



Review

Anatomist and Co-Founder of Polish Veterinary Education—Ludwik Henryk Bojanus (1776–1827)

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Abstract: Ludwig Henry Bojanus was born on 16 July 1776 in Buchsweiler, Alsace. After studying in Jena and Vienna, L. H. Bojanus enrolled at the University of Jena for his doctoral studies. Bojanus's scientific activities are closely associated with Vilnius, where he was a professor of veterinary medicine from 1806 (he was elected to this position in 1804). In 1815, he became a professor of comparative anatomy. These were the times of the greatest flourishing of Vilnius University, where the foundations of modern Polish science were being laid. At Vilnius University, he established a technical and anatomical-pathological office for the zoo, a veterinary clinic and a model forge for shoeing horses in 1823. Bojanus founded a veterinary school in Vilnius and drew up a plan for a veterinary institute, which was not opened until 1832, simultaneously with the opening of the medico-surgical academy. He became known as one of Europe's most prominent anatomists and zoologists. A lasting memorial to the scientist is the monograph "Anatomy of the Tortoise", which many scholars still point to today as a model of accurate and precise anatomical research. He was the first to identify the anatomical differences between the European bison (*Bos bonasus*) and the aurochs (*Bos primigenius*). In his lectures on comparative anatomy, Bojanus presented the principle of uninterrupted development. He can be described as one of the most decisive and consistent evolutionists before Darwin. He died in 1827.

Keywords: Louis Bojanus; history of anatomy; history of veterinary medicine; origins of veterinary education



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1. Introduction

Ludwik Henryk Bojanus (Figure 1) is known first and foremost as the founder of the Polish veterinary school; only secondly is he spoken of as an outstanding anatomist and representative of medical science. In this work, we would like to present the figure of Prof. Bojanus concerning his anatomical and organisational achievements related to the creation of the veterinary school in Vilnius. We also must remember the contribution of our hero to the education of his successors, who developed the veterinary education system in the Polish lands. The end of the 18th century and the beginning of the 19th century were a period of revival of the sciences in Poland. Thanks to the efforts of the Commission of National Education, established in 1773, the Polish education system was reformed, and two academies were reorganised and named Main Schools. The Crown Main School was established in Kraków, while the Main School of the Grand Duchy of Lithuania was established in Vilnius. As Poland did not have sufficient scientists at the time, importing scholars from abroad became necessary. Among them was Ludwik Henryk Bojanus. His name became permanently associated with the history of anatomy, veterinary science and zoology in Poland, particularly with the history of the Imperial University of Vilnius (the name given to the Main School of Vilnius in 1803).



Figure 1. Ludwik H. Bojanus (lithograph by Elichwald from the first half of the 19th century. Archive of the Polish Academy of Sciences in Warsaw).

2. Materials and Methods

In the preparation of this article, heuristic methods and a search of source materials collected in the State Archive in Warsaw, the Lithuanian Central State Archive in Vilnius, the Veterinary History Room at the Voivodeship Veterinary Inspectorate in Bydgoszcz and the Veterinary Museum at the Ks. Krzysztof Kluk Museum of Agriculture in Ciechanowiec were used. While writing the thesis, scientific literature was also used, particularly on works published in Polish scientific and veterinary journals. The search included full yearbooks of “Przegląd Weterynaryjny”, “Medycyna Weterynaryjna”, “Życie Weterynaryjne”.

3. Youth and Scientific Career

He was born on 16 July 1776 (Table 1) in France at Buschweiler (Buschwiller) near Strasbourg and, by the standards of the time, as a subject of Louis XVI, was French. He spent his youth and early school years in French Alsace. He began his education at a French-speaking secondary school in Buschweiler and finished at a German-speaking one in Darmstadt near Frankfurt am Main, where his German family moved when he was thirteen. After the incorporation of Alsace into France, the Bojanus family moved to Darmstadt in Hesse, due to the fact that Ludwig’s father, Jacob, was an official of the ducal forests. He was Protestant and treated both languages equally. Furthermore, he studied medicine at the University of Jena, receiving his doctorate in 1797 [1,2]. After defending his doctoral dissertation, he travelled to Vienna to further his medical knowledge. He presumably came into contact with scholars of the then-highly regarded Viennese veterinary school. After a year, he returned to Darmstadt, where he practised as a doctor for two years. In 1801, he travelled to France and studied at a veterinary school—the Ecole Veterinaire d’Alfortville in Alfort, near Paris, and at the National Museum of Natural History in Paris. He became a veterinarian after studying at the veterinary school [3]. These journeys were funded by the Hessian landgrave Wilhelm IX. In Paris, he began his first anatomical studies of animals under the famous professor of comparative anatomy, Georges Cuvier [4]. He then went on to study at veterinary schools in Lyon, London, Hanover, Vienna, Berlin and Copenhagen, as well as at major animal breeding centres. In doing so, he acquired extensive

