

## HISTORY OF THE MEDICINE

**Niels Stensen — Prestigious scholar of the 17th century**

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**The authors present a biography of modest, extraordinary educated Danish scholar Niels Stensen, who gave his life to anatomy, geology and finally to theology. His anatomical studies of salivary glands, lymphatic system, muscles and heart, and also of other organs of human body, based on study of contemporary anatomy classify him among most important scholar of 17th century. The truth, scientific approach and his method of explaining anatomical structures in a connection with physiological notes are original and valid from a today's point of view. (Fig. 3. Ref. 8.)**

**Key words:** Niels Stensen. personality.

To the great personalities of the history of anatomy, who were in their time very interested in medical and anatomical questions and whose significance is honoured today belongs without doubt Niels Stensen, an universal scholar of 17th century.

Niels Stensen — Nicolaus Stenonis, Steno, Stenonius, Stenon — as it is introduced in literature, was born on January 10th, 1638 in Copenhagen, in a protestant family of goldmakers. He began the study of medicine on Copenhagen's University, where he picked up also the basic knowledge of natural science and manifested an interest in philosophy.

The fruitful life of Niels Stensen as anatomist is so important and interested, that his other activities as a scientist — zoologist, geologist, or ardent philosopher and at the end as a priest, we are showing briefly.

**Holland**

Niels Stensen began the study of medicine in Copenhagen. On the basis of recommendation by Thomas Bartholinus he continued his study (as was the custom for excellent Danish students) in Holland. He started with a great enthusiasm and energy to study anatomy at the University in Amsterdam, where in that time an independent hall was built for anatomical practices and dissections. Stensen began with a dissection of the salivary glands. A first success of his dissections was discovery of the duct of the parotid salivary gland — ductus parotideus (April, 7th, 1660), later named as Ductus Stenonianus (it was named according to discovery by Johannes van Horne, the professor of anatomy in Leyden).

Modest but full of research pleasure, 22 year old Stensen was reported in one letter to Thomas Bartholinus:

*“As I obtained agreement for independent dissection, the luck was smiling on me. In the head of the first sheep, which I bought on April, 7th, 1660 and dissected in a study room alone, I found a channel, which as I know was described by nobody. I decided to perform first a reconnaissance with a probe the course of veins and arteries, which are crossing the oral cavity. I noticed, that the peak of probe is not surrounded by membranes, but it moves free in a spacious cavity. Immediately I heard, that metal struck on teeth.*



**Fig. 1. Niels Stensen (Nicolaus Steno) (1638-1686).**

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Stensen found out by repeated preparations, that the channel begins in glandula parotis (the name takes origin by Stensen) and transported secretion to the oral cavity — saliva, which is needed for the softening and movement of dry and hard food.

Stensen speaks modestly about his discovery of the ductus parotideus, as about the inventiunculum — an accidental discovery of slight importance. Just the discovery of the inventiuncula has brought him the great fame.

His teacher Gerhard Blasius appropriated this discovery in his personal letters and publications and Stensen made a written controversy about it for nearly 4 years. This conflict about discovery has led at the end to the removing of young Dane to Leyden.

In Leyden he was still interested in anatomy but also in the study of mathematics. His above average knowledge gave him the possibility to realize his systemic reconnaissance of muscles and their mechanics and by this way to revise the opinion of Galen, that the heart has a structure of parenchyma as well as the predominant idea of that time, that *“the heart is a place of ghost, congenital heat or the creator of a certain liquor as is a blood”*. Stensen identified the heart as a muscle. This assertion, which he based on his own observations, was absolutely revolutionary at that time.

Niels Stensen defended in front of the public in year 1661 his scientific work *“About glands of mouth and about still unknown ones”*, which he published shortly after wards. In this writing he describes clearly and in detail his discovery of the ductus parotideus, he announces also many other discoveries of glands and at the same time he speaks about their general meaning. An important part is an explanation about the function of glands. He refuses until that time a valid idea about origin of saliva in the brain. According to his opinion saliva are product of glands and are originated from blood.

