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AT THE INTERSECTION OF HISTORY AND MODERNITY: A SYSTEMS ANALYSIS OF NOBEL PRIZES IN THE RESEARCH ACTIVITIES OF THE DEPARTMENT OF SCIENTIFIC INFORMATION AND INNOVATION STUDIES

S. V. KOMISARENKO, V. M. DANILOVA[✉]*, O. P. MATYSHEVSKA, M. V. GRIGORIEVA*

Palladin Institute of Biochemistry, Nation al Academy of Sciences of Ukraine,
Department of Scientific Information and Innovation Studies, Kyiv;
[✉]*e-mail: valdan@ biochem.kiev.ua*

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The results of a systematic historical and scientific analysis of the groundbreaking achievements of Nobel Prize laureates in the fields of chemistry, physiology or medicine are presented. The study covers the entire history of this most prestigious scientific award – from its founding to the present day – and enables the identification and evaluation of the impact of Nobel discoveries on the advancement of modern knowledge and technologies. Particular attention is given to the role of these achievements in the development of medical-biological sciences, also known as life sciences, including disciplines such as biochemistry, molecular biology, immunology, genetics, genetic engineering, molecular medicine, and other related fields. This analysis contributes to the development of strategies for further progress and helps identify priority areas in the field of medical-biological research, while also deepening our understanding of how scientific knowledge has evolved.

K e y w o r d s: Nobel Prize, groundbreaking discoveries, biochemistry, molecular biology, life sciences, scientific progress, research priorities.

Brief history of the Department

In accordance with the resolution of the Bureau of the Presidium of the Academy of Sciences of the Ukrainian SSR, dated November 16, 1979, ‘On approval of the standard regulation on the Department of Scientific Information of the Research Institutions of the Academy of Sciences of the Ukrainian SSR’, a Department of Scientific and Technical Information (DSTI) was established at the Palladin Institute of Biochemistry in January 1980. Its first head was *Yevheniya Vovnyanko*, PhD in biological sciences. From 1983 to 1998, the Department was led by *Volodymyr Nazarenko*, PhD in biological sciences and a senior researcher. From 1998 to 2002, it was led by *Mykola Parkhomenko*, PhD in biological sciences and a senior researcher. Since 2002, the Department has been led by *Valentyna Danylova*, PhD in biological sciences and a senior researcher. In 2024, the Department of Scientific and Technical Information was renamed the Department of Scientific Information and Innovative Research (DSIIR), reflecting its expanded focus and evolving mission.

Current Situation

Today, the Department of Scientific Information and Innovative Research (DSIIR) combines several functionally diverse units, including: the Information Group; the Sector for Technology Transfer, Innovation Activities, and Intellectual Property;

Head of the Department – PhD in Biological Sciences, Senior Researcher Valentyna Danylova the editorial office of The Ukrainian Biochemical Journal; the editorial office of Biotechnologia Acta; the Scientific Library; and the Memorial Museum of O.V. Palladin. Each unit fulfills its specific functional responsibilities while simultaneously conducting scientific research, participating in the implementation of research and development projects at the Institute.

The team of the Department of Scientific Information and Innovation Research has extensive experience in conducting historical and scientific studies, gained during the years 2003-2017 while executing research topics: "Scientific schools of the Palladin Institute of Biochemistry of the National Academy of Sciences of Ukraine. History, Development, Perspectives" (2006-2011), "Historical and scientific analysis of the works of Ukrainian scientists awarded the O.V. Palladin Academic Prize, in the context of generalizing trends in the development of biochemistry, molecular biology, and biotechnology in Ukraine" (2012-2014), and "Inventive Activity of the Palladin Institute of Biochemistry of the NAS of Ukraine in the fields of biochemistry, nano- and biotechnologies for medicine, agriculture, ecology, industry. History, present, and promising innovations" (2015-2017).

As a result, today, the Department has a significant body of work, including monographs, analytical reports and publications about the scientific biochemistry schools of world-renowned scientists–academicians and professors: O.V. Palladin, D.L. Ferdman, R.V. Chagovets, M.F. Guly, V.O. Belitser, V.P. Vendt, O.S. Tsiperovich, S.V. Komisarенко; about the scientific achievements of laureates of the O.V. Palladin academic prize for the period 1973-2013 (a total of 60 scientists), and about the institute's accomplishments in inventive activity and its prospects.

