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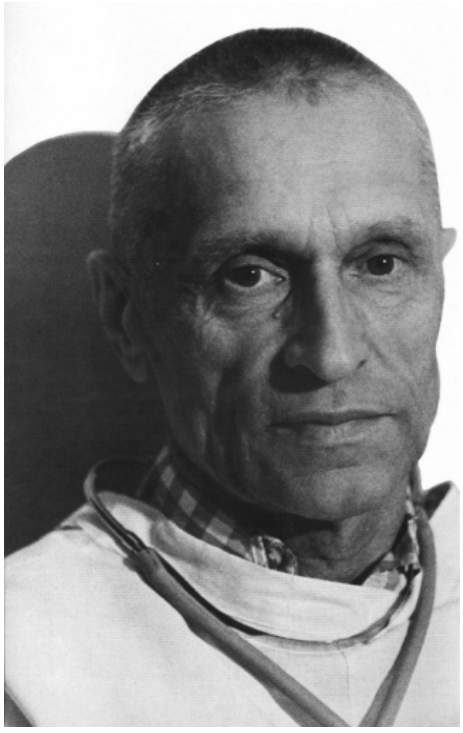
Mykola Amosov: engineer, surgeon, and world-class thinker

Mykola Mykhailovych Amosov (1913—2002) was an outstanding Ukrainian surgeon, cardiac surgeon, world-class scientist and innovator. Born into a poor peasant family, he developed an early interest in both technology and medicine, ultimately obtaining degrees in engineering and medicine. During World War II, Amosov served as a leading surgeon in a front-line hospital, where he improved methods for treating gunshot wounds and established the basis for his PhD research. After the war, he worked in Bryansk and Kyiv, quickly becoming a leading specialist in thoracic surgery. Amosov founded the first department of thoracic surgery in Ukraine, introduced an artificial blood circulation device, performed pioneering heart operations, and developed innovative valve prostheses. As director of the Institute of Cardiovascular Surgery, he elevated the institution to a leading position in Europe. Concurrently, he headed the department of biocybernetics, contributed to the modeling of physiological and mental processes, and developed the first autonomous robots. Mykola Amosov died in 2002, leaving a substantial scientific and humanistic legacy.



Mykola Mykhailovych Amosov was born on December 6, 1913, in the village of Olkhovo, Olkhovo Volost, Cherepovets County, Novgorod Province, into a poor peasant family. His mother, Yelyzaveta Kyrylivna, worked throughout her life as a midwife at a medical center in Vilkhovo. His father participated in World War I and returned from German captivity in 1919. After some time, his father left the family, and from then on, his mother became his primary support. After completing the eighth grade, Amosov attended a woodworking technical school and, upon graduating in 1932, worked for three years as a mechanic at a power plant in a lumber mill. During this period, he developed an interest in designing various mechanisms and innovative devices. Lacking technical knowledge, Amosov enrolled in the All-Union Correspondence Industrial Institute. He further pursued his academic ambitions by entering the Arkhangelsk Medical Institute, where he completed a two-year program in his first year. He advanced rapidly, finishing the second year and proceeding directly to the third year, which provided his initial exposure to clinical medicine, including patient care. From his fourth year, Amosov began teaching at the paramedic school and studied a wide range of disciplines, including ophthalmology. He graduated from the medical institute with honours, receiving only two grades of «four». In August 1939, Amosov began his surgical career in a traumatology clinic. In February 1940, he passed his final exams and defended his diploma project with excellence at the All-Union Correspondence Industrial Institute, receiving an engineering diploma. Amosov became a certified doctor and engineer almost simultaneously.

Amosov worked at an interdistrict hospital in Cherepovets, where he served as the interim head of the surgical department, overseeing 50 beds. Over time, his responsibilities expanded to include teaching anatomy and physiology at the paramedic school. Under his leadership, the surgical department experienced notable progress, with patients undergoing planned operations. Remarkably, during his year of service in Cherepovets, there were no patient fatalities.

At the beginning of World War II, Amosov was appointed as the head of the surgical department and leading surgeon at the field mobile hospital No 2266, holding the rank of military doctor of the third rank.