veterinary knowledge and the organisational knowledge for running an animal doctor's training. This is important because there was no coherent veterinary education system at the beginning of the nineteenth century. At that time, schools had different views and methods of treating animals, often conflicting. In 1803, he returned to Darmstadt, where a new veterinary school was planned to open, which Bojanus was to head [5]. However, the facility failed to get off the ground, and due to a competition announced by Vilnius University, Bojanus decided to use his knowledge to create a veterinary school at that very institution [6,7].

Table 1. Key dates in the life of L. H. Bojanus [8,9].

Year	Events
1776	born in Bousville (Buchsweiler) in Alsace
1797	obtains a doctorate in medicine and surgery in Jena
1801–1803	scientific journey to become acquainted with the veterinary schools in Alfort, Paris, Lyon, London, Hanover, Vienna, Berlin and Copenhagen
1802	becomes a member of the Society for the Study of Man in Paris
1804	wins the competition to become professor at Vilnius University as the chair of “bovine treatment”
1810	becomes a member of La Societe Imperiale des Naturalistes de Moscou
1810	becomes an honorary member of the Mediko-Chirurgiczskoj Akademii in St. Petersburg
1814	becomes a member of the Imperial Academy of Sciences in St. Petersburg
1815	begins lectures on comparative anatomy
1818	becomes a member of the Kaiserlich Leopoldinisch-Carolinisch Deutsche Akademie der Naturforscher in Bonn
1818	becomes a member of the Royal Society for the Improvement of Veterinary Medicine in Copenhagen
1818	becomes a member of the Wernerian Natural History Society in Edinburgh
1821	becomes a member of the Königlga Svenska Vetenskapsakademien in Stockholm
1820–1822	takes part in the committee appointed by the University Council to create a project for the reform of studies at Vilnius University
1824	becomes a member of the Medical and Surgical Society in Berlin
1824	becomes a member of the Impieratorskogo Moskovskogo Obszczestva Sielskogo Choziajstwa
1827	dies in Darmstadt

4. Founder of Veterinary Education on Polish Soil

When considering Ludwik Bojanus as the founder of the Polish school of veterinary medicine, it should be remembered that he was active during the Partitions of the Polish–Lithuanian Commonwealth, when this country did not exist on the maps of Europe. The fact is that the school he created functioned on Polish soil, and the language of instruction was Polish. The students were overwhelmingly Polish. This entitles us to conclude that Ludwik Bojanus was the real founder of Polish veterinary education. Having been informed of a competition held by the University of Vilnius, he put forward his candidature for the chair of “cattle treatment”, a unit of veterinary medicine functioning in the Faculty of Medicine [8,10]. He presented a work on the organisation of veterinary schools known to him, “Über den Zweck und die Organization Thierarznei Schulen” (later published in print in 1805 in Frankfurt am Main). In it, he wrote that veterinary medicine was a worthy profession and that by engaging in it, one could become an excellent scientist. He heralded the strictly scientific direction of veterinary training. He also presented the opinions about

veterinary medicine prevailing in various European countries [11]. He did not arrive in Vilnius until 20 May 1806, bringing his extensive library of veterinary works as a gift to the University [9]. He was appointed professor and taught veterinary knowledge to fourth-year medical students six hours a week.

