

## REVIEW ARTICLE

## THE SCIENTIFIC AND PEDAGOGICAL HERITAGE OF DOCTOR N.I. PIROGOV

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### ABSTRACT

**The aim:** was to analyze the scientific and pedagogical heritage of N.I. Pirogov, which remains relevant in the modern medical and pedagogical community, and opens new little-known pages of the scientific, pedagogical and medical activity of the doctor.

**Materials and methods:** The authors conducted a thorough analysis of scientific publications by N.I. Pirogov and papers devoted to his activity as a doctor, educator and researcher using analytical, comparative and bibliosemantic methods.

**Conclusions:** The study suggested the new chronological boundaries in the scientific and educational heritage of N.I. Pirogov. The developed periodization accurately reflects the beginning of his scientific and pedagogical path in medical education, specifically refers to the period of his work in Germany as a supervisor of professorial candidates from 1862 to 1866, and the period of his participation in Sevastopol (Crimean) campaign and in the Franco-Prussian War, which was very important for the development of military field surgery.

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

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### INTRODUCTION

The reform of national healthcare system has identified priorities for the competence paradigm of training future doctors and updating educational programs for healthcare professionals. The combination of modern developments in medical science with major cultural achievements and the vast heritage of prominent Ukrainian doctors should extrapolate the problem of updating Ukrainian medical education at all levels of professional training and preserving its national identity. In our opinion, the appeal to the scientific and pedagogical heritage of Nikolai Ivanovich Pirogov (1810 – 1881) – a prominent scientist, founder of topographic anatomy and military field surgery, doctor, educator, humanist, enlightener and reformer of national education, – is a basis for generating new ideas and developments in the field of medical education, as a classic example of a combination of professional and intellectual, theoretical and practical, social and personal aspects.

### THE AIM

The aim of the research is to analyze the scientific and pedagogical heritage of N.I. Pirogov, which remains relevant in the modern medical and pedagogical community, and opens new little-known pages of the scientific, pedagogical and medical activity of the doctor, giving impetus for a systematic analysis of his life-work.

### MATERIALS AND METHODS

The authors conducted a thorough analysis of scientific publications by N.I. Pirogov and papers devoted to his activity as a doctor, educator and researcher using analytical, comparative and bibliosemantic methods. The study of scientific and pedagogical literature showed that N.I. Pirogov's personality was researched by scientists of different fields, but despite a considerable amount of research of pedagogical views, N.I. Pirogov's scientific and pedagogical heritage needs further systematization and special consideration. Most modern scholars (O. Bieliaieva, L. Bondar, N. Zarems'ka, M. Levkivskyi, O. Mykytiuk, O. Pisots'ka, N. Pobirchenko, S. Sysoieva, I. Sokolova et al.) encourage to study the pedagogical heritage of N.I. Pirogov due to importance and adaptability of pedagogical developments of the scientist for the present pedagogical activity for the school system of national education under conditions of its reformation.

The scientists' appeal to educational ideas of N.I. Pirogov has been going on for over a hundred years, and has a great deal of proficiency in the form of profound dissertation studies of his works and pedagogical activity, considering the humanistic nature of his pedagogy (O. Horchakova, K. Fedoruk et al.) and views on the upbringing of the young person's individuality (O. Bakushkina, O. Dolia, V. Inozemtsev, O. Savytska et al.). Some works are devoted to research and teaching activities of N.I. Pirogov in higher

medical education and his medical and educational ideas of improving the efficiency in medical practice (O. Bieli-aieva, M. Voronov, I. Haivoronskyi, O. Klantsa, M. Kushyk, B. Pazynych, A. Postoi, H. Semanov, O. Okulov, E. Khodosh and others).

The scientific and medical heritage of N.I. Pirogov has been extrapolated by modern scientists to solve problems of anatomy, military medicine, forensic medicine and other medical branches.