Since 2018, the Department has been conducting a large-scale scientific project within the framework of the department's topic, aimed at fundamental research and systematic historical and scientific analysis of the achievements of leaders of scientific progress–Nobel laureates in chemistry, physiology or medicine, covering the entire period of this prestigious scientific award from its founding to the present.

Established in the early 20th century, the Nobel Prizes are widely regarded as the most prestigious awards in science. Their history reflects the complex development of natural science and human civilization over the past century and in the present day. Although many awards exist worldwide to recognize significant scientific achievements across various fields, the Nobel Prize remains the most honorable. Nobel laureates are truly part of the global intellectual elite, including renowned physicists, chemists, physiologists, medical doctors, economists, writers, and public figures whose work has made the most significant impact on humanity. Notably, there is no specific Nobel Prize dedicated exclusively to biochemistry; however, many scientists have been awarded the Nobel Prize for their biochemical research through the Nobel Prize in Chemistry, Physiology, or Medicine - the disciplines closest to biochemistry among the Nobel categories, and the ones to which we dedicated our research.

To conduct this research, a combination of retrospective, bibliographic, and chronological analyses of the Nobel laureates' work in physiology or medicine, and chemistry was used. As a result, detailed information was collected and analyzed regarding the main ideas, methodology, and outcomes of their breakthrough works, as well as their influence on modern scientific knowledge and technologies, particularly on the development of medical-biological sciences, or Life Sciences (biochemistry and its branches, molecular biology, immunology, genetics, genetic engineering, molecular medicine etc). Below, we present our conclusions and invite you to explore the key findings of our research in the brief overview.

First, we collected and systematized materials and information about the personality of the genius of experimental chemistry, Alfred Nobel, the motives behind establishing the Nobel Prize, and the significant role these awards have played in setting scientific priorities and advancing global progress [1].

The first Nobel Prizes were awarded in 1901, including the prize in physiology or medicine, to the German bacteriologist and professor of hygiene at the Universities of Halle and Marburg, Emil von Behring, "for his work on serum therapy and especially its application against diphtheria…" which can be considered the first step in the development of modern immunology [3].

The works of Nobel laureates Emil Fischer (1902) [2] and Albrecht Kossel (1910) [4], pioneers in studying the chemical composition of nucleic acids, can be regarded as the starting point for the development of modern biochemistry and, consequently, the formation of experimental and theoretical medicine and biology.

Nobel laureates in physiology or medicine in the first decade of the 20th century became some of the most outstanding scientists who inscribed immortal pages in the history of medical and biological sciences. This period was marked by the awarding of Nobel Prizes to eminent microbiologists who laid the foundations for our understanding of infectious disease. Among the most prominent was Robert Koch (1905), who discovered the tuberculosis bacillus, the cholera vibrio, and formulated the classic principles of medical microbiology. More attention was given to the discoveries of Ilya Mechnikov, the founder of cellular immunology, born in Ukraine, and his scientific rival, Paul Ehrlich, a key proponent of humoral immunity theory (both were jointly awarded the Nobel Prize in 1908) [3].

The second decade was marked by the fact that, in 1913, the Nobel Prize in Physiology or Medicine was awarded to Charles Richet "in recognition of his work on anaphylaxis" [3]. His research significantly advanced the understanding of allergic reactions, highlighting not only the protective aspects of immune responses but also their potential risks. It is important to note that, during World War I, the Nobel Prizes were not awarded. They resumed only in 1919 with the award to Belgian immunologist Jules Bordet "for his discoveries relating to immunity" [3], which, in fact, laid the foundations for transplant immunology.

The analysis of the themes of Nobel Prizes awarded in the 1920s–1940s reveals that the achievements recognized during this period fully reflect the trends in scientific development of the time. This period can be considered the end of the classical, "pre-molecular" phase of biology and medicine. These years were marked by the discovery of human blood groups (Nobel Prize 1930 to Karl Landsteiner) [3]. In biochemistry, the first breakthroughs occurred in studying enzymes involved in cellular respiration and the molecular organization of oxidative processes (Nobel laureates Otto Meyerhof, Archibald Hill (1923); Otto Warburg (1931); Albert Szent-Györgyi (1937)) [4]. The first half of the 20th century was also a fruitful period for research on biologically active substances, particularly hormones and vitamins. Among the pioneering researchers of hormones were Frederick Banting and J.J.R. Macleod (Nobel Prize 1923 "for the discovery of insulin"). The discovery of insulin was a turning point in practical medicine, offering life-saving treatments for thousands of diabetics [5].

