

## REVIEW ARTICLE

**NIKOLAI IVANOVICH PIROGOV – AMICUS HUMANI GENERIS**

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**ABSTRACT**

**The aim:** Was to analyze the scientific and pedagogical heritage of N.I. Pirogov through the prism of his outstanding polymathic abilities.

**Materials and methods:** The authors examined the scientific and pedagogical heritage of N.I. Pirogov using the method of historiographical analysis, as well as the methods of synthesis and generalization. The study relies on research publications devoted to N.I. Pirogov's biography, as well as his epistolary and autobiographical works.

**Conclusions:** The scientific novelty of the research is that the biography of N. Pirogov is represented with refinements and additions based on his latest work "From the Diary of an Old Doctor". The authors analyzed the epistolary heritage of N. Pirogov, which served as a valuable biographical source. Given the anthropocentrism of the current stage of the existence of society and European civilization, the authors sought to "revive" the biography of N. Pirogov. In this regard, considerable attention is paid to his personal life. As a result, the article considers this outstanding personality in a new perspective, presenting the main stages of his scientific and medical activity.

**KEY WORDS:** N.I. Pirogov, higher education, scientific heritage, education and training of future doctors

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**INTRODUCTION**

Nikolai Pirogov (1810–1881) is one of the most prominent representatives of medicine of the nineteenth century. Indeed, he was a comprehensively educated surgeon, physician, anatomist, and pathologist, as well as and the founder of field surgery and topographic anatomy, pioneer of plastic surgery, a renowned teacher, innovator, and reformer of Russian education, both secondary and university. By his contribution to medicine and pedagogy, Nikolai Pirogov, rightfully can stand alongside the polymaths of the Renaissance. The figure of N.I. Pirogov, his biography, various aspects of medical, surgical and pedagogical activity are constantly in the focus of scientific interests of many scientists, as evidenced by numerous research works [1-8, 10-12].

**THE AIM**

The aim of the research is to analyze the scientific and pedagogical heritage of N.I. Pirogov through the prism of his outstanding polymathic abilities.

**MATERIALS AND METHODS**

Historiographical analysis is the main method used in this research. In addition to publications in which the biography of N.I. Pirogov was studied from different angles, the autobiographical work of the scientist «From the diary of an old doctor» and his epistolary inheritance were analyzed. We also used general scientific methods of analysis, synthesis, and generalization.

**REVIEW AND DISCUSSION**

*Childhood and youth.* Nikolai Ivanovich Pirogov was born on November 25, 1810 in Moscow. He was the penultimate of fourteen children (and one of the six who survived) of Ivan Ivanovich Pirogov, treasurer of the Moscow Provincial Depot. Nikolai Ivanovich's grandfather came from peasants and served as a coachman. Pirogov received primary education at home. N. Pirogov wrote that the first teacher started to teach him during the ninth year of his life, and before that, he was self-educated, with the help of his mother and sisters. His first teacher was a university student, and his second teacher was a student from Moscow Medical and Surgical Academy. At that time, young Pirogov already read and translated into Latin quite well [9, p. 444]. As a child, Pirogov already aspired to become a doctor. He described his «playing a doctor» as follows: «having seated several people, including a cat, dressed as a lady, passing from one patient to another, I sat at a table, wrote prescriptions, and kept reading how to take medicine» [9, p. 458]. Subsequently, Dr. G. Berezkin presented Nikolai with «Directory of plants used in medicine», and the boy first began to collect herbarium, and then created his own «herb collection» (the so-called book describing medicinal plants and methods of treatment with these plants) [7].

Pirogov (together with his brother Amos) received secondary education at a private boarding house of Vasilii Kriazhev, but since his father bankrupted – Ivan Pirogov's subordinate stole a large sum of money and fled to Moscow, there were no money to pay for Nikolai's further education. According to advice of Professor Yefrem Mukhin, who at that time was the Dean of Medical Faculty and was con-

sidered one of the best practitioners in Moscow (he was invited to treat Pirogov's elder brother, who was ill with rheumatism but, unfortunately, died of the disease at a young age), 14-year-old Nikolai writes an application for admission to Moscow University, successfully passes the exams and becomes a medical student.