One year latter, in the year 1662, he published his next writing about glands under the name *“Observationes anatomicae, quibus varia oris, oculorum, narium vasa describuntur, novique salivae, lacrymarum et mucii fontes eguntur”*, in which he describes saliva, tears and phlegm, as well as the vessels of the mouth, eyes and nostrils and takes a clear and total explanation of a mechanism and of a function of the lacrimal apparatus.

*Stensen states “... I suppose, that liquid, which facilitates the movement of eyelashes takes origin in a tear gland and is transported by it's ducts. The formation of tears is influenced by external and internal conditions. The tears find out by emotions, their control is outside our will, also when for young women is easy, according to their will and to their need to have eyes wet”*.

This book, which contains many pioneer anatomical and physiological observations, he presented to his teachers in Copenhagen and Leyden.

*In that time it was known to anatomists, that all membranes are wet, but without knowing the reason. Stensen had elaborated a working hypothesis, that moisture takes origin from glands and this is the reason the glands must have ducts. He found glandulae nasales, et canalis nasopalatinus, glandulae buccales, glandulae linguales et glandulae palatinae.*

*He found out that earwax takes origin from small glands in auditory canal and it's formation depends on the gland's activity.*

Gerhard Blasius, his opposer, did not give up and undertook some desperate experiments to defend his view about his discovery of ductus parotideus in front of the young scientist. Stensen definitely responded to these attacks in 1663 in the work *Apologie Prodomus*.

Research of the glands and lymphatic system was in 17th century the most important area of research. Famous men as Johann van Horne, Caspare Aselli, Johann Georg Christopher Wirsung, Jean Pecquet, Thomas Bartholinus, Tomas Warton conducted this research with considerable successes. The widest extent and the biggest review about glands, about their building, structure, meaning and function was written by Niels Stensen, thanks to his systematic access.

His stay in Holland was for the young Stensen a very fruitful and important period.

### Copenhagen

Stensen, as a famous anatomist, returned in the year 1664 to Copenhagen with a demand to occupy a teaching position for DOMUS ANATOMICA. Here he published a famous writing *“De musculi et glandulis enervationum specimen”* (Amsterdam, 1664; Leyden, 1683).

Albrecht von Haller (Swiss writer) marked this writing like *“aureus libellus”*. Instead of this success the place for teacher in Domus Anatomica in Copenhagen, Stensen did not obtain thanks to his enemies and envy.

### Paris

From Copenhagen Stensen went away again abroad. He did not return back to Holland, but he went to France. A new met him in Paris, that *“for his unusual learning — IN ABSENTIA”*, without need to show a special documents, he was appointed as Doctor of Medicine.

In Paris, the Danish anatomist Stensen made dissections day after day in the presence of many men eager for science. That majority at dissections he made so clearly, that the people present

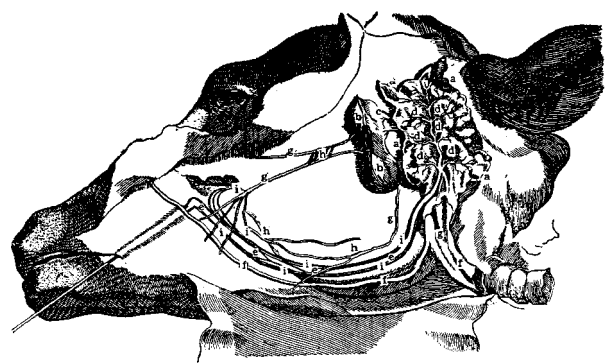


Fig. 2. The head of the sheep — discovery of parotid duct (according to Sauer, 1962).

were wondering, how they could have escaped previous anatomists. His discoveries brought him admiration and respect.

Instead of systematic confirmation of his extensive gland research he was interested in a research of muscles and a special attention he gave to heart muscle. The conclusions of his observations were extraordinary important.

To this period belongs also an embryologic paper "Embryo monstro affinis Parisiis Dissectus" (Dissection of deformed embryo in Paris). Stensen through dissection found a defect of heart septum between two chambers, right sided aorta, stenosis of pulmonary artery and hypertrophy of right heart chamber. This malformation was "rediscovered" in 1888 (200 years after Stensen) by the Frenchman Etienne Louis Arthur Fallot and carries his name, Tetralogy of Fallot.