The next significant stage in research on biologically active substances was the works of Nobel laureates organic chemists – Heinrich Wieland (1927), Adolf Windaus (1928), Adolf Butenandt, and Leopold Ruzicka (1939), who almost simultaneously isolated and determined the chemical structures of bile acids, vitamins of D group, and sex hormones (both female and male) [5]. They also discovered that all these compounds have a steroidal nature and that the starting substance for their biosynthesis in the body is cholesterol. The research on highly active steroidal substances was continued by Edward Kendall, Philip Hench, and Tadeusz Reichstein (Nobel Prize in Physiology or Medicine, 1950), who first synthesized and studied the structures and biological effects of adrenal cortex hormones - corticosteroids. They also developed the first industrial method for producing cortisol, which is now widely used in the treatment of inflammatory processes.

In the first half of the 20th century, experimental research by scientists (organic chemists, biochemists, physiologists) in collaboration with physicians led to the discovery of a new class of biologically active substances – vitamins. Many of these scientists were awarded Nobel Prizes: Christian Eijkman and Frederick Hopkins (1929), Albert Szent-Györgyi and Walter Haworth (1937), Paul Karrer (1937), Richard Kuhn (1939), Henrik Dam and Edward Doisy (1943), Dorothy Hodgkin, Robert Woodward (1965) [6]. Thanks to their efforts, nearly all known vitamins at that time (B_1, B_2, B_6, B_9, B_{12}, C, A, E, K) were characterized, their structures were determined, and their mechanisms of biological action were mainly understood [6]. It was found that many vitamins are coenzymes involved in crucial biochemical transformations. This period is also marked by the decoding of intermediates and pathways of intracellular carbohydrate metabolism (by American biochemists, the husband-and-wife team of Gerty and Carl Cori, 1947). By the end of the 1930s, the description of the tricarboxylic acid cycle, the famous "Krebs cycle", was completed, and the Nobel Prize in 1953 was awarded to Hans Krebs and to Fritz Lipmann, the discoverer of coenzyme A and the role of ATP in bioenergetic processes [7].

The development of antibiotic therapy in the 1940s and 1950s was of paramount importance for the further progress of medicine and healthcare. The discovery of the first effective antimicrobial agents marked the beginning of significant advances that dramatically improved the effectiveness of infectious disease treatment and transformed clinical practices in internal medicine and surgery. The discovery by a group of British scientists–microbiologist Alexander Fleming, biochemists E. Chain, and H. Florey – in 1940 of the first antibiotic, penicillin, gained worldwide recognition (Nobel Prize in 1945). Another achievement in antibiotic therapy was the research by American microbiologist Zelman Waksman (born in the Ukrainian town of Pryluky), who isolated streptomycin in 1943, the first highly effective anti-tuberculosis antibiotic (Nobel Prize in 1952) [8].

The second half of the 20th century was marked by groundbreaking discoveries in the fields of protein chemistry and biochemistry. Nobel laureates in Chemistry for 1946 – James Sumner, John Northrop, and Wendell Stanley were the first to isolate individual enzymes and viruses in a pure crystalline form and to prove their protein nature, making a valuable scientific contribution to the development of important biological fields such as biochemistry, particularly enzymology, virology, and molecular biology [9]. The outstanding 20th-century chemist, American scientist Linus Pauling, made significant contributions to understanding the chemical bonds that form the secondary structure and other levels of protein organization. He received the Nobel Prize in Chemistry in 1954 "for his research into the nature of the chemical bond and its application to the elucidation of the structure of complex substances". Biochemists recognize him as the originator of the terms "secondary structure of proteins," α-helix, and β-structure [9]. Frederick Sanger, a two-time Nobel laureate (1958 and 1980), was the first researcher to determine the primary amino acid sequence of a protein, specifically the two polypeptide chains A and B of insulin. F. Sanger demonstrated that the structural order of a protein is similar to the sequence of genes in DNA [9]. The question of how the structure of a protein is organized in space was answered by English biochemists Max F. Perutz and John Kendrew, who used X-ray crystallography to analyze the three-dimensional structures of hemoglobin and myoglobin, and in 1962, they received the Nobel Prize in Chemistry "for their studies of the structures of globular proteins" [9].

