

Ilya Buyalsky, professor in the Department of Anatomy at the Imperial Medical and Surgical Academy

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Abstract

This article gives a systematic account of the activities of Ilya Buyalsky in the Department of Anatomy at the Imperial Medical and Surgical Academy in Saint Petersburg. It successively traces the key stages of his life at the academy: his first appointment as a prosector, the defence of his doctoral dissertation, his election as a full professor, and then as head of the department (after the retirement of Academician Pyotr Zagorsky), and his subsequent years of intensive and diverse research and teaching work. Buyalsky's work as a skilled preparator who made a significant contribution to the development of new techniques for preparing anatomical specimens and embalming is explored in depth. Buyalsky had a natural talent for drawing and a refined taste in art; he used various visual teaching aids, many of which were genuine works of art. He was acquainted with well-known artists (Karl Bryullov, Aleksei Yegorov, Maksim Vorobyov, and so on), who helped to create these aids. With the help of archive sources, the recollections of contemporaries, and the historical literature, details are provided of the organisation of teaching, research and curricular work in the department under Buyalsky and his assistants. It is noted that Buyalsky's textbook *A brief general anatomy of the human body* was innovative for its time, including not only information on descriptive human anatomy and physiology, but also an introduction to general pathology, surgery and therapy.

Keywords

history of medicine, Medical and Surgical Academy, normal and pathological anatomy, anatomy teaching, corrosion casts, I.V. Buyalsky, P.A. Zagorsky

Through his diverse academic and practical career, the great Russian physician Ilya Buyalsky (1789–1866) made an outstanding contribution to the development of Russian medicine in the first half of the nineteenth century (Gaivoronsky et al. 2018). Buyalsky, a brilliant surgeon and anatomist, and an internationally recognised scientist, made a significant contribution to many areas of medical science (including pathological anatomy, forensic medicine, therapy, obstetrics, hygiene and public health). He was also one of the first people in Russia to teach surface anatomy. Having a natural affinity for the visual arts and a refined taste in culture, Buyalsky became a professor of anatomy at the Imperial Academy of Arts in 1831, and was subsequently the

first Russian medical professional to be elected one of its academicians.

This study aims to shed light on the main stages of Buyalsky's scientific and practical career in the Department of Anatomy at the Imperial Academy of Medicine and Surgery (IAMS) in Saint Petersburg (fig. 1), and to identify specific aspects of how anatomy was taught an academic discipline in the first half of the nineteenth century.

The meeting of Ilya Buyalsky, a first-half year student in the Department of Medicine at the Moscow branch of the IAMS (in 1809–1810), and Professor Yefrem Mukhin (1766–1850), one of the greatest physicians and scientists of the early nineteenth century, must be considered an exceptionally felicitous

event in the history of Russian science (Smirnov and Kuzybaeva 2019). Mukhin's charisma, impressive capacity for work and passion for his chosen field undoubtedly helped to inspire Buyalsky's interest in scientific research in the fields of anatomy, pathology and other medical disciplines. In Mukhin's anatomy class, the young Buyalsky received an outstanding education, which he continued in the Department of Anatomy at the Saint Petersburg branch of the IAMS (in 1810–1811) under the great Russian anatomist Pyotr Zagorsky (1764–1846).

From the very start of his studies at the Saint Petersburg branch of the IAMS, Buyalsky performed practical work in the anatomical theatre: at the behest of Professor Zagorsky, he initially worked on “preparing corpses and specimens for the daily lectures” (Chistovich 1876, p. 293). On 17 July 1811, he was permitted to perform the duties of an assistant prosecutor, and, in fact, performed all the duties required of a prosecutor. On 25 July 1814, Buyalsky qualified from the academy as a physician. He went on to work there as a part-time (from 1814 to 1818) and then full-time anatomy prosector, a position he would occupy until 1829.

By the start of the 1820s, the anatomical museum established at the department had a wealth of specimens (more than 2,000), principally the anatomical collections of Johann Lieberkühn (1711–1756) and William Cumberland Cruikshank (1745–1800), some of the collection of injection casts of Frederik Ruysch (1638–1731) that were not in the *Kunstkamera*, the osteological cabinet of Professor Knackstedt, anatomical specimens from the 2nd Military Army Hospital, and works by previous prosectors – Matvei Rozhalin (1776–after 1832), Vasily Malakhov (1779–1856), Fyodor Yavorsky (1780–1828), and other alumni of the academy. The young Buyalsky studied this rich anatomical legacy enthusiastically and carefully. He was particularly interested in the technique of anatomical corrosion casting, one of the pioneers of which was the celebrated German anatomist and physician Johann Lieberkühn. In 1817, Buyalsky became the first per-