*The Dörpt periods and internships in Europe.* In 1828, after graduating from Moscow University, N. Pirogov (at that time a young doctor, aged 17), was sent to Dörpt (now Tartu, a city in Estonia) to study at the Professor's Institute in order to prepare for teaching surgery and invasive arts. Professor J. Moier (1786–1858) immediately drew attention to the extraordinary abilities and hard work of the young doctor, who began to engage N. Pirogov in his scientific activity. In addition, they socialized informally – the professor invited Nikolai Ivanovich to his weekends, together they had lunches and discussed the latest scientific achievements, and subsequently Pirogov almost became a member of J. Moier's family and visited his house almost daily [7; 9]. In December 1829, N. Pirogov won a gold medal for the competition work «What is observed in the ligation of the large arteries?».. On August 31, 1832 (he was only 22 years old at that time) he defended his thesis «Num vinctura aortae abdominālis in aneurysmate inguināli adhibitu facile ac tutum sit remedium?» («Is bandaging of the abdominal aorta with inguinal hernia an easy and safe intervention?»). In this work, N. Pirogov investigated and described the location of the abdominal aorta in humans, circulatory disorders in its dressing, the ways of circulation in the obstruction of this aorta, and explained the causes of postoperative complications. He also offered two accesses to the aorta: abdominal and extra-ventricular. The dissertation was of great theoretical and practical importance, since before N. Pirogov the ligation of the abdominal aorta, followed by the *exitus letālis* of the patient, was performed only once – by an English surgeon, court physician of the kings George IV and William IV, as well as Queen Victoria, Sir Astley Paston Cooper (1768–1841) [7]. In 1833–1836, N. Pirogov was in Germany – Berlin and Goettingen, where he was acquainted with the experience of teaching surgery. During this period, a great influence on the further development of Pirogov as a scientist and practicing surgeon was exerted by professor of the University of Göttingen, surgeon Bernhard Rudolf Konrad von Langenbeck (1810–1887), professor of the University of Berlin, anatomist F. Schlemm (1795–1858), and a prominent physiologist, specialist in comparative anatomy, ichthyologist and herpetologist Johannes Peter Müller (1801–1858). Undoubtedly, Professor Langenbeck, who taught Pirogov the purity of surgical techniques, taught him «to hear the completed melody of surgery», had the greatest influence on the young N. Pirogov, showed how it was necessary to adapt the movements of the legs and the whole body to the movements of the hands during surgery. The most talented student, N. Pirogov, became the embodiment of an ideal surgeon, according to Langebeck, who despised slowness and immobility and demanded clear and harmonious work from his students [7].

German scientists highly appreciated the scientific achievements of young Pirogov, in his memoirs, he wrote that the famous Opitz got acquainted with his thesis and immediately ordered to translate it from Latin into German and print it in the then famous Grefe and Walter journal, and the findings and recommendations by Pirogov began to be actively implemented by many surgeons in different corners of the world. Returning home from Germany, Pirogov came down with typhoid fever and was forced to stay in Riga for further treatment, where, after recovery, he began his surgical career. His career in rhinoplasty began: N. Pirogov provided a noseless barber with a new nose, which he would later call the «best made nose» in his life. From Riga, N. Pirogov went to Dörpt, as he learned that the Moscow department which he had been promised to head, was given to another contender – F. Inozemtsev (1802–1869). N. Pirogov himself wrote about this fact on December 27, 1880, to Y.V. Bernstein [9, p. 429]: «while I was lying sick in the Riga military hospital, Inozemtsev, my friend, was elected... as a Professor of Surgery in Moscow, and I, a Muscovite, remained no beans to count and in a hospital bed» [9, p. 431]. However, N. Pirogov was given a department in Dörpt, which was handed to him by his former mentor – Professor J. Moier. N. Pirogov's Dörpt period lasted for five years. The great scientist wrote about these years as follows: «...5 years of professorship, which required daily eight-hour sessions at the clinic, lecture room and anatomical theater with attendees» [9, p. 431].