It is hard to imagine how chemistry, biology, and medicine would develop without analytical research methods such as ultracentrifugation (Theodore Svedberg, Nobel Prize in Chemistry, 1926), electrophoresis (Arne Tiselius, Nobel Prize in Chemistry, 1948), and chromatography (Richard L.M. Synge, Nobel Prize in Chemistry, 1952) [10]. Today, innovative high-tech laboratory ultracentrifuges are widely used in various scientific fields and clinical practices, including colloid chemistry, biochemical analysis, virology, clinical diagnostics, pharmacy, nanotechnology, and other related areas. Electrophoresis, with a high probability, allows for the detection of protein abnormalities; therefore, it is widely used in many medical centers around the world for diagnosing infectious-inflammatory diseases, genetic and immune disorders, malignant tumors, and other conditions. Chromatography is widely applied in biochemical research, the quality control of medicinal products, food products, and other areas.

In the 1950s–1960s, a fundamentally new stage of development in biology and medicine began – the molecular-biological stage. The milestone marking the start of this stage is considered to be 1953 – the year when James D. Watson and Francis H. Crick published their famous article in the journal "Nature" about the structure of DNA, which, in their view, 'has some new properties that are of general biological interest' – proposing a model of the DNA molecule as a double helix. This allowed, for the first time, to form clear scientific ideas about the mechanism of duplication – DNA replication, that is, the equal distribution of genetic material between daughter cells. Watson and Crick's discovery (which earned them the Nobel Prize in 1962, shared with Maurice H. Wilkins) was revolutionary for biology. It explained how hereditary information is preserved and transmitted, initiating the development of molecular biology, molecular genetics, and genetic engineering [12].

Molecular biology has established the foundation for the fundamentally new ideas about development mechanisms, molecular diagnostics, and pharmacotherapy of complex pathological processes, including hereditary diseases. Using genetic engineering, recombinant DNA technology, and molecular and cellular cloning, a biotechnological synthesis of medicinal products – antibiotics, hormones, enzymes, and interferons – has been developed.

Among the brightest stars on the scientific horizon of the second half of the 20th century were, in particular, Nobel laureates Severo Ochoa and Arthur Kornberg, who were awarded the Nobel Prize in Physiology or Medicine in 1959 "for their discovery of the mechanisms in the biological synthesis of RNA and DNA" [13]. Their experiments are now considered a cornerstone of genetic engineering because they first demonstrated the possibility of synthesizing RNA and DNA outside of a living cell. This also includes François Jacob and Jacques Monod, who first established the mechanisms of genetic control of protein synthesis through the action of regulatory genes (awarded in 1965 jointly with bacteriophage researcher André Lwoff) [14], and the 1968 laureates – Marshall W. Nirenberg, Har Gobind Khorana, and Robert W. Holley, who decoded the genetic code of nucleic acids and the principles of its function in protein biosynthesis [15].

It was previously believed that nucleic acids DNA and RNA were only carriers of genetic information, while chemical processes of cell life were catalyzed by proteins. Scientists' views on the functioning (biocatalysis) in living cells changed thanks to the discovery by Sidney Altman and Thomas Cech (Nobel Prize in Chemistry 1989), who demonstrated the catalytic properties of RNA [16].

Another notable figure is Kary Mullis, a Nobel laureate in Chemistry in 1993, who developed the revolutionary method of polymerase chain reaction (PCR), based on the repeated selective copying of a specific DNA segment using enzymes *in vitro*. In medical practice, this method is widely used for diagnosing infectious, genetic, and oncological diseases, as well as in transplantology, forensic examination, pharmacogenetics, and so-called personalized medicine [17].

A significant achievement of molecular biology and genetics was the creation of the first human genome map in 2000 and the development of cloning programs for higher organisms as a real technological challenge, in solving which the two-time Nobel Prize in Chemistry laureate Frederick Sanger made a substantial contribution [18].