## REVIEW AND DISCUSSION

In our opinion, the analysis of N.I. Pirogov's scientific and pedagogical heritage deserves particular attention from the standpoint of the current state of national medical education and the importance of his scientific work for its reformation in terms of entering the European and world educational space. In the scientific literature, there are several periods in the formation of N.I. Pirogov's pedagogical views. For example, O. Horchakova in the study of the formation and development of the humanistic pedagogical concept of N.I. Pirogov proposes 5 periods, "corresponding to the stages of his pedagogical activity" [1, p. 6-7]: the first period (1810-1828) is the stage of formation of the character, the worldview of the scientist, his definition in scientific interests and priorities of research in the medical field; the second period (1828-1841) is the stage of scientific and medical search and experience of teaching practices in Tartu University; the third period (1841-1856) is the stage of formation of the pedagogical concept of the scientist at the Medical and Surgical Academy in St. Petersburg and publication of the article "Issues of Life"; the fourth period (1856-1861) is the stage of practical realization of the pedagogical concept of Pirogov in Odesa and Kyiv educational districts; the fifth period (1861-1881) is the time of recognition of pedagogical views of Pirogov in the society and dissemination of his ideas in the pedagogical theory and practice. In our opinion, the chronological boundaries of periodization, which have been outlined, do not accurately reflect the beginning of his scientific and pedagogical path in medical education, they do not specifically mention the period of his work in Germany as a supervisor of professorial candidates from 1862 to 1866, and the period of his participation in Sevastopol (Crimean) campaign and in the Franco-Prussian War, which was very important for the development of field surgery. These "white spots" in the periodization of research and educational views of N.I. Pirogov need appropriate correction on the basis of study of new sources and scientific publications in medical and pedagogical heritage of the famous doctor.

The analysis of scientific works by N.I. Pirogov and publications devoted to his activity as a doctor, scientist and educator, demonstrate that the first steps in the formation of scientific and pedagogical views of N.I. Pirogov were made during his studies from 1824 to 1828 at the Medical Faculty of Moscow University. Under the influence of lectures delivered by M.Ya. Mudrov (1776-1831) – a professor, clinician and brilliant educator at the university, the young

N.I. Pirogov became interested in pathological anatomy, although it was not taught as a separate subject at that time. In the monograph by the famous pathologist, professor M.K. Dal, it is noted that according to the statement of N.I. Pirogov, the lectures by M.Ya. Mudrov "continually explained the need to study pathological anatomy and dissection of corpses... and thereby made me want to get acquainted with this *terra incognita*", and later, as M.K. Dal wrote, N.I. Pirogov said that university studies "left a deep impression on the whole life, slammed into the soul and gave a well-known direction for life" [2, p. 4-5].

The next period of formation of N.I. Pirogov as the scientist was the so-called "Dörpt period". This is when N.I. Pirogov was sent to Dörpt University in Germany after completing his studies at the University to write a doctoral thesis. The topic of dissertation was suggested by N.I. Pirogov, and it was entitled: "Can Ligation of the Abdominal Aorta Give a Favorable Result in the Inguinal Aneurysms?". In the content of his dissertation, N.I. Pirogov used the elements of pathological anatomy, thereby establishing the technical possibility of ligation of the abdominal aorta. He suggested the most convenient location for such ligation and identified operative approaches to the abdominal part of the aorta. In his dissertation, on the basis of animal studies, N.I. Pirogov was the first to demonstrate the presence of collateral circulation and its connection with the circulation in the abdominal aorta and spinal cord. The thesis was defended on August 31, 1832. The text of the thesis in 40 pages was published in Latin and translated into Russian for publication in *Bulletin of Natural Sciences and Medicine* that was monthly published in Moscow and was edited by Dr. Iovskiy [2, p. 4-5].

A few years later, in Berlin, N.I. Pirogov showed his dissertation to the famous surgeon Opitz, who was amazed by the practical achievements of the young surgeon and ordered to translate it into German as a matter of urgency [3, p.11]. Thus, in 1838, it was published in a German surgical journal. The stay of N.I. Pirogov in Dörpt was not limited to writing and successful defending of his thesis. The first scientific work by N.I. Pirogov was published in 1829 and was dedicated to anatomic and topographic description of the hip and groin area. At that time, N.I. Pirogov conducted numerous practical researches in the field of pathological anatomy; he worked with German professors and surgeons Schlemme, Langenbeck and Textor, whose experience N.I. Pirogov highly praised and criticized at the same time. For example, N.I. Pirogov had some practical remarks to certain techniques and surgical instruments of Langenbeck, though he highly appreciated his operational skills. Professor Textor received the most severe criticism from N.I. Pirogov, because of the slowness of his operations, which the young scientist considered unacceptable. At the same time, the young N.I. Pirogov greatly appreciated Schlemme's operating experience and found many common scientific interests in anatomy [3, p. 11-12]. Through his experimental studies, the young doctor aspired to change the attitude of well-known surgeons to pathological anatomy and to gain recognition of his