During these five years, N. Pirogov published works that have not lost their scientific significance even now: 1) «Anatomia chirurgica truncōrum arterialium atque fasciārum fibrosārum» («Surgical Anatomy of Arterial Trunks and Fibrous Fascia», 1837–1838), in Latin and German with atlas *in folio*; 2) «Annals of the Surgical Clinic», 1836–1837; 3) «Clinical Annals», 1837–1838; 4) the monograph «On the Achilles Tendon Incisions». Undoubtedly, the most outstanding of these works was «Anatomia chirurgica truncōrum arterialium atque fasciārum fibrosārum», in which N. Pirogov laid the foundations of surgical anatomy – a science, which he created step by step, and for which he was awarded the Academic Demidov Prize in 1840.

*The Petersburg period.* In 1841, N. Pirogov was invited to become the head of the Department of Surgery, Pathological and Surgical Anatomy at St. Petersburg Medical and Surgical Academy. Last but not least, this was made possible thanks to the project of introducing hospital classes in Russia for graduates and young doctors, which was submitted by Pirogov to the Trustee of this institution – Kleinmichel. The project was accepted and approved, and N. Pirogov himself headed the Department of Hospital Surgery at the 2nd Military Land Hospital, and also embraced the position of the senior doctor of the surgical department at the same hospital with the right to attend to patients (i.e., the thoracic department). The undeniable merit of N. Pirogov is that since then the hospital clinics have gradually become established at all Russian universities.

N. Pirogov worked at Medical-Surgical Academy for 14 years – these were the years of the height of his talent

and his self-fulfillment as a scientist, teacher and practical surgeon. In the letter of Y.V. Bernstein as of December 27, 1880, Pirogov wrote that for 14 years, he not only taught the course of pathological anatomy, but also personally kept the protocols of 11000 autopsies [9, p. 429]. N. Pirogov was an excellent lecturer. According to contemporaries, his lectures, which were distinguished by a clear manner of teaching and extraordinary content, always took place in overcrowded lecture theatres [2]. Journals and newspapers wrote about N. Pirogov, and his lectures on surgical dissections, sutures, purulent inflammations and autopsy results were metaphorically compared to the performance of the Italian opera singer Angelica Catalani, highly popular at that time – a phenomenal soprano of extremely beautiful and pure timbre, taking G in the third octave.

In 1846, Pirogov was again sent abroad to become acquainted with the organization of anatomical institutions. Since N. Pirogov's duties included the training of military surgeons, he not only began to study the common surgical methods at the time, but also radically refined and improved many of these methods and techniques. Hence, Pirogov paid much attention to the introduction of anesthesia (etherification) into surgical practice. The result of this was his work «Etherisation per rectum», written in French and published in 1847. In July of the same year, during the next Caucasian War, N. Pirogov performed the world's first field operation using anesthesia *per os et per rectum*. He also introduced such new methods of anesthesia as the intravenous and intratracheal routes. During the same military campaign, N. Pirogov for the first time applied fixed bandaging, impregnated with starch, to immobilize complex limb fractures, known as «Seutin bandage» (Louis Joseph Ghislain Seutin, 1793–1862, a Belgian surgeon who suggested this method of immobilization). During his stay in the Caucasus and southern Russia, on behalf of the military department, Pirogov inspected more than 100 military hospitals and in 1848, upon returning to St. Petersburg, issued a «Report on a Medical Trip to the Caucasus», accompanied by an atlas, statistics of all operations performed by him, the use of anesthesia and his own studies of gunshot wounds, which he studied in the wounded and in corpses [p. 432].

In the summer of 1848, an epidemic of cholera Asiatica began in St. Petersburg, and Pirogov organized a special ward for patients at his hospital clinic. The scientist wrote that within 6 weeks he had autopsied 600 deceased with this diagnosis. Furthermore, he presented the results of his own research in the book «Pathological Anatomy of Asiatic cholera» in Russian and French with atlas *in folio*. For this research, the scientist was awarded the Great Demidov Prize from the Academy of Sciences. The period of 1849–1852 was also very fruitful. During these years, N. Pirogov continued to be active in teaching activities, he also headed the Anatomical Institute, consulted patients in five hospitals: Obukhovskaya, Mary Magdalen, Petropavlovskaya, Children's and Masimilianova. In addition, he worked on «Annals of Hospital Clinic», where he gave a description of an osteotomic amputation at the ankle

joint, and the book «On Happiness in Surgery», which he wrote in German.