Faced with a high volume of wounded soldiers, he worked daily from eight in the morning until two the following morning. As Amosov later recalled, «if they had said earlier that such a thing was possible, I would not have believed that it was possible to withstand such a load».

While stationed at the front, Amosov systematically acquired expertise in treating gunshot fractures of the limbs and introduced modifications to existing medical techniques. Notably, he enhanced the surgical approach for gunshot injuries to the knee joint, and this innovation became the foundation of his PhD research, «Primary treatment of knee joint wounds», which he wrote daily during his limited rest periods between operations. Beginning in March 1943, the hospital expanded its focus to include the treatment of chest injuries, during which Amosov again implemented novel, proprietary methods.

By undertaking considerable personal risk, Amosov initiated lung resection procedures, a practice that would later contribute to his international recognition. In early January 1944, he reached a significant personal milestone when he married Lydiia Denysenko, a senior nurse and junior lieutenant.

After his demobilization in December 1946, Amosov assumed the position of head of the main operating room at the M. V. Sklifosovsky Institute. However, despite his strong aspiration to continue surgical practice, he was not permitted to perform operations. Dissatisfied with these limitations, he chose to resign from the position.

In February 1947, Amosov received an invitation to take up the position of regional surgeon and head of the surgical department at Bryansk Regional Hospital. His wife, Lydiia, was appointed as the senior operating room nurse. Reflecting on his own experiences, Amosov stated, «The Bryansk years – from 1947 to 1952 – were the brightest in my life. There, I felt surgical happiness, friendship with my subordinates. Later, this was no longer the case». As a former front-line surgeon, he also remarked, «The war made me a surgeon. But Bryansk made me a real surgeon».

In November 1951, a major surgical conference took place in Kyiv. By that time, Amosov had performed hundreds of operations for pulmonary pathology and had completed a draft of his doctoral dissertation. After his presentation, Amosov received an invitation from Alexander Samoilovych Mamolat, director of the Scientific Research Institute of Tuberculosis named after Academician F. G. Yanovsky, to join the institute. The move to Kyiv was expedited because Mykola Mikhailovich's wife had entered the Kyiv Medical Institute.

In November 1952, Mykola Amosov and his wife, Lidiia, moved to Kyiv. Amosov was appointed to lead a newly established thoracic surgery clinic. He defended his doctoral dissertation entitled «Pneumonectomy and lung resection in tuberculosis».

Subsequently, the rector of the Kyiv Medical Institute, Terentii Yakovlevych Kalinichenko, invited Amosov to head the Department of Surgery within the Sanitary and Hygienic Faculty. While students appreciated Amosov's lectures, his commitment to rigorous academic standards occasionally resulted in unsatisfactory exam scores for some. At that time, none of the clinic employees had seen or performed the surgical interventions introduced by Amosov. Interest in cardiac surgery was growing rapidly, and in 1955, he performed a commissurotomy for mitral stenosis under local anesthesia. Recognizing the necessity of endotracheal anesthesia combined with artificial lung ventilation, Amosov was compelled to acquire expertise in anesthesiology. In 1955, through his tireless organizational efforts, Amosov founded the first department of thoracic surgery in Ukraine at the Kyiv Institute of Advanced Training of Doctors, which he headed. The department of anesthesiology was later separated from this unit. The year 1956 marked a significant personal milestone for Amosov with the birth of his long-awaited daughter, Katia, on February 8. In the autumn of 1957, Amosov was delegated to the International Surgical Congress in Mexico. The most consequential aspect of this trip was his observation of an operation utilizing an artificial circulatory system. Amosov recognized that the advancement of cardiac surgery depended on the adoption of modern general anesthesia techniques and artificial circulatory systems. In Kharkiv, an artificial circulatory system was designed at one of the local factories. By the end of 1958, the first attempt to use this system in the operating room was made, with success achieved on the third attempt.

In 1958, Amosov published his seminal work, «Essays on Thoracic Surgery», which became an essential reference for both thoracic and general surgeons.

In 1959, Amosov maintained an exceptionally demanding schedule, performing 150 to 200 operations annually, preparing lectures for cadets, participating in surgical society meetings, supervising student dissertation defenses, and delivering presentations at conferences, congresses, and conventions.