son in Russia to prepare such casts (Gaivoronsky and Nichiporuk 2018, p. 251), and discovered the secret of preparing a “Lieberkühnian injection” – a fluid for filling the circulatory system of parenchymatous organs, the formula for which he did not publish until 1863: “Take 2 pounds of pure white beeswax and 1 pound of *colophonii depurati* [purified rosin – *author's note*]; break into pieces, liquefy in a saucepan, strain through a clean new cloth, pour a little into a stone mortar pre-heated with boiling water, and add the appropriate dye, ground into the finest powder and sieved: for the artery, pure cinnabar, *cinnabaris in pulvere tenuissimo*, or cochineal; and for the veins verdigris, *aeruginis crystallisati pulverati tenuissime*, or Berlin blue, and grind well with a pestle. Next, pour into the saucepan and heat” (Buyalsky 1863, p. 12).

Buyalsky's method of preparing corrosion casts of the parenchymatous organs was as follows. First, remove the required organ from the body, lightly squeeze the blood out of it, insert the injection tubes into the cut vessels, having ligated the adjacent vessels, place it in a tub of warm water, and leave it to heat up for an hour. Next, fill this organ with the special fluid. If preparing a liver specimen, introduce the fluid into the portal vein first, and

then the hepatic vein and artery in turn; if preparing kidneys, introduce it into the veins, arteries and ureter. Cool the organ in cold water until the fluid sets, and then leave it in a jar of nitric acid solution for several months to excarnate (macerate) the parenchyma, and then wash it, dry it out, mount it on a stand, and cover it with varnish. The remarkable amount of work involved in this process can be seen from the fact that in eight years of work Buyalsky regarded just thirteen out of more than three hundred specimens as fully successful.

Since the specimens were very fragile and easily damaged, Buyalsky found a novel way to record their appearance: he drew and photographed them (a new method at the time), hand-colouring the arteries and veins in the resulting images in red or blue. These photographs were used to produce litho-

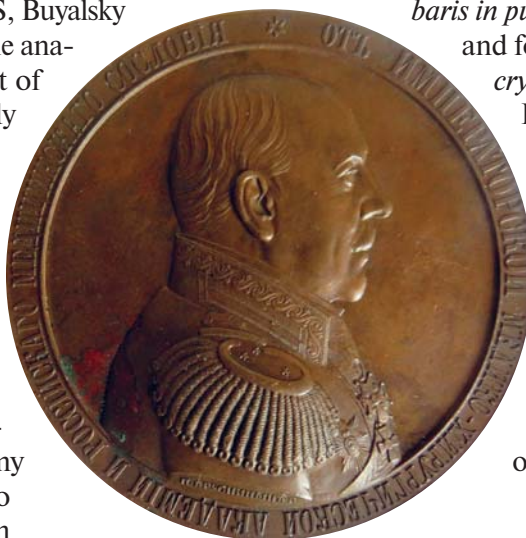


Fig. 1. Medal in memory of the 50th anniversary of service of Professor Ilya Buyalsky. Medalist P.L. Brusnitsyn. Saint Petersburg Mint, 1864. Bronze. From the personal collection of A.V. Smirnov.

graphs, which were included in an appendix to his book *Photographic illustrations of excarnated arteries and veins of human kidneys (arteriae et venae renum excarnatae), removed from specimens, with a detailed description of the method of preparing such specimens* (1863). Based on his own experience, Buyalsky advised those producing such images to “fill the arteries with white, and the veins red: then the arteries will be sharply distinguished from the veins on the photographic illustrations”. In this way, three specimens preserved in Buyalsky’s personal anatomical collection were prepared: “A filled artery of an adult human kidney, of which all the fleshy part has been corroded, resembling a thick branch without any leaves”, “The excarnated renal artery and vein, also resembling a bush without any leaves”, and “The renal artery and vein, filled with the same composition”. Regarding the latter, he provided the following clarifications: “In this specimen, the artery was filled so successfully that the composition reached their thinnest endings, called the hair-like vessels (*vasa capillaria*): the veins are almost invisible; it is likely that the rest of the blood in the said veins prevented the injection from reaching the very ends. The whole specimen, as depicted on the illustration, resembles a bush of the smallest moss. Even the edges of the kidneys found in newborns can be seen in the illustration”. (Buyalsky 1863, p. 5).