During the Caucasus Campaign of 1851 – 1852, Pirogov worked on improving the immobilizing starch «Seutin bandage», as previous experience showed its shortcomings in the practice of field surgery. In this regard, he began developing the plaster bandage. The scientist himself wrote as follows: «...I undertook the application of my fixed bandage on the battlefield, because from the experience of the siege of Salta (this is the first Caucasian experience of N. Pirogov – military operation near the village of Salta – the territory of modern Nagorno-Dagestan; the siege of this the village lasted 54 days – from July 25 to September 15, 1847, and Pirogov was directly involved in the military conflict as a surgeon) I saw the various disadvantages of the Seutin starch band... once I went to the sculptor, and became acquainted with the plaster casting of the canvas and immediately applied and tested plaster bandages at hospitals, being sufficiently convinced of their convenience» [9, p. 432].

At about the same time, in search of an effective method of teaching surgery, Pirogov decides to organize anatomy training on frozen corpses (the scientist himself referred to this method as «ice anatomy»). The result of this innovative anatomy study was the publication of the unique anatomical atlas «Anatōme topographica sectionibus per corpus humanum congelatum triplici directione ductis illustrata» («Topographic Anatomy: Illustrated Autopsy, Conducted through the Frozen Body of a Man in Three Directions», 1851–1859) – it was an edition containing 995 full-size cross sections (like in a 3D format) with four notebooks of various prefaces and detailed explanations. Thanks to this atlas, surgeons were able to perform operations with minimal injury to patients. Nikolai Ivanovich wrote about his works without undue modesty: «My works for the first time showed with accuracy and clarity the relation of the fascia to the arterial trunks and indicated the ways most convenient and accurate to perform surgery on the arterial trunks. The sections of organs and cavities frozen in different positions together with the anatomical sculpture provided a way to determine the normal anatomical position and the interposition of different organs and joints with accuracy, impossible through the usual way of study» [9, p. 437]. Moreover, the cross section method proposed by Pirogov became the basis for such extremely common and informative methods of life-time diagnostics as computed tomography (CT) and magnetic resonance imaging (MRI). N. Pirogov participated in the Crimean campaigns of 1853 and 1855. Thus, during the Crimean War of 1853 he was the chief surgeon besieged by the Anglo-French troops of Sevastopol. During this military campaign, N. Pirogov, operating the wounded, for the first time in the history of medicine, used a plaster band to immobilize the limb, thus establishing the tactics of preserving the injured limbs and saving many soldiers from amputation. During the siege of Sevastopol, Pirogov supervised the nurses' training and work – the Holy Cross community of sisters that was an unprecedented innovation until then. N. Pirogov is con-

sidered the founder of military surgery, because it was he who introduced a new method of care for the wounded: the injured were subjected to careful examination and triaging at the first dressing point. Depending on the severity of injuries, some had to be operated as quickly as possible in the field, while others, with minor injuries, had to be evacuated deep into the country for treatment in stationary military hospitals.

In 1861–1864, a book by N. Pirogov, «The Basics of General Military Field Surgery», was published in Leipzig in German, where the scientist presented his views on hospitals, medical administration, dressing points and wound healing. Nikolai Ivanovich wrote about this work: «My proposed system of triaging the wounded and the energetic resistance against the evil inflicted on the wounded at hospitals made a great impression. This book represented the ideal of the Red Cross Association before it was officially adopted.

*Personal life.* N. Pirogov was quite uncompromising in his personal life. In the second year of his stay in St. Petersburg, he became ill and thought that he had no family, so he finally decided to marry. The great scientist was married twice: for the first time – to Katerina Dmitrievna Berezina (1822–1846) – a girl from the noble but impoverished family (she was the granddaughter of the famous Earl M. Tatishchev – cavalier of all orders of the Russian Empire, her father gambled away her mother's dowry). According to biographers, the wedding, which took place on December 11, 1842, was quick and modest. During the fourth year of married life, Katerina died of complications during childbirth, leaving Pirogov with two sons: the elder – Nikolai (1843–1891) and the younger – Vladimir (1846–1910). With all his frankness, N. Pirogov confessed that after the death of his wife, he felt very lonely – two attempts to marry were not successful. Meanwhile, few friends have told Nikolai Ivanovich about a girl who is passionate about reading his article about a perfect woman. Four years after the death of his first wife, Pirogov married for the second time. His second wife and, as it turned out later, the love of a lifetime, as well as a loyal friend and soulmate, was that very girl who enthusiastically read the article about a perfect wife – Baroness Alexandra Antonovna von Bistram (1824–1902) – the daughter of General Lieutenant A. von Bistram and the great-granddaughter of the navigator I.F. Krusenstern. N. Pirogov had no children from this marriage.