active practices in this field. His anatomical experiments were supported by the famous German professor Moyer, who supported the young N.I. Pirogov in the direction of development of pathological anatomy. Moyer gave him the opportunity for extensive surgical practice in his clinic and facilitated his research activities. N.I. Pirogov's work at Dörpt Surgery Clinic demonstrated his undeniable talent as a scientist and surgeon, therefore his assignment as a Professor of Surgery at Dörpt University in 1836 was a natural result of his extensive work in surgery and anatomy.

The beginning of N.I. Pirogov's professorship and teaching activities was associated with publication of the two volumes of "Annals of Surgical Clinic", which were the first attempt to share with young doctors the experience in surgery and to predict their errors in practice [2, p. 9]. The critical attitude of Pirogov to his medical activities in this scientific publication was a very unusual recognition of one's own mistakes by the professor and practicing surgeon. The world appraisal of Pirogov as a leading scholar of the time in the field of operative surgery were heralded by the work "Surgical Anatomy of Arterial Trunks and Fascias", which was published in Dörpt in 1837 in Latin, German and French. The work was primarily written for young surgeons in order to show the relationship between pathological anatomy and surgery in their practical dimension, and to teach them new techniques for providing surgical care [2, p. 10]. For this work, N.I. Pirogov later received the Demidov Prize of the Academy of Sciences.

Lectures of the young professor N.I. Pirogov were very different from the ordinary lectures of professors at Dörpt University. He was the first to introduce simultaneous teaching of theoretical and practical surgery with assigning of students to patients at clinics. Researchers in the scientific and pedagogical heritage are unanimous in that N.I. Pirogov had an extraordinary lecturing skill in delivering meaningful, sophisticated material, which was accompanied by his own hands-on research and prompted students for scientific inquiry and enhancing their professional competence. One of the priority teaching tasks of N.I. Pirogov was the development of students' scientific thinking and motivation to learn from other people's mistakes. This was brilliantly demonstrated to his students during his lectures. The peculiarity of his lectures was that in actual clinical cases he pointed the necessity of knowledge in surgical anatomy of that body part, which needed surgery. Such a clinical and pathological analysis, according to N.I. Pirogov, enabled a doctor to better perform medical diagnostics and prevent errors in surgery. The desire to change the teaching and learning methods was not positively favored by the German education system and, in our opinion, was the reason for N.I. Pirogov's return to St. Petersburg in 1840, where he was invited to head the Department of Surgery at the Academy. However, due to bureaucratic obstacles of the time N.I. Pirogov was officially appointed to the position of Professor at the Academy only a year later, in 1841. It was in 1841 that a new period of teaching activity of Pirogov at St. Petersburg Medical and Surgical Academy began, as well as the continuation of

his practical surgical activity as the Head of the Surgical Department of the Second Military Land Hospital [3, p.18]. As an educator, N.I. Pirogov considered it necessary to constantly combine lectures and practical classes. He paid attention to the use of his own research, clinical experience, emotional connection with the audience and the use of clarity in teaching. In 1846-1852, he taught students of the 5th year of study in pathological anatomy at the sectional table, delivered lectures "On Typhoid Lesions and Typhoid Deposits in the Lung, Spleen, Kidneys and Intestines", "On sepsis after Typhoid", "On Typhoid Process" [5, p. 9-10], as well as presented reports in medical communities on the features of manifestation of typhoid fever and on his own pathological and anatomical studies of patients who died. N.I. Pirogov continuously used the knowledge and experience of well-known foreign doctors Pettenkofer, Seitz, Louis and Rokitanskyi in the fight against typhus epidemic during his lectures and in his professional medical practice during an epidemic in 1848.