In performing experiments with corrosion casts of various organs (the kidneys, liver, lungs, uterus, etc.), and studying them, including with the aid of a microscope, Buyalsky became aware of one of the most important and fundamental issues of anatomy, which has been comprehensively researched today: the particular nature of the blood channels within an organ, depending on the structure of that organ: “Viewing with the help of a microscope the thinnest arteries and veins, filled, and then the excretory channels of different organs of our body themselves, we see that their plexuses are different in different organs, while the excretory channels differ in length: simpler in one organ, and more complex in another, such as in the cellular pleura, in the serous and mucous membranes, in the skin, in the muscles, in the lungs, in the uterus, in the conglomerated glands and others, the division of the arteries is different each time. Without any doubt, this variance in the vascular plexuses, and the different lengths of the excretory channels, has a great influence on the difference between liquid and fleshy parts of our body being prepared or separated from the same fluid, that is, from the blood: clearly,

the involvement of the nerves is the most important cause of the difference in the products. Physiologists rightly observe that the more important an organ is to an animal’s life, the far more numerous the divisions of the blood vessels in it. In the lungs, for example, all the plexuses surrounding the air vesicles greatly exceed the surface area of the entire body, which is necessary to make the blood circulation in the lungs equal to the circulation in the whole body, and for uniform air pressure on the outer surface of the body and the inner surface” (Buyalsky 1863, p. 8).

Buyalsky’s corrosion casts not only astonished his contemporaries with their beauty and excellent craftsmanship, but were also important for teaching and research: “At a time when the X-ray method did not yet exist, preparing such specimens made it possible to obtain for the first time a visual picture of the blood channels within an organ” (Popov and Dyskin, p. 14).

Buyalsky added significantly to the academy collections with specimens he had prepared himself, which his teacher, Pyotr Zagorsky, described as “not inferior to those by Ruysch, Cruickshank and Tomasov” (Prozorov 1850, p. 228). In 1818, Buyalsky was awarded the Order of Saint Anna, third class, for preparing 100 anatomical specimens. In 1819, he prepared another 120. This collection was kept in two cabinets. It included “a) several kidneys, prepared in Lieberkühn’s manner (*preparata excarnata*), the likes of which no one before him in Russia had produced – these specimens earned the utmost praise of the whole Conference and the President of the Academy; b) various specimens of the ocular and hearing organs, with the arteries successfully filled” (Prozorov 1850, p. 228).

The young Buyalsky’s accomplishments were highly rated by professors Zagorsky, Johann-Peter Busch (1771–1843) and Sergei Gromov (1776–1756), who petitioned the Conference for him to be rewarded: “The anatomy protector, medical professional and surgeon, collegiate assessor and knight Buyalsky, in addition to performing his duties with due dedication, has often, because of illness to Academician Mr. Zagorsky, especially during the last three years, taught anatomy lectures with the agreement of the conference, and therefore he, Mr. Zagorsky, considers it his duty to request the conference to procure a worthy reward for Buyalsky as recognition.”¹ The Academy

¹ Russian State Military Historical Archives (RGVIA). F. 316. Op. 69. D. 164. L. 382.

Conference responded to this collective request with a special ruling: “Having agreed all this with the approvals of Messrs academicians Busch, Zagorsky and Gromov set out above on the dedication to service of prosector Mr. Buyalsky, taking account of his ability and excellent knowledge, particularly in anatomy, to confer on him the title of assistant professor in this area, with a salary according to the payroll”.²

In 1822, Buyalsky received a one-time monetary reward of 2,500 rubles for preparing 13 corrosion casts of kidneys “to encourage his endeavours in anatomy and as a reward for his remarkable labours and rare talents” (Stoletie... 1902, p. 81). He gave five of the casts to the anatomical cabinet at the IAMS, and one to the anatomical cabinet at the University of Kiev, and kept seven in his personal collection of “various specimens, medical instruments and antiquities” (“Buyalsky’s Cabinet”), which he built up over half a century (Kuzybaeva 2009, p. 77). In 1829, the universities of Kazan and Saint Petersburg sent letters of gratitude to the Conference, addressed to Buyalsky, for the specimens and tables “donated for the benefit of the universities”.³

Another area of applied anatomy in which Buyalsky did a lot of work and achieved impressive successes was embalming. Buyalsky may rightly be called one of the best embalmers of his day. Although a number of works on embalming⁴ were published in Russian medical literature in the first half of the nineteenth century, the theory and practice of embalming were explained most fully in a work by Buyalsky published in 1866 in the *Meditinskiy vestnik* (“Medical Bulletin”). Buyalsky described his embalming method as follows: “To embalm a body, that is, to fill it with substances preventing decay, one must first make a strong solution of sublimate in ether and inject as much of this solution (comprising one part sublimate and three parts ether) as possible into the arteries and veins with the help of an anatomical syringe and tubes with valves... One must extract all the viscera... After completing this, the whole body is placed in

a bath filled with petroleum (kerosene) or strong spirit of wine, and, if time permits, left to soak in the petroleum or spirit for several days. ...After this, one must first wash the entire inner surface well with tannic acid, a strong astringent (drying) substance, and give this fluid time to act; then, secondly, sprinkle it with finely powdered sublimate; thirdly, fill all the cavities with non-decaying substances, that is, resins, adding 2 or 3 pounds of aromatic oils. The resinous substances used for this are the following: rosin, myrrh, frankincense, mastic, camphor, as well as burnt alum: 40–60 pounds of all the materials, depending on the size of the body. These substances are blended with aromatic oils... After sewing up all the cut parts, coat the whole body three times with tannic acid, and three times with a strong solution of sublimate in alcohol, so that the surface of the body even becomes whitish from the sublimate” (Buyalsky 1866, p. 321–323).