In that time Stensen had an access to the learned Melchisedec Thevenot, who was later a librarian of Ludvik the Fourteenth, and who organized meetings of the science society. The presentation of Niels Stensen was a big event of the French winter. Stensen introduced his most elegant lecture in French language about brain anatomy "Discours sur L'Anatomie Du Cerveau", which unveiled him as sovereign anatomist of the brain. The lecture was published by the press in French language (1669) and in Latin translation in 1671 in Leyden. Later it was published in an introduction of a great anatomical work of his compatriot Jacob Beningus Winslow (Exposition anatomique de la structure do corps humain, 1752) as an example of anatomical and natural science research method.

*Winslow is writing in his Exposition Anatomique: "I want to express my sincere confession, that the Discours ... of deceased Mister Stensen was for me an inspiration and an example for advance in anatomical works. Niels Stensen with his access and truth in research stands out among his contemporaries, who considered big mistakes as a truth".*

Stensen in his contribution disputes brain science experts of the time, mainly against René Descartes and Thomas Willis. He criticized their methods of dissection on brain, he described a heavy that time's operations and drawings led to superficial conclusions. He presented his own suggestions for dissection and a precise description of brain and in an enclosure he offered his own drawings of the brain. He criticized sharply an unworthy terminology and showed new ways of study, by which a better knowledge of the brain anatomy could be obtained.

### Contemporary anatomy

Stensen investigated various kinds of mammals, fishes, and birds and by dissection he found conspicuous differences. He made for himself the goal to research in detail single organs, to compare them with organs of human body and to describe their function. That's why he made orientation to contemporary anatomy the next step finding the truth. For example, in a description of a fish dissection he wrote conclusions about the skin. Stensen described the layers of skin, skin vessels and glands. His observations by dissection of animals were not an impulse for him to make a corresponding conclusions from animals to human body,

but he made conclusions until he verified his own findings using dissection of human bodies. As Stensen tells himself "I don't want to pronounce a general conclusion through one observation".

### Florence

Niels Stensen left Paris at the end of winter in 1665 and travelled to Florence. He was warmly admitted by the Duke of Tuscany, Ferdinand the Second de Medici, the enthusiastic supporter of science. Ferdinand the Second was patron of scientific arch ACCADEMIA del CIMENTO. Stensen found a new home on a Medicean court in a ring of excellent scientists living there. He embarked with a great enthusiasm to work and to anatomical dissections. Here as a Protestant, the Catholic company made confrontations all the time and this partially took away his mind. From this resulted a conflict of faith which ended by his conversion to the Catholic religion, by which he surprised the scientific world.

Niels Stensen worked strenuously as a scientist also after his conversion. In the same year he wrote a very famous writing "Elementorum myologiae specimen seu musculi descriptio geometrica" (Florence, 1667; Amsterdam, 1669), as a continuation of previous studies about muscles. With the friendship of anatomist Marcello Malpighi, who was in this time professor of anatomy and practical medicine in Bologna, they worked together on a research of spleen, they exchanged their outcomes from the observations of female genital organs and of various kinds of animals and also other experiments. They cooperated also very closely with Reiner de Graaf.

His world of ideas and activities was in reality more under the influence of a new faith, which was more shifted to the center of his life's interests. In the age of 37 years, seven years after his conversion, Niels Stensen quit his science research.

A new area of research — geology, was opened in years 1667—1674 in front of him. He known many English scientists, who followed and admired him during dissections and with whom he devoted to geological studies (he visited also Slovakia). Niels Stensen worked also in this area very hard and he obtained extraordinary results.

He published an important study "De solido intra solidum naturaliter contento dissertationis prodromus", which is considered as a fundamental work of modern geology, paleontology and crystallography.

### Copenhagen

The tension and limitation of religious freedom in Denmark was aplased during the government of the Danish king Christian the Fifth. Niels Stensen obtained in the middle of geological researches in Tuscany an invitation letter from Danish statesman, friend of childhood, to return back to Copenhagen and to take a place as the ANATOMICUS REGIUS (King's anatomist). Stensen made immediately a decision for return to home. His effort was to animate THEATRUM ANATOMICUM in Copenhagen, in which as a student he began and picked up the basis of medi-

cine, and which was not used that time. He desired again after a long interruption to devote his time to anatomy because, as he said himself “*many researches are missing in anatomy*”. He was called upon to be a teacher, who wanted to make possible a true knowledge to his students and to correct widespread mistakes of other anatomical research.