Furthermore, he lectured in excellent Latin, so interestingly that crowds of people came to his lectures, including professors from various faculties of the University and from outside its walls. From 1815 he also taught classes in comparative anatomy. At the same time, he devoted himself to intensive research work in zoology and veterinary medicine, assisted by Steven Drew, a medical doctor who arrived from England [9]. He began his scientific work by organising the first animal anatomy clinic in post-partition Poland and Lithuania. In a short time, he collected several hundred specimens [12]. He published many works in Latin, German, French and Polish. Before arriving in Vilnius, he was the author of several veterinary treatises, including an article in 1805 on the progress of veterinary medicine in the last three centuries [5], “Kritische Übersicht der Fortschritte der Thierarzneykunde in den leztverflossenen drey Jahrhunderten. . .”. Printed in Marburg, in this publication he recommended a thorough knowledge of animal anatomy and discussed the state of veterinary knowledge of the last three centuries. One of Bojanus’s ideas was to separate scientific veterinary medicine, which was to train veterinary surgeons, from the practical part of the profession, which was to be carried out by veterinary fieldmen. The same year, Bojanus’s article on the education of veterinary surgeons ‘Über den Zweck und Organization der Thierarzneyschulen’ was published in Frankfurt am Main [9].

It should be mentioned that Ludwik Bojanus’s experience in organising veterinary schools contributed to the fact that the Government Commission for Religious Denominations and Public Enlightenment of the Confederate Kingdom of Poland asked Bojanus (in addition to Prof. Jerzy Sick and Dr. Adam Rudnicki) to prepare plans for a practical veterinary school in Warsaw (based on the Imperial Decree of 25 September 1816). Despite his involvement in establishing the school in Vilnius, Ludwik Bojanus submitted a project, which he presented at a meeting of professors at Vilnius University on 15 February 1821. It proposed the division of the Institute into three separate establishments: A chair at the University of Warsaw for the training of medical students in veterinary science; A Practical School of Veterinary Medicine for the training of competent animal doctors; A separate scientific and veterinary establishment for scientific experiments. The Government Commission, in a letter of 21 March 1822, expressed appreciation and thanks for the plans prepared and awarded Bojanus the medal of the University of Warsaw but chose Rudnicki’s project as the more practical option [13].

5. Epizootiologist

At the time of the great foot-and-mouth epizootic that occurred in 1808, when half of the cattle in Lithuania died, Bojanus became intensively involved in epizootiology. This was reflected in a book published in 1810 in Riga in German and translated into Polish, “O ważniejszych zarazach bydła rogatego i koni”. The Polish edition of this publication was, for many years, the basic textbook on epizootiology and contributed significantly to the communication of the principles of epizootic management to animal physicians in Poland. The work was reprinted in 1832 and 1846 and sent to district medical doctors as a manual for action in cases of infectious animal diseases [14]. The book was so important for the agricultural economy and public health that Bojanus received the Order of St. Vladimir from the Tsarist authorities for it. In this publication, he discussed the more important infectious diseases of animals, such as horned cattle plague (rinderpest), splenitis, carbuncle, anthrax, muzzle plague (foot-and-mouth disease) and many other diseases. When describing cattle blight, he surmised that it was caused by contagion, which was confirmed in later studies by other scholars. At the time, rinderpest caused huge losses on cattle farms. To combat it, he recommended the use of vaccination: *“A four- or five-ounce cotton string, half a foot long, is soaked in the moisture of the eyes or nostrils, or in the blood or bile of cattle suffering from the plague. For this, the infectious matter is chosen between the 8th and 10th day of the plague,*