On 19 October 1821, Buyalsky was approved as an assistant professor of anatomy, and in 1822 he wrote his first major scientific work, *Dissertatio medico-chirurgica sistens momenta quaedam aneurysmatum, Pathologiam Therapiamque spectantia* (“A medical-surgical dissertation, including certain aspects of aneurysms relating to pathology and therapy”). At the same time, he presented the Academy Conference with a description of 210 complex surgical operations. In this, he put forward a new and then original theory on the pathogenesis of aneurysms, based on inflammation of the inner wall of the arteries. The Academy Conference sent this work to professors Busch, Friedrich (Fyodor) Heiroth (1776–1828) and Felix Matakiewicz (1789–1833) to review, and they gave positive assessments of it.⁵ The public defence of the dissertation took place on 24 March 1823, after which the 34-year-old Buyalsky was awarded the degree of Doctor of Medicine and Surgery.

Zagorsky continued to support his brilliant student. In 1824, he informed the IAMS Conference: “Throughout the duration of his service at the academy, he has always fulfilled, and to this day fulfils, his duties with remarkable dedication, and therefore, as a reward for Mr. Buyalsky’s previous remarkable labours and assiduous performance of his duties, this official, outstanding in his thorough knowledge

² RGVIA. F. 316. Op. 69. D. 164. L. 382.

³ RGVIA. F. 316. Op. 69. D. 172. L. 172.

⁴ See Spassky I.T. Embalming. *Voенно-медитинский журнал* [Military Medical Journal], part XXVI, no. 1, 1835 (In Russ.); Busch, J.P. A guide to teaching embalming surgery, 1837 (In Russ.); Busch, J.P. On embalming dead bodies, *Drug zdraviya* [Friend of Health], no. 76, 1840 (In Russ.).

⁵ RGVIA. F. 316. Op. 69. D. 165. L. 166.

of anatomy and original art of making anatomical specimens, invented by him, should be appointed to the extraordinary professors”.⁶

In 1825, Buyalsky was approved as an extraordinary professor of anatomy. Gradually, he started giving anatomy lectures in place of Zagorsky, who was often ill at the time, and administering examinations.⁷ In 1824, Buyalsky suffered an accident: when embalming the body of Duchess Antoinette of Württemberg (1779–1824), he cut a finger on his left hand, and the next day the veins and lymphatic vessels in the whole of his left arm started swelling. He was bedridden for more than eight months, and then could not use his left arm properly for another two years. As a result, he resigned as a prosector in 1829.⁸ He was replaced by his student, Pavel Naranovich (1801–1874), who, while studying in the early 1820s, had “willingly helped Buyalsky during his illness to prepare viscera and make injections of arteries and veins, and to prepare nerves for lectures”.⁹

On 5 December 1831, Buyalsky was elected “to the rank of ordinary professor”,¹⁰ “for his outstanding achievements”, and on 10 August 1833, he was appointed Head of the Department of Anatomy, following Zagorsky’s retirement. Pavel Naranovich was appointed his assistant, and the role of prosector was taken by the latter’s brother, Pyotr, who moved to the University of Kharkov in 1837.

Having taken over the department from his teacher, Buyalsky sought to preserve its academic traditions and methods of teaching anatomy: “The first-year students attended Buyalsky’s lectures three times a week, while practical classes were held for those who wanted them; in the second year, preparation was mandatory under the prosector’s supervision. As an educator, Buyalsky was notably even-tempered, and remarkably tireless and efficient” (Tikotin 1950, p. 174–175). In teaching his lecture course, Buyalsky always made his audience aware of the specific features of the topographical anatomy of a particular structure, accompanying his narrative with a demonstration of numerous visual aids, and giving examples from his own extensive practice. One of Buyalsky’s former students, physician Fyodor Oransky, recalled

that when giving a lecture on the foot, for example, “he presented to his audience, in addition to the feet of a dead man, woman, baby and embryo, and skeletons of feet from various tribes, plaster feet used by artists as models; he talked about the changes in the shape of the foot when at rest and in motion, about the advantages of its support points for the weight of the body, about the most comfortable footwear most appropriate for the structure of the foot; he asked his audience to feel the raised bones that serve as guides for the surgeon in various foot operations, and added accounts of certain pathological cases to all this. In discussing the veins running through the bend of the elbow, having shown them on a corpse, and pointed them out on illustrations on the board, he moved on to an explanation of bloodletting and in conclusion gave examples of successful and unsuccessful bloodletting” (Oranskiy 1866, p. 23). Modern teachers of this discipline also recognise the importance of a visual approach, as well as mnemonic approaches to remembering the huge amount of information involved in a traditional university course on normal human anatomy (Murashov and Komandresova 2020, Vagapova and Bulygin 2017).

