recurrent laryngeal and superior laryngeal nerves (Table 3).

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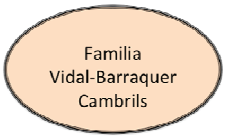

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