In 1971, the Nobel Prize was awarded to Earl W. Sutherland Jr. for the discovery of cyclic nucleotides cAMP and cGMP as universal mediators in signal transduction of bioregulators (hormones, neurotransmitters) from the cell membrane to the cell's effector systems [19].

The Nobel Prizes have honored major advances in fields such as endocrinology and oncology, including: the first use of hormonal drugs (estrogens) for prostate cancer treatment (1966 award to American surgeon and oncologist Charles B. Huggins); development of radioimmunoassay methods to measure peptide hormones (Rosalyn S. Yalow, 1977) [20]; discovery of hypothalamic releasing factors (Roger Guillemin, Andrew W. Schally, 1977); prostaglandins (Sune Bergstrom, John R. Vane, Bengt Samuelsson, 1982) [19]; and clarification of how tissue growth factors regulate normal and tumor growth (Rita Levi-Montalcini, Stanley Cohen, 1986) [21]. American scientists – geneticist Michael S. Brown and clinician Joseph L. Goldstein – made significant contributions to understanding atherosclerosis and hereditary hyperlipidemias by identifying and studying low-density lipoprotein (LDL) receptors. Their research, recognized with the 1985 Nobel Prize, "significantly enhanced our understanding of cholesterol metabolism and opened new possibilities for preventing and treating atherosclerosis" [19].

The end of the 20th century was marked by a surge in infectious diseases due to mutations of known microorganisms and the emergence of new nosological forms, as well as the spread of the human immunodeficiency virus (HIV) epidemic. A threat of a new 'plague' for humanity arose – slow viral infections, particularly the so-called 'prion diseases'. The etiological factor of these diseases, which primarily affect the central nervous system of humans, is 'rion proteins' (PrP) – infectious agents of protein origin that were isolated and studied in 1982 by American scientist, molecular biologist, and Nobel laureate in 1997, Stanley B. Prusiner [22]. In previous years, the greatest contribution to understanding the causes of neurodegenerative diseases caused by 'slow viruses' was made by pediatrician and virologist D. Carlton Gaidushek (Nobel Prize 1976).

At the end of the 20th century, a new type of intracellular regulator was discovered – the molecule of nitric oxide. The unraveling of the nitric oxide mystery by Nobel laureates in Physiology or Medicine in 1998, Robert Furchgott, Louis Ignarro, and Ferid Murad, sparked an international boom in research on the role of this signaling molecule in the regulation of the cardiovascular system and provided a new impetus for the development of modern effective drugs to combat heart diseases, particularly the world's leading killer – ischemic heart disease [23].

The beginning of the new millennium was marked by discoveries of mechanisms of chemical signal transmission in the central nervous system, clarifying the mediating role of dopamine, processes of slow synaptic transmission, short-term and long-term memory, and mechanisms of action of antipsychotic and antidepressant drugs (Arvid Karlsson, Paul Greengard, Erik Kandel, 2000) [24].

Fundamental research in molecular biology conducted over the past few decades has also led to a significant breakthrough in understanding the deepest mysteries of biology. Thus, the Nobel Prize in 2001 was awarded to a group of scientists – Leland Hartwell (USA), Tim Hunt, and Paul Nurse (Great Britain) – “for the discovery of the key regulators of the cell cycle – cyclins and cyclin-dependent kinases” [25].

The 2002 award was jointly granted to British researchers Sydney Brenner, John Salston, and American scientist Robert Horvitz, who achieved fundamental results by using a new experimental model – the embryo of the nematode *Caenorhabditis elegans* – to uncover patterns of genetic regulation of organ development, cell division, differentiation, and programmed cell death (apoptosis) [26]. According to experts, these discoveries are crucial for the advancement of theoretical and clinical medicine, particularly in understanding the pathogenesis of various human diseases, including malignant tumors.

The fruitful combination of clinical medicine with modern high-tech physical methods led to the discovery and development of a non-invasive diagnostic technique based on the phenomenon of nuclear magnetic resonance (MRI), for which Paul Lauterbur, a professor at the University of Illinois (USA), and Peter Mansfield, a scientist from Nottingham University (Great Britain), were awarded the Nobel Prize in Physiology or Medicine in 2003 [27]. This discovery enabled the production of two-dimensional images of structures within a living organism that could not be visualized by other methods previously. Today, the MRI technique is widely used in clinical practice for diagnosing and determining the optimal treatment for various diseases, particularly for detecting brain tumors.