In his memoirs, physician-in-ordinary Professor Nikolai Zdekauer (1815–1897) recalls an amusing episode that happened to him when he was studying anatomy under Buyalsky and Pavel Naranovich: “Having decided to dedicate myself to the study of medicine, I set about my studies with much gusto. The main subject in the 1st year was anatomy; I borrowed from my late father’s fairly extensive medical library several of the best anatomy manuals of his day and Weber’s famous tables. Having purchased for myself a well-preserved skull, I began to apply myself in earnest to craniology, studying every bone of the skull in the minutest detail – I knew them perfectly. Meanwhile, Professor Buyalsky, under whom P.A. Naranovich was a prosector at the time, finished teaching all the osteology and instructed his prosector to give us the first half-yearly mock examination. I turn up for this ill-fated examination; I take a ticket and read with horror on it the words “*Os femoris*”. All I knew of this subject was that this means “thigh bone” in Latin; I put the ticket back, bowed and returned, embarrassed, to my place. After the examination, P.A. Naranovich expressed surprise that I had found the question so hard, as he had

⁶ RGVIA. F. 316. Op. 69. D. 167. L. 98.

⁷ RGVIA. F. 316. Op. 68. D. 173. L. 236.

⁸ RGVIA. F. 316. Op. 69. D. 172. L. 173–176.

⁹ RGVIA. F. 316. Op. 69. D. 165. L. 198.

¹⁰ RGVIA. F. 316. Op. 69. D. 174. L. 473.

regularly seen me at all Prof. Buyalsky's lectures. When I explained to him my method of studying anatomy, he smiled, advised me to keep up with the lectures when studying a subject, and said that he would question me separately in two weeks' time, and would not give any mark for now. At the appointed time, I passed the examination superbly" (Zdekauer 1891, p. 479).

From 1836 to 1840, even before the IAMS had a separate department of pathological anatomy, Buyalsky taught a course on this discipline and performed pathoanatomical dissections. We can get an idea of how these lectures went from his many extant publications ("pathologo-anatomical descriptions"), containing information on the pathological changes in the body that Buyalsky observed during surgical operations and the anatomical dissection of corpses, such as his pamphlet "An anatomical description of the changing position of the heart, all the major veins and certain other viscera found in the human body, with a defect of the spleen" (1829) (Dorokhina et al. 2020).

Influenced by his teacher, Pyotr Zagorsky, one of Russia's greatest experts on teratology, Buyalsky created a whole series of illustrations of various types of congenital deformities and made extensive use of these images as visual aids for teaching normal and pathological anatomy. The scientist's artistic capabilities were shown in the illustrated publications he produced for students: "A depiction of a horizontal cross-section the human eye, five times enlarged" (1832), "A depiction of the hearing organ" (1833), "Lithographed anatomical illustrations for those studying medical science" (Notebook 1, 1833), containing depictions of the structure of the temporal bone and the inner ear, as well as the underside of the brain with the initial sections of the cerebral nerves. In his preface to the latter, Buyalsky wrote: "Students learning anatomy at Russian academies of Medicine and Surgery and universities badly need anatomical illustrations depicting smaller objects and those necessary for practical medicine, which, seen in lectures once, are difficult to retain in the memory, with a brief description, set out in the order of the lecture book, to make them simpler and faster to read and view. Wishing to make my students' work easier, I have decided to publish such illustrations at my own expense, which will be issued as notebooks, without setting a date. In publishing them, I have been greatly assisted by

his excellency Andrei Petrovich Sapozhnikov, with his dedication and love for the sciences" (Buyalsky 1833, p. 3).

Unfortunately, financial difficulties meant that the latter, approved by professors Busch and Salomon, was not published in full. It is worth noting that many of Buyalsky's other works (primarily those concerning pathological anatomy) also featured excellent illustrations.¹¹ These were produced with the help of artists Andrei Sapozhnikov (1795–1855) and Fyodor Solntsev (1801–1892), who worked directly with Buyalsky's specimens. Many years later, Solntsev recalled how he first met the great physician: "I first met Buyalsky in the following circumstances. One day, he suggested to A. E. Yegorov that he draw various operations of the kind performed by Buyalsky, and anatomical specimens in general. Yegorov declined and recommended me, as a young man who drew no worse than himself. ... From then on, I regularly drew for Buyalsky right up to his death, and, incidentally, made drawings from corpses for his well-known anatomy publications that have been engraved by Afanasyev, Iordan and Professor Utkin" (Solntsev 1876, p. 125).