that is, from the second to the ninth day of the manifestation of the disease: for earlier and later, the matter is ineffective. This cord, soaked in fresh material, is pulled with a coarse needle or a suture through the folds of the skin of the hind legs, in the loincloth, between the forelegs, or in any other place on the body of the cattle to be vaccinated. After pulling the string from the top to the bottom, move it back and forth so that the material rubs off, and then tie the ends of the string together. To be more secure, you can inoculate in two places together. On the third to fifth day after inoculation, the wound is usually inflamed; on the sixth and seventh day, the disease appears, of course, and the cord is removed as unnecessary". [14] (p. 28). Bojanus recommended a method of vaccinating animals that was well-known in the West but had found no practical use in Lithuania. This method of vaccinating animals was called 'putting on the veil'. He believed that contagious diseases were caused by infection. He was probably familiar with the views of Bourgelat, who believed that glanders in horses was caused by infection, as well as a pamphlet by the English physician Edward Jenner published at the end of the 18th century. Jenner proved that inoculation with cowpox gave humans immunity to smallpox. This was called variolysis (variola vera—smallpox) and later vaccinia (vacca—cow). The concept of contagion was known as early as the 16th century and was introduced by the father of epidemiology, Girolamo Fracastoro (1483–1553), the papal court physician. In 1810, Bojanus published a treatise in Polish entitled "O kuciu koni podług zasad Kolemana" (On the Forging of Horses According to the Rules of Kolemans) and published a work on epizootiology entitled "Über die Ausrottung der Rindvieh—Pest (in Polen und Lithuanian). . .", in which he recommends that in order to combat cattle infestation, cattle from neighbouring countries should not be allowed into Poland and Lithuania for ten years [15].

6. Anatomy

Bojanus became interested in anatomy questions already during his scientific tour of European veterinary colleges. While in Hanover, he described the horse's muscular system, comparing it with that of the human, thus giving rise to comparative myology. Bojanus's pupil, Karol Muyschel, wrote about this [16]. On his return to Vilnius, he began his lectures on comparative anatomy in 1815 with an introductory lecture entitled. "Introductio in anaten comparatam" [17]. In this lecture, he compared the organs and functions of various groups of organisms, beginning with plants and ending with man, demonstrating at every step the relationships and gradual complication and refinement of structure.

This introductory lesson made Bojanus one of the forerunners of evolution, already formulated in his time in the writings of Lamarck, Geoffroy St. Hilaire and other scholars and so brilliantly developed later by Charles Darwin [18]. The lectures on comparative anatomy by Bojanus were the first lectures on this subject on Polish soil. However, their beginning should be assigned not to 1815 but to 1806, as Bojanus had lectured on the comparative anatomy of domestic animals since his arrival in Vilnius. In his veterinary works on anatomy, he discussed horse tendons and the forging teeth in horses and sheep. In embryology, he described the foetal membranes of sheep, horses, hares and humans and the structure of the omohypophysis and villi in dog foetuses. In osteological work, he elaborated on the cranial structure of sheep, goats, fish, birds and other vertebrates. He studied the fossil bones of the mammoth and the aurochs, finally extinct as a species in the first half of the 17th century in Poland. He gave it the Latin name '*Bos primigenius*'.

Furthermore, he was the first to prove that the bison and the aurochs were separate animal species [19]. He described the anatomical structure of the leech, clam, spider and crayfish. He also published parasitological works. He became world-famous for his monograph on the turtle's anatomy, now known as the mud turtle, '*Anatome testudinis europaeae*'. Furthermore, he compiled it after ten years of studying 500 specimens of this reptile [20,21]. It was published in Vilnius in 1819–1821. Two hundred and one drawings were made by the author's hand for this publication, from which Ferdinand Lehmann, an engraver (engraver) brought from Darmstadt, produced copperplate engravings [9]. Eighty copies of this book were published at the author's expense. In the Library of the Lithuanian

Academy of Sciences (former Wróblewski Library) in Vilnius, a copy with one colour engraving and the autograph of the future professor of the Medical and Surgical Academy Adam Adamowicz, a pupil of Bojanus, has been preserved. This copy was donated to the library in 1930 by the then-professor of the Stefan Batory University in Vilnius and, after the war, of the Nicolaus Copernicus University in Toruń, Professor Stefan Narebski. Two copies with a set of colour engravings are also known to exist [8]. Bojanus also compiled an anatomical monograph of the sheep, for which he made several hundred drawings. Due to technical difficulties and the voluminous nature of this work, it was not published but remained in manuscript and was lost in Darmstadt years later [20]. His views on evolution were ahead of the times, as he believed that certain species of plants and animals could evolve into others and that gradual evolution occurs over time. In his view, there are transitional forms between groups of plants and animals, the so-called 'Zoophytia' [9].