As a Royal Anatomist he gave an introduction speech, very interesting and noble in Theatro Hafniensi Anatomicarum, where he made a public dissection of woman’s body and the body of a deer, he presented:

“*Beautiful is, what is accessible by senses without cutting, more beautiful is what cutting brings from inside on the light, but most beautiful is what escapes the senses, but with sensual perception is known by the mind*”.

By this way Niels Stensen fixed for him the sense of anatomy, which was high above the description of organs and above knowledge of their relations. Anatomy enabled him to know the sense of the structure of nature and he gave his expectations towards anatomy:

“*Is a real aim of anatomy, to take up the spectators by admirable artistic work of body to a dignity of the ghost and as through the miracle of both to knowledge and to love of God*”.

Niels Stensen spent only two years (1672—1674) in Copenhagen. His activity was not the same as he was an enthusiastic scientist anatomist. A religious longing called him to lovely Italy. Also the intolerance of his compatriots disappointed him (majority of Protestants in country), so in the year 1674 he left his country again and definitely.

When he had come to Florence, he took the place of teacher and tutor of the 12-year old prince. The latter monarch Ferdinand the Third had to be educated “in Philosophia Christiania”, which contained as scientific as moral religious duties of monarch. When after two years the education had finished, Stensen left to his student a writing “Trattato Di Morale Per Un Principe”, which has not been preserved in writings.

### Stensen — a Priest

Theology fully attracted Stensen. His aim was to acquire mainly converted persons or some friends and students such as Spinosa, Holger Jacobsen, Caspar Bartholinus junior and others. By this way definitely the third chapter of his life is opened — working of Niels Stensen as a priest.

Niels Stensen was consecrated as a priest. After two years he went as an apostle vicar to Hannover with a plan to obtain the north for Catholicism. He went to Munster in the year 1680, where he became a consecrated as bishop.

Stensen wrote in his memories on his life to Leibnitz:

“*In order to start more to know about weakness of human ghost daily, you see my mister, how God led me through anatomical discoveries to the point, that I renounced the philosophy, and step by step the made me do acceptance of love to christian humility*”.

Stensen resigned as bishop at the end of 1685 and he lived as a simple priest in ascetism and poverty until his premature death (December, 6th, 1686).

*The last years of his life were sad. Niels Stensen suffered from malignant intestine disease, which urged him to lie in bed. He asked for a paper and ink two days before death to write to Cosim the Third a letter and he asked the prince to finance the costs of his funeral, but at the same time he asked for a funeral of a poor man.*

Niels Stensen was buried in a crusade of the House in Schwerin. Shortly then he was transferred to Florence according to wish of Duke Cosim from Tuscany, where he was buried in a tomb of princes’s of Medici in San Lorenzo.

The grave of Niels Stensen was opened in 1953 and residues of his body were found and were transferred to a new place to the side chapel in San Lorenzo, which was named CAPELLA STENONIANA. Italy gave to this rare man a sarcophagus from the 14th century, which was found in Arno (where Stensen made a geological researches).

Residues of Niels Stensen were transferred on October 25th, 1953, by solemn procession through streets „of his Florence“ which he loved very much. Italian and Danish scientists gave their respects.

An old marble tablet in Capella Stenoniana in Florence has his Latin epitaph:

Here rest the remains of Niels Stensen, bishop of Titiopolis, a God-fearing man.

Denmark gave him a life in heresy, Tuscany gave him a re-birth in a true faith.

Rome in bravery honoured him by a bishop degree.

Germany had a heroic announcer of the gospel.

Schwerin lost him completely crushed and suffering for Christ.

The Church has mourned him. Florence wanted to own at least his ashes.

Anno Domini 1687.

In year 1938 at the occasion of the 300th anniversary of the birth of Niels Stensen an idea took origin in Germany for his consecration. The process of consecration was ended on October 23rd, 1988, when the anatomist, geologist and bishop Niels Stensen was proclaimed by Pius Jan Pavol the Second a saint.

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