Since Solntsev dates these recollections to 1815–1817, we can assume that the young Buyalsky was already familiar by then with leading figures from the Saint Petersburg art world, in particular the renowned professor of history painting Alexei Yegorov (1776–1851), academician Fyodor Iordan (1800–1883), and engravers Nikolai Utkin (1780–1863) and Andrei Ukhtomsky (1770–1852), the latter of whom provided illustrations for Buyalsky's doctoral dissertation (*Vystavka...* 1827, p. 134). Buyalsky's closest colleagues also included Academician of Painting Vasily Shebuyev (1777–1855) and Baron Peter Clodt von Jürgensburg (1805–1867).

His particular attention to the artistic side of scientific works is particularly evident in two seminal works that brought him international renown and consolidated his reputation as the greatest Russian

¹¹ See "An anatomo-pathological description of a double uterus, each of which was pregnant at different times", 1832 (In Russ.); "An anatomo-pathological description of two conjoined infants of the female sex...", 1832 (In Russ.); "On the seventh pair of cerebral nerves", 1843 (In Russ.); "An anatomo-pathological examination of ectopic pregnancy", 1843 (In Russ.); "On blood transfusion", 1846 (In Russ.).

surgeon of the first half of the nineteenth century, “Anatomo-surgical tables explaining the practice of ligation operations on major arteries” (1828) and “Anatomo-surgical tables explaining the practice of operations to remove and break down urinary stones” (1852). Buyalsky also devoted a lot of attention to publishing educational anatomical tables (“On the seventh pair of cerebral nerves” (1843); and the anatomical tables in *A brief general anatomy of the human body* (1844)).

In 1836, Buyalsky contributed to Adolphe Pluchart’s celebrated *Encyclopedic Lexicon* with the articles “The tympanic cavity”, “The tympanic membrane”, “The chorda tympani”, “The innominate gland of the eye”, “The innominate bones”, “The crus, shank”, “The cartilage unit”, “Brunner’s glands”, “The belly”, and “The peritoneum”.¹²

A unique outcome of Buyalsky’s many years of work in the Department of Anatomy at the IAMS was his textbook *A brief general anatomy of the human body*,¹³ an outstanding work for its time, as recognised even while its author was alive. Buyalsky complemented the extensive factual material relating directly to human anatomy with information from other natural sciences (comparative anatomy, zoology and physiology), significantly expanding the scope of the ‘canonical’ academic textbooks of descriptive anatomy of the first half of the nineteenth century such as Zagorsky’s *Concise anatomy* (1802) and Mukhin’s *A complete anatomy course* (1815). At the same time, Buyalsky’s textbook is a compilation of the views of its author, a convinced evolutionist and supporter of the theory of gradual development in the organic world (developing the ideas of his teacher, Zagorsky): “The beginnings of a nervous system can already be seen in plants, for we see that leaves and flowers, albeit moving slowly, turn towards sunlight, which constitutes the necessary stimulation for them. Indeed, other plants exhibit clear and rapid movement from stimulations applied to them, such as the mimosa, but we do not find nerves in them. Animals of the simplest form, such as zoophytes and certain members of the worm class, show sensation and movement, like the higher animals, but nothing like nerves, vessels and muscles can be seen with the help of a microscope in their translucent and gelatinous bodies. True, in some worms and insects,

a nerve acting like a spinal cord, from which, in the caterpillar, nerve branches run to other organs, can be distinguished, but they have no brain at all. The brain starts to appear in cold-blooded animals. In the warm-blooded, it is large and extremely complex. And in the human, the brain is the most perfect” (Buyalsky 1844, p. 149–150).

Later, in his *Photographic illustrations of excarnated arteries and veins of human kidneys...* (1863), Buyalsky expands on certain ideas in *A brief general anatomy* concerning the view of nature as a coherent whole: “Looking at these illustrations, one immediately gets the idea that the branchings of the arteries and veins comprising the blood circulation system truly depict, or represent, corals in the living organism, forming a conical shape. In these illustrations, one can see a general law for the structure of bodies, found initially in the mineral kingdom – in corals; then in plants and trees: and finally we see the continuation of this same law in the vein structure of all animals. Consequently, all three kingdoms of nature – mineral, plant and animal organisms – are organised by one universal life – one power – one law: and therefore they have a similarity in their structure” (Buyalsky 1863, p. 6).