In addition to vertebrate anatomy, Bojanus presented many papers on the anatomy of invertebrate animals (including parasites). In his work 'Kurze Nachricht über Cercarien' [22], he stated that cercariae, commonly considered at the time to be adult independent animals, are the developmental stages of flukes, the intermediate host being the snail *Lymnaea stagnalis*. Bojanus also worked out the anatomy of the leech and described it in the works: *Die Anatomie des Blutegels* [23], *Was wir denn eigentlich vom Bau des Blutegels* and *Observations nouvelles sur la sangsue* [24]. A separate line of research was the study of the anatomy and biology of *Anodonta cygnea* (the great rats). He published many papers [25], the most important of which is *Über die Athem—und Kreislaufwerkzeuge der zweischaligen Muscheln*. He undertook studies on the reproduction of *Anodonta cygnea*, but also described the respiratory organs, the excretory and vascular systems, and established many unknown facts, including describing the excretory organ, later called the 'Bojanus organ' (he erroneously classified it as a respiratory organ). It is important to emphasise the wide range of Bojanus's research interests, which included both vertebrates and invertebrates, adult forms and developmental forms. Bojanus's laboratory in Vilnius was the first zoological research workshop in the Polish lands.

Bojanus belonged to the 'natural philosophers' because, like Goethe, Oken, Spix and Carus, he propounded the idea that the skull is the transformed anterior end of the vertebral column and consists of deformed and fused vertebrae. There were many arguments in favour of the theory: the skull, like the vertebral column, initially passes through a cartilaginous stage and later ossifies; the skull includes the anterior end of the dorsal cords; there is a cavity in the skull filled with the brain, which can be considered an extension of the medulla oblongata. Goethe, who was the first to publish the "vertebral theory of the skull" as early as 1790, had a similar understanding. Oken came up with a similar idea in 1807, independently of Goethe. In the pages of "Isis", a discussion began on this topic, in which, in addition to Oken, Spix and Frank, Carus and also Bojanus took part [9].

In addition to anatomy, medicine and veterinary science, he was interested in print-making and painting and was himself a gifted draughtsman. This helped him to document his scientific work. In 1817, he lectured at the University of Vilnius on a novel graphic technique, lithography, which began to be used in printing book engravings. This lecture was translated from French into Polish and published in print as the 'Lecture on Lithographic Art'.

7. Anatomical Theatre

Even before the opening of the first veterinary school in Vilnius, after he had already taken up the “chair of cattle treatment”, Bojanus set about creating an anatomical theatre. In 1808, the University acquired the ruins of the Uniate Spasskaya Orthodox Church (Figure 2) and the larger and smaller palaces on the opposite side of Spasskaya (Metropolitan) Street, which belonged to the Uniate Metropolitan. These buildings were utterly devastated during the siege of Vilnius by the Russian army in 1794 [26]. In their place, the Anatomical Theatre and two buildings designed by the architect Szulc were built to house studios and flats for University staff. It was probably not realised that buried in this church were the parents of the Polish King Wladyslaw Jagiello, Prince Olgierd and Juliana, and later in 1513 the wife of Alexander Jagiellon and daughter of Ivan III the Terrible, Helena, as well.

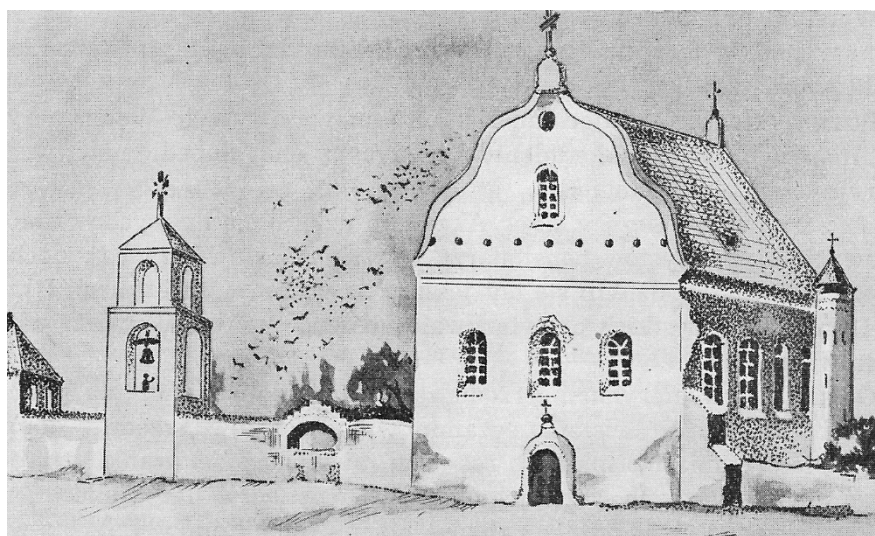


Figure 2. Spasskaya church engraved in the first half of the 19th century.