During this period, N.I. Pirogov actively participated in combat events in the Caucasus region (1847) as a military surgeon of the acting army, and participated in the defense of Sevastopol (1854-1855) as a surgeon and organizer of military medical service. In particular, during Sevastopol (Crimean) campaign, he organized a special epidemiological and quarantine hospital (more than 1000 beds) that were located along the military deployment that made it possible to timely prevent the spread of epidemic in the army [5, p. 11]. During his work at the Medical and Surgical Academy, N.I. Pirogov developed a general academic prosectorium and pathoanatomical museum of the Academy, managed the Anatomical Institute (approved by his project) [6, p. 56], and for his scientific achievements in the medical field he was elected as a corresponding member of the Russian Academy of Sciences of the Biological Branch and academician of the Medical and Surgical Academy.

In our opinion, professorship at the Academy and regular meetings with students formed N.I. Pirogov's own vision of the development of education, pedagogy and personal upbringing of the young man's personality, therefore his appointment as a trustee of Odesa educational district in 1856, and a trustee of Kyiv educational district since 1858 after his retirement from the Medical and Surgical Academy, was a natural development of his scientific and pedagogical activity of a scientist and his desire to influence education of the young generation. He noted that "in pedagogical activity I was mostly concerned about the agreement between school and life, about the freedom of scientific research, about the excitement of respect for human dignity and truth in students and teachers" [7, p. 937-938].

In our opinion, the work by A. Rozhdestvina "Mykola Ivanovych Pyrohov as a Teacher" (1902) is a deep and original research of this period in his scientific and pedagogical activity. In this work, A. Rozhdestvina detaches from Pirogov's characteristics as a teacher, administrator and devotes her research to Pirogov as a theorist, teacher, drawing attention "to the ideas of the great teacher, which

were most important both in principle and practical respects” [8, p. 7]. The book reveals and organizes scientific and pedagogical views of N.I. Pirogov on the following issues: education and training; the role of sciences in the educational process; the importance of visualization and words in learning; the teaching methods and their peculiarities; the importance of a foreign language for education of young children; the duty of the society in relation to education and training. Pedagogical ideas of N.I. Pirogov on the formation of culture of mental work in young scientists are further analyzed and described in a very original way by I.O. Sikorskyi in his work “N.I. Pirogov as a Thinker and a Man” (1910). A well-known psychiatrist, professor at Kiev University of St. Vladimir, he notes that N.I. Pirogov, “like Shakespeare,” makes a clear dependence in shaping the personality of a young man of “university age” from their systematic pursuits of science and mental work. Interest in scientific activity creates “physiological conductivity in the mechanism of neuro-psyche innervations” in a young man and is a “psycho-hygienic tool” for the development of self-control, nurturing freedom, formation of vital, moral principles of being. N.I. Pirogov recommended that young people should spend their youth years as he did in education and scientific activity. It is this persistence to study the sciences at a young age that ensures success and protects young people from “wandering and disturbance” [9, p. 9-10].

During this period, excited with reforming the educational system, N.I. Pirogov received great support and appraisal from the progressive professors of the time, teachers and students. Perhaps the most striking characteristic of the scientist in the position of a trustee of Odesa and Kyiv educational districts is the feedback on his work after his retirement in 1861 due to the state of health. In fact, various Kyiv and Odesa educational institutions organized a solemn ceremony at which N.I. Pirogov encouraged students to stay true to science [10, p. 908-910]. In memory of his teaching at Kiev University, N.I. Pirogov presented students with his portrait, which is now kept in one of the university auditoriums as a symbol of progressive ideas and reforms, which were the main tenets of the scientist's activity as a trustee. After his retirement, the scientific and pedagogical activity of N.I. Pirogov continued in Germany as the head of the professorial candidates, who were sent to continue scientific work under his tutelage [11, p. 37]. Scientific knowledge, experience in Germany, personal relations and organizational abilities of N.I. Pirogov over the period of four years helped more than one hundred professorial candidates in different specialties to choose scientific supervisors among the leading European scientists, to study the current directions of research of that time and to develop their own scientific topics and programs that could be further developed at national scientific universities. This period of the scientist's life involved the possibility of implementing his scientific experience, his knowledge in organization of research work of young scientists. For Pirogov, organization of research by professorial candidates at the European universities was commonly related with

practice, accompanied by the creation of favorable conditions for classes, sufficient material support of researchers abroad and ensuring the introduction of scientific developments in the domestic science after returning home. N.I. Pirogov was very attentive to professorial candidates, highly valued their scientific abilities and hard work, and recommended his students to the departments of leading universities.