Buyalsky’s classification of the components of the human body generally follows Zagorsky’s system, identifying “the liquid, or supported, parts”, of which he names three classes (chyle and lymph, blood and “fluids separate from the blood” and “the fleshy, or supporting, parts” (hard – the bones, cartilage and nails – and soft – the ligaments, muscles, internal organs, vessels, nerves and glands): “During an animal’s life, continuous change takes place in the organic matter; the liquid parts or fluids become fleshy, and the fleshy liquid” (Buyalsky 1844, p. 7).

Buyalsky identified twelve “key systems” of the body (“the cellular pleura [adipose tissue – *author’s note*], epidermis, skin, mucosa, bones, cartilage, ligaments, muscles, blood vessels and absorbent [lymphatic – *author’s note*] vessels, nerves and glands”) and nine organs, or rather organ systems, formed by them (the five organs “of the external senses” and the four “organs of vital functions” – the organs of respiration and digestion and the genitourinary organs), while also setting out the views of leading foreign scientists (Johann Blumenbach, Xavier Bichat, François Magendie, Pierre-Augustin Bécclard, Johann Friedrich Meckel, etc.) on this matter in the book.

¹² See *Encyclopedic Lexicon*. Saint Petersburg: A. Pluchart, 1836–1841. (In Russ.)

¹³ Hereinafter *A brief general anatomy*.

Buyalsky particularly emphasises the importance of the individual variability of the elements of the human body: “All the parts of our body, both the liquid and the fleshy and hard, starting from the moment of birth, or, to put it better, from the moment of conception, right up to death itself, are continuously changing in size, shape, structure, etc. ... Consequently, an internal and continuous motion takes place in us, through which our organs, it seems, wear out and wane on one hand, and wax and gain new strength on the other. This renewal of our component parts constitutes one of the main activities of life, or even, one might say, constitutes life itself” (Buyalsky 1844, p. 148).

Buyalsky’s description of osteology and syndesmology generally follows Zagorsky, but he adds information on age-related changes and parallels from comparative anatomy. In explaining angiology and the nervous system, Buyalsky provides a lot of new (his own) information: he describes the development of the paths of collateral circulation when major vessels are ligated (“After ligation of the main trunks of the arteries, the connecting branchlets greatly distend, and, gaining a suitable increase, replace the ligated artery” (Buyalsky 1844, p. 119)), portocaval anastomoses and veins and their innervation, provides information on individual anatomical variations of the structure of the vessels, and the structure of the autonomic (vegetative) nervous system, and, finally, puts forward a very important theory regarding its central regulation: “the action, or function, of these nerves is not subject to the action of our will; but neither is it independent, but subject to an overall nerve-centre [i.e. the brain – *author’s note*]” (Buyalsky 1844, p. 173).¹⁴

Buyalsky’s wealth of practical experience as a surgeon, and his aim of providing future doctors studying anatomy with elementary information from the fields of surgery and therapy that will be useful to them in clinical practice in the future, are especially evident in the section on angiology: “The ratio of the perivenous space to the periarterial space varies in different periods of life: in infants, it is equal to the periarterial space; in childhood, it is slightly larger; in adulthood, it becomes highly significant, and in old age it is extremely large. This difference results

from the fact that as a person’s body grows the circulation of the blood slows down, and the blood in the veins, in slowing, distends them, leading to the local expansions that often occur in the pelvis and the lower limbs” ... “The junction of the branches of the internal haemorrhoidal vein (*v. haemorrhoidalis int.*) with the branches of the sciatic veins can be larger or smaller. When the junction is large, without doubt, the blood can flow more freely from the haemorrhoidal veins to the hypogastric veins, and thence to the inferior vena cava, thereby reducing the pressure and congestion of the blood, and, consequently, alleviating the attacks of haemorrhoids. Conversely, when the junction of these veins is small, the blood has to congest, so the attacks of haemorrhoids will also be stronger. There is no doubt that whether the junctions of these veins is greater or lesser must have an influence on haemorrhoids” (Buyalsky 1844, p. 126, 135). This approach to teaching human anatomy, introduced by Buyalsky, which was new for Russian medical schools, was developed by his students and successors.

The internal organs are described in *A brief general anatomy* using an original narrative: the structure of the organ in humans; information from comparative anatomy (insects, fish, reptiles, birds and higher animals); age- and sex-related differences; illnesses causing pathological changes in the organs and their congenital malformations. In a number of cases, he also includes elementary information on physiology. In the section on the digestive organs, Buyalsky even goes beyond Ivan Pavlov’s teaching on the influence of the central nervous system on the digestive processes: “Between digestion and the function of the brain, one finds a close connection: with an empty stomach, a person is capable of every mental activity; conversely, with great mental stress, great anxiety, sudden fear, one stops feeling hungry for several days, and digestion is completely impossible: and the food that has previously entered the stomach does not change at all. In contrast, moral pleasure, gaiety and laughter aid digestion” (Buyalsky 1844, p. 228).