The Anatomical Theatre housed the comparative anatomy department and veterinary surgeries and laboratories. A large, oval, amphitheatre-shaped lecture theatre was created on the ground floor and an animal prosectorium on the ground floor. At the formal opening of the prosectorium on 13 December 1815, Professor Bojanus delivered a lecture in French, “Des principales causes de la d  g  n  ration des chevaaux.”, which translated into Polish as “On the causes of the disappearance of good horse species”. In this lecture, he predicted the extinction of the pure breed of Polish horses due to the importation of breeding horses from England [27].

Lectures on veterinary medicine and zoology were held in the amphitheatre hall and, from 1815, on comparative anatomy as well. Gradually, exhibits of stuffed domestic animals and Lithuanian fauna and their skeletons began to be placed there. Many species and breeds of stuffed birds were exhibited in the neighbouring halls known as the zoological museum.

On the opposite side of Spasskaya Street, a larger building housed studios for macerating bones and stuffing animal exhibits, and on the floors there were flats for the staff. The attic, had a “blich” (boiler) for bleaching the bones. An animal clinic was built next door. In the neighbouring smaller building, a blacksmith’s shop, carriage house and storerooms were set up on the ground floor. On the first floor, Professor Bojanus took up residence. After the Anatomicum was built, the staff of the medical and natural sciences faculties had very good conditions for scientific research and lectures. Bojanus performed most of his scientific work in the Anatomical Theatre (Figure 3) [28,29].

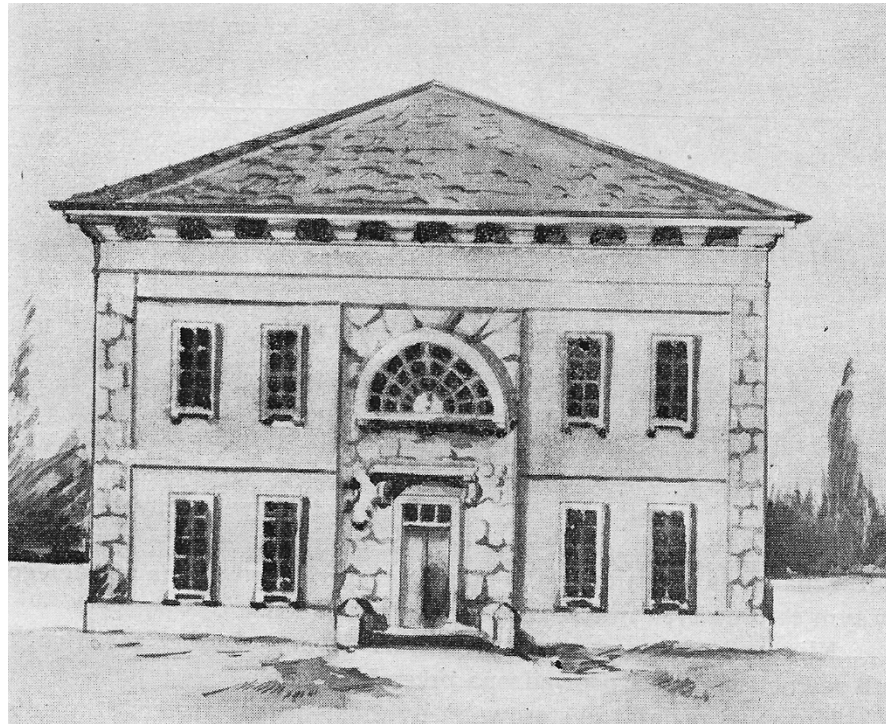


Figure 3. Anatomical theatre engraving 1st half of the 19th century.