*Vinnitsia period.* In 1859, shortly before his retirement, N. Pirogov bought an estate with the romantic name «Vyshnia» (meaning «Cherry») near Vinnitsia, where his family settled. In his estate, N. Pirogov organized a charge-free hospital. After his resignation, the scientist traveled abroad several times on behalf of the Red Cross, and also to St. Petersburg to lecture at the invitation of St. Petersburg University. During the Franco-Prussian War, the scientist was invited to inspect the military hospitals opened on the frontline. N. Pirogov inspected more than 70 infirmaries and was widely respected everywhere, because the vast majority of Prussian doctors applied the techniques and relied on the principles of military surgery, established down by

this distinguished scientist. The inspection resulted in the «Report on Visits to Military Establishments in Germany, Lorraine and Alsace», published in Russian and German. Like anything done by N. Pirogov, this report was of great importance for the improvement of medical treatment in the army and organization of first aid to the wounded [6]. As one of the most famous surgeons of the nineteenth century, N. Pirogov treated German Chancellor Otto von Bismarck, the Russian composer Peter Tchaikovsky, and also saved the leg of Giuseppe Garibaldi, the Italian national hero, commander, revolutionary and political figure, from amputation [1].

*Illness and death.* At the beginning of 1881, N. Pirogov drew attention to the pain and irritation of the mucous membrane of the hard palate. On May 24, the same year, the eminent surgeon M. Sklifosovskiy (1836–1904) diagnosed N. Pirogov with cancer. The caring wife first took Pirogov to Moscow, where he was examined by local physicians, and then to Vienna for consultation with the well-known surgeon Billroth, who assured Nikolai Ivanovich that the ulcer on the palate was benign and the operation was unnecessary... A prominent surgeon died of cancer on 5 December (23 November) 1881. According to the legend, during the agony of Nikolai Ivanovich, a lunar eclipse occurred. N. Pirogov's widow received permission from the Orthodox Church to embalm the body of the prominent surgeon, after which it was moved to the basement with a window, over which the Church of St. Nicholas was built in 1885. Until her death (1902), Alexandra Antonovna took care of the estate, but due to material difficulties that occurred in the family of the great surgeon after his death, the estate gradually declined. Around 1914, the grave of a great scientist and doctor was devastated: an épée – a gift from the Austrian Emperor Franz-Joseph, was stolen from it, as well as a metal cross lying on Pirogov's chest. The further fate of these valuables is unknown. During the grand opening of the monument to Pirogov, another prominent surgeon in Moscow, M. Sklifosovskiy, delivered a speech in which the essence of Pirogov's figure is concentrated: «Pirogov's contribution to science... will remain an eternal treasure and cannot be erased from the historical tablets until the European science exists... The people, who had their Pirogov, have the right to be proud...» [11].

## CONCLUSIONS

The authors analyzed the epistolary heritage of N. Pirogov, which served as a valuable biographical source. Given the anthropocentrism of the current stage of the existence of society and European civilization, the article sought to “revive” the biography of N. Pirogov. In this regard, considerable attention is paid to his personal life. The scientific novelty of the research is that the biography of N. Pirogov is represented with refinements and additions based on his latest work “From the Diary of an Old Doctor”. As a result, the article considers this outstanding personality in a new perspective, presenting the main stages of his scientific and medical activity. The study of the scientific and pedagogical

heritage of N.I. Pirogov is a basis for generating new ideas and developments in the modern medical education, as a classic example of combination of professional and intellectual, theoretical and practical, social and personal skills and abilities of a doctor.

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## Conflict of interest:

*The Authors declare no conflict of interest.*

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**A** – Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article