In Heidelberg, and then in Berlin, N.I. Pirogov organized literary evenings at his home, which the youth called Pirogov's Saturdays. Professor I. Sokolovskyi says that these Saturdays raised topical issues of life and science, and, typically, there were ardent discussions and debates in which Pirogov was active, but “willingly conceded the word to each of those present” and “was strong in dialectics and found particular pleasure in scientific discourse” [12]. As a teacher and reformer in Germany, N.I. Pirogov continues to analyze the problems of higher education and writes a series of “Letters from Heidelberg”, as well as the article “The University Issue”, published as a separate brochure, in which he offers his competent vision of university reform with qualitative changes in “material status” of the university life, “division of rank and position”, “free competition”, “development of respect for the fact” [13, p. 324-393]. However, the most significant scientific work by Pirogov in this period was the publication of “The Beginning of Field Surgery” in German. The work was published in Leipzig and became an indispensable guide for surgeons in the organization of hospitals, medical administration, dressing rooms and antiseptic wound treatment. N.I. Pirogov briefly described his experience of military and medical work in twenty paragraphs of the book, which were then published in 2 volumes in Russian.

N.I. Pirogov witnessed the implementation of his recommendations on organization of hospital surgery a few years later during the Franco-Prussian war as a representative of the Society of Care for Wounded and Sick Soldiers. Within 5 weeks, N.I. Pirogov inspected 70 military hospitals and noted that all foreign doctors had comprehensively applied his methods of treatment and organization of medical care for the wounded and sick. As a result of this trip in 1871, he published “The Report on the Visit to Military Health Facilities in Germany, Lorraine and Alsace in 1870”, and after a period of six months in the Russo-Turkish War, N.I. Pirogov wrote “Military and Medical Treatment and Private Care at the War Theater of Bulgaria and in the Rear of the Active Army” in 1879. The importance of these books for the formation and development of field surgery was so crucial that many researchers refer to them as the real scientific feat of N.I. Pirogov [11, p. 57-63].

The active period of scientific and pedagogical practice of N.I. Pirogov continued in 1879-1881 at Vyshnia estate near Vinnytsia. At this time, he wrote the memoir “Issues of Life. The Diary of an Old Doctor”. This work became the last one in Pirogov's heritage on the issues of human education. The humanistic orientation of Pirogov's entire life was reflected in his work as observance of the norms of Christianity, civic duty, ethics and morality. Researchers

note the anthropological approach of the scientist to the essence of a man [14; 15]. Solving problems of education and training, which are strongly linked, were considered by N.I. Pirogov as crucial in the formation of personality, his/her spiritual foundations, ideas about the world, values and way of being. Until the last days of his life, the severely ill N.I. Pirogov worked on the manuscript of his "diary". These memoirs remain relevant both to modern pedagogical science and to the formation of a modern personality of the 21st century.

Thus, a deep analysis of various sources gives us the opportunity to develop a new periodization in scientific and pedagogical activity of N.I. Pirogov, namely:

**The 1st period: formation of a scientific (1824-1828)** – study at the Medical Faculty of Moscow University, where under the influence of prominent professors of that time the young Pirogov developed a scientific interest in complex medical processes and problems, as well as the desire to solve them with new non-standard methods.

**The 2nd period: Dörpt (1828-1832)** – training at the professorial institute of Dörpt University, writing the first scientific work "What is Observed during Operations for Ligation of Large Arteries" (1829), defense of doctoral thesis, dedicated to the ligation of the abdominal aorta (1832).

**The 3rd period: teaching (1833-1839)** – scientific and practical work in the clinics of Germany (1833-1835) and France (1838), the beginning of teaching activities at Dörpt University (1836), publication of "Annals of the Surgical Clinic" and "Surgical Anatomy of the Arterial Trunks and Fascias" (1837-1839).