8. Interests

In addition to comparative anatomy and veterinary medicine issues, Bojanus approached various aspects of everyday life with curiosity, which he usually considered from the point of view of science. In 1807, during the war in which the Russian army and the Prussian army fought against Napoleon, Bojanus worked in the hospitals of Vilnius, caring for wounded soldiers [9,30]. He noticed recurring lung problems, which he attributed to the faulty design of the army satchel and the poorly designed thongs from which it was suspended. The observation led him to devise a different solution for attaching the military satchel. Bojanus left for St. Petersburg when Napoleon Bonaparte's Grand Army entered Russia in 1812 and did not return to Vilnius after the withdrawal of the French [9]. In 1821, during Tsar Alexander I's stay in Vilnius, Ludwig Bojanus presented a new type of satchel that came into use in the Tsar's army. As a reward for this modification, Tsar Alexander I awarded him a special ring. The hero of this article also became famous as a talented draughtsman. By attaching drawings to his works, he to the time to reproduce details accurately and produce artistic effects. In 1817, he presented a lecture on the art of lithography at a session of the University, which he later published in print: *Lecture on the Art of Lithography* [9]. In 1818, when he proceeded to publish his *Anatomy of a Tortoise*, having found no suitable equipment locally, he built the press for printing the engravings himself. Also, he made the paints himself [31]. He brought an engraver from Germany, Ferdinand Lehmann, to whom he entrusted the engraving of his prepared drawings on copper and their reflection on the newly equipped press. Bojanus also painted portraits of himself, his wife and his friend Gregory Langsdorf. A lithograph depicting his self-portrait is in the collection of the Vilnius Medical Association [7].

9. Conclusions

Ludwig H. Bojanus was, for his time, an active scientist, as evidenced by the publication of 70 scientific papers and his membership in many scientific societies in Europe. There was a break in his work in 1812 when the French army was approaching Vilnius. His organisational activities are also admirable. He expanded the zootomic cabinet, collecting 1653 preparations and skeletons of various animal species and 144 preparations of parasites

called ‘visceral worms’. In 1820, he proposed a reform of the organisation and curriculum of the University. He was widely liked, respected and admired. In 1818, he was offered the position of professor and director of the College of Veterinary Medicine in Berlin. However, he refused, as he also did when the University of Vilnius asked him in 1822 to accept the position of rector. His aim was to organise a veterinary faculty at the University in the longer term. He established a clinic and a school but failed to establish an institute because he lacked sufficiently trained scientific staff. In 1824, he fell ill, probably with tuberculosis. The University granted him indefinite medical leave.

The bibliography of Bojanus’s works demonstrates his extraordinary diligence and diversity of interests. However, he was not only the founder and propagator of a new direction of zoological research in Poland but was also able to gather around him many disciples who later worked in the direction indicated by the master of what we can rightly call the Bojanus school. The most prominent among them are Adam Ferdynand Adamowicz, initially a professor at the veterinary school for fieldpersons and later at the Medical and Surgical Academy in Vilnius, author of many works on anatomy and veterinary medicine; Konstanty Balbiani, author of the anatomy of the medical leech; Adam Bielkiewicz, professor at Vilnius University and the Medical and Surgical Academy in Vilnius, anatomist and physiologist; Karol Muyschel, professor at the Veterinary School, later professor of pet anatomy at the Vilnius Medical and Surgical Academy; and finally Fortunat Jurewicz, prematurely deceased but promising deputy professor of zoology and comparative anatomy at Vilnius University.

Bojanus left Vilnius and went to Germany for treatment, where he died on 2 April 1827 in Darmstadt. A self-portrait and portrait of his wife by Bojanus have been preserved in the collection of the Vilnius Medical Association. Among the most important achievements of Ludwig Henry Bojanus we can include:

1. the organisation and launch of the first veterinary school in the Polish lands in 1823
2. the compilation of a monograph on the anatomy of the European pond turtle “*Anatome testudinis europaeae*” between 1819 and 1821
3. the development of methods for dealing with infectious diseases of animals and publishing them in the book “*O ważniejszych zarazach bydła rogatego i koni*”.

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