In *A brief general anatomy*, Buyalsky also provides information from anthropology, following Blumenbach’s classification of human races (the latter’s *Handbuch der Naturgeschichte* (“Handbook of Natural History”) had been published in Saint Petersburg back in 1797): Caucasian (European according to Linnaeus), Mongolian (Asian), Ethiopian (African), American and Malayan. It is worth noting

¹⁴ Experimental confirmation of this theory came after Buyalsky’s death in the works of Vasily Danilevsky (1852–1939).

that Blumenbach's classification was commonly followed in early Russian anthropological literature, including by Ivan Dvigubsky *Elementary foundations of natural history* (1820), Alexei Lovetsky (*A compendium of physiology or anthropobiology* (1835) and *A brief guide to understanding the tribes of the human race* (1838)), Karl Ernst von Baer (a report "On the origins and distribution of the human races", (1820s)) (Levin 1960, p. 10–13, 18–19). Buyalsky's final work, *Anatomical notes for those studying painting and sculpture at the Imperial Academy of Arts* (1860) includes a table of "Different generations of people", repeating a similar table presented in *A brief general anatomy*.

Immediately after the publication of Buyalsky's guide to anatomy, reviews appeared pointing out various shortcomings in it (for example, it did not mention the cell theory of the structure of living organisms or Baer's discovery of the mammalian ovum, included erroneous ideas about haematopoiesis, etc.). Interestingly, when Buyalsky submitted his work for the academy's Zagorsky Prize, the panel, which included Karl Ernst von Baer himself, as well as Nikolai Pirogov (the chairman) and the younger Zagorsky, rejected it. Evidently, this decision was driven on one hand by the fact that Buyalsky underestimated the state of histology at the time, and focussed on describing the macroscopic features of organs and tissues at the expense of the microscopic, and on the other by the rivalry between Buyalsky and Pirogov, which was emerging at the time. However, Buyalsky's innovative approaches to explaining human anatomy undoubtedly make this work one of the most significant Russian medical publications of the first half of the nineteenth century.

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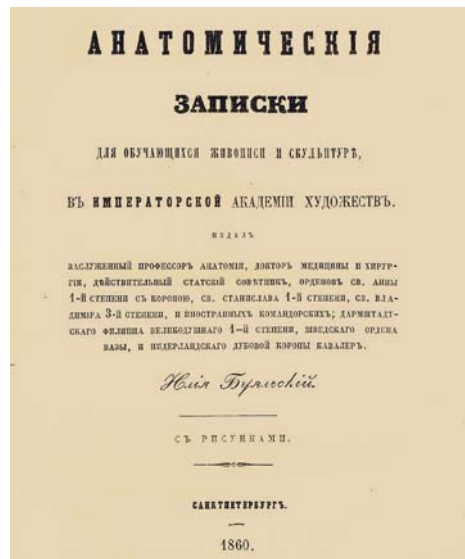


Fig. 2. Buyalsky I.V. "Anatomical notes for those studying painting at the Academy of Arts", Saint Petersburg, 1860, front page. From the personal collection of A. V. Smirnov.

Buyalsky's thirty-year term of service at the IAMS ended on 20 August 1844. Even so, being full of strength and energy, he asked to carry on working. On 6 October 1844, however, came the following imperial edict: "To dismiss him from his position as an academy teacher, to consider his department vacant, and to set about choosing a new teacher" (Tarentsky 1895, p. 63). Pavel Naranovich was elected Head of the Department of Anatomy. Buyalsky, meanwhile, continued to teach anatomy at the Imperial Academy of Arts, where he had been a professor since 1831 (fig. 2).

As such, Buyalsky headed the Department of Human

Anatomy at the IAMS for more than a quarter of a century, successfully combining the most diverse responsibilities: giving lectures and administering examinations, preparing anatomical specimens and embalming corpses, and producing numerous scientific works and teaching materials. Buyalsky's affinity for the visual arts played a major role in the originality of his research and teaching activities, and the artistic skills he acquired in his youth were a significant help to him in studying and teaching anatomy, and in establishing his own collection of medical rarities ("Buyalsky's Cabinet"). As a practising doctor and surgeon, Buyalsky was particularly conscious of the scholasticism of the traditional (descriptive) approach to anatomy, and its detachment from the interests of everyday medical practice, and this is reflected in his *A brief general anatomy of the human body*, which is full of clinical observations, interesting "interdisciplinary" comparisons, and brilliant medical insights, many of which were not confirmed until the twentieth century.

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