In 1962, Amosov spent one month in the USA studying advancements in cardiac surgery. It marked the beginning of his specialization in this field. In 1963, he first performed the mitral valve prosthesis procedure for heart defects.

In 1965, Amosov reported his experience with the successful implantation of hemispherical heart valve prostheses in patients with small left ventricles, for whom spherical prostheses could not be used. That

same year, he became the first in the world to design and implement an antithrombotic heart valve prosthesis. Amosov developed a number of innovative surgical techniques for treating heart defects.

At the end of 1969, Amosov was elected a full member of the Academy of Sciences of Ukraine. In 1976, a significant event took place in his professional life. The clinic under his leadership moved to a new building with 350 beds, necessitating an increase in surgical interventions. In 1982, the clinic performed 2,000 operations, including 600 procedures utilizing an artificial blood circulation apparatus.

In 1983, the cardiac surgery clinic of the Kyiv Research Institute (RI) of Tuberculosis and Thoracic Surgery was reorganized as the Kyiv Research Institute of Cardiovascular Surgery of the Ministry of Health of Ukraine. In 1993, it became the Institute of Cardiovascular Surgery of the Academy of Medical Sciences of Ukraine, now known as the National Institute of Cardiovascular Surgery named after M. M. Amosov of the National Academy of Medical Sciences of Ukraine. Naturally, Amosov was appointed as the first director of the newly established R&D Institute.

Beginning in 1984, Amosov experienced health problems and was diagnosed with heart block. In January 1986, he received a pacemaker in Kaunas. On December 6, 1988, upon reaching his 75th birthday, Amosov made a difficult decision to resign from his position as director of the R&D Institute of Cardiovascular Surgery.

In addition to his surgical work, Amosov focused on contemporary issues in biological, medical, and psychological cybernetics. From 1959 to 1990, he headed the Department of Biological Cybernetics at the Institute of Cybernetics of the National Academy of Sciences of Ukraine. Under his leadership, fundamental research was conducted on heart self-regulation systems, the development of machine diagnostic methods for heart diseases, the creation of a physiological model of the «internal environment of the human organism», computer modeling of basic mental functions, and some socio-psychological mechanisms of human behaviour. These contributions received national and international recognition. During the 1960s and 1970s, he also participated in the research and design of artificial intelligence systems. Together with colleagues at the Institute of Cybernetics, he developed the world's first autonomous robots controlled by an artificial neural network.

In 1996, the progression of Amosov's aortic valve defect became evident. However, he continued to work at the computer. In 1999, following a decline in his health, Amosov underwent surgery performed by Professor Reiner Körfer in Germany, during which a biological aortic valve was implanted, and two coronary artery shunts were placed. After the operation, Amosov resumed his professional activities and continued to write. However, age-related diseases progressed, particularly ischemic heart disease, which led to a myocardial infarction and his death on December 12, 2002, at the age of 90. He was buried at Baikove Cemetery in Kyiv.

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Микола Амосов: інженер, хірург і мислитель світового рівня

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Микола Михайлович Амосов (1913—2002) — видатний український хірург, кардіохірург, учений і новатор світового рівня. Народився в бідній селянській родині, рано захопився технікою та медициною, отримавши одночасно дипломи інженера й лікаря. Під час Другої світової війни працював провідним хірургом фронтового шпиталю, де вдосконалив методи лікування вогнепальних поранень і заклав основу своєї кандидатської дисертації. Після війни працював у Брянську та Києві, швидко ставши провідним фахівцем із торакальної хірургії. Амосов створив першу в Україні кафедру грудної хірургії, запровадив апарат штучного кровообігу, виконав одні з перших у світі операцій на серці та розробив унікальні клапанні протези. Як директор Інституту серцево-судинної хірургії він перетворив його на провідний європейський центр. Паралельно очолював відділ біокібернетики в інституті кібернетики, займався моделюванням фізіологічних і психічних процесів, створенням перших автономних роботів. Помер у 2002 році, залишивши величезний науковий і гуманістичний спадок.