**The 4th period: academic and military (1840-1856)** – was a very active stage of N.I. Pirogov's life, and it should be divided into the following directions: *The first direction: academic and administrative* – working as a professor at the Medical and Surgical Academy in St. Petersburg (1840-1856), founding of the surgical clinic and pathoanatomical museum of the Academy, running the Institute of Practical Anatomy at the Academy (1846), election as a corresponding member of the Russian Academy of Sciences, Biological Branch, and academician of the Medical and Surgical Academy (1847), election as an associate member of the Petersburg Academy of Sciences, election as an honorary member of Moscow, Kharkiv and Kiev universities (1855), retiring from the Academy (1856). *The 2nd direction: military and surgery* – working as a chief doctor at surgical department of II military land hospital, conducting the first surgery under ether anesthesia (1847), working as a military surgeon in the combat army in the Caucasus region (1847), a surgeon and organizer of the military medical staff in the defense of Sevastopol (1854-1855), initiator of involving the Sisters of Charity in the care for the wounded, resigning as a surgeon practitioner (1856). *The 3rd direction: research and practice* – embraced publication of the monograph "On the Transection of the Achilles Tendon as an Operative Orthopedic Therapeutic Agent" (1840), publication of 12 issues of the manual "A Complete Course of Applied

Anatomy of the Human Body, with Figures (Descriptive, Physiological and Surgical Anatomy)" (1843-1848), publication the book "Anatomical Images of the Human Body, Intended Primarily for Forensic Doctors. With an Atlas" (1846), publication of "Illustrated Topographic Anatomy of Cuts Drawn in Three Directions Through a Frozen Human Body" (1852-1859), and publication of the article "Issues of Life" in *Maritime Collection* (1856). *The 5th direction: teaching (September 1856-1861)* – working as a trustee of Odesa (1856) and Kyiv (1858) educational districts, publication of "Collections of Literary Articles by N.I. Pirogov" (1858), publication of the article "What do We Want?" and "On the Subjects of Judgments and Debates at the Pedagogical Councils of Gymnasiums" (1859), "Thoughts and Comments on the Draft Charter of Schools at the Department of Ministry of Public Enlightenment" and "School and Life" (1860), retiring from the office of the trustee due to state of health (1861), moving to Vyshnia village near Vinnytsia (1861). *The 6th direction: scientific and organizational (1862-1866)* – working in Germany as a supervisor of professorial institute, writing scientific and pedagogical articles "The University Issue" and "On Sunday Schools" (1863), publication of the book "Fundamentals of General Military Field Surgery" (1864 – in German, and 1866 – in Russian). *The 7th period at Vyshnia (1867-1881)* – Pirogov's stay in the manor of Vyshnia village, social and medical activities, inspections of military hospitals during the Franco-Prussian War as a representative of the Society of care for the wounded and sick soldiers (1870), publication of "The Report on the Visit to Military Health Facilities in Germany, Lorraine and Alsace in 1870", staying six months on the Russo-Turkish war (1877), writing of "Military and Medical Field and Private Assistance in the War Theater of Bulgaria and in the Rear of the Active Army in 1877-1878" (1879), working on memoirs "The Diary of an Old Doctor" (1879-1881). The proposed periodization of the scientific and pedagogical heritage of doctor N.I. Pirogov on the basis of systematic analysis of different sources reveals new facets of medical and pedagogical activity of the scientist.

## CONCLUSIONS

Thus, we suggest to identify the following chronological boundaries in the scientific and educational heritage of the scientist, doctor, educator Pirogov: the lower limit (1824) is the admission to study at the medical faculty of Moscow University; the upper limit (1881) is the scientist's death in his estate in Vyshnia village. The scientific and pedagogical heritage of doctor N.I. Pirogov retains applicability in the modern medicine and education. His medical researches in the field of anatomy, surgery, therapy and phthisiology are still relevant. Pedagogical views of the scientist on the development of secondary and higher education are constantly cited by young researchers. His talent and scientific achievements can only be exceeded by his humanity, unselfishness and humanity.

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The Authors declare no conflict of interest.

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