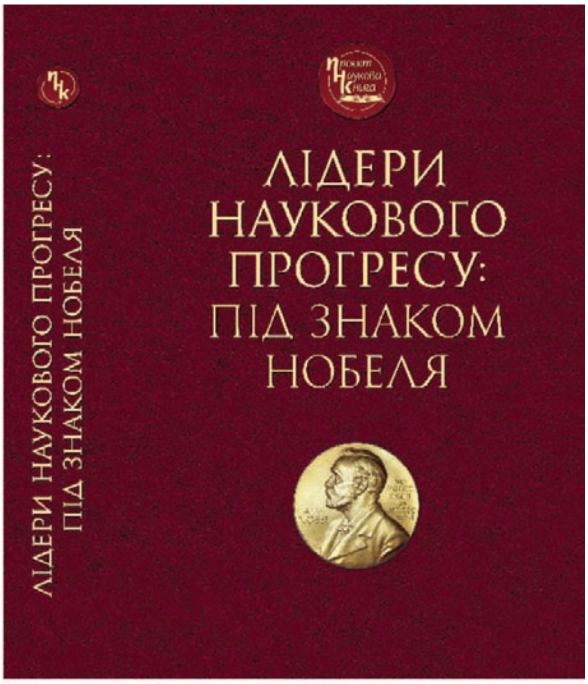
The Nobel Prize in Chemistry in 2004 was awarded to Aaron Ciechanover, Avram Hershko (Technion – Israel Institute of Technology, Haifa, Israel), and Irwin Rose (University of California, Irvine, USA) for the discovery of the non-lysosomal ATP-dependent pathway of protein degradation within cells [28]. These scientists demonstrated that by selecting a protein destined for destruction, the cell first tags it with a biochemical marker called ubiquitin, and the polyubiquitination of the protein serves as a signal for its proteolysis. It was later found that deviations in this system lead to various diseases. Based on this discovery, powerful pharmaceutical companies began developing drugs for use in molecular medicine.

In 2006, the Nobel Prize in Chemistry, “for fundamental studies of the mechanisms of copying genetic information in eukaryotic cells”, was awarded to American biochemist and Professor of Structural Biology at Stanford University, Roger Kornberg [29]. It should be noted that this was the first time a single individual received a prize in the field of natural sciences. The father and son Kornberg studied the same problem – the mechanisms of nucleic acid synthesis as carriers of genetic information, but Arthur Kornberg shared the Nobel Prize with Severo Ochoa (1959), as mentioned above, while Roger, equipped with a much more advanced toolkit, was the first to make the process of informational RNA synthesis visible, had no competitors in this field, and received the Nobel Prize alone. The scientific breakthroughs of R. Kornberg are difficult to overestimate, as elucidating the structure of RNA polymerase II and the catalytic mechanism of this enzyme's functioning is a key element in understanding the entire transcription process.

In undertaking this project, we paid attention to the fact that the constellation of Nobel laureates includes bright figures of scientists not only of the male gender but also of the female gender – no less remarkable individuals. Among the women Nobel laureates are Gerty Cori (1947) [30], Dorothy Hodgkin (1964) [31], Rosalind S. Yalow (1977) [20], and Rita Levi-Montalcini (1986) [21], who made invaluable contributions to the development of medical-biological sciences, influenced all aspects of medicine and biology, and also triumphantly overcame gender and religious barriers in the field of experimental research, ensuring them a rightful honorable place in the history of science.

The brief overview does not allow for, nor is it necessary to, analyze in detail the entire complex and turbulent development of medicine and biology in the 20th and early 21st centuries. Relevant material can be found in our book “Leaders of Scientific Progress: Under the Sign of Nobel”. Second edition, revised. Kyiv: Naukova Dumka, 2024, 678 pages; ISBN 978-966-00-1904-1.

It should be emphasized once again that the analysis we conducted in the project contributes to the development of a future strategy and the identification of new priority areas for medical-biological research, as well as understanding the evolution of scientific knowledge overall.



Book "Leaders of Scientific Progress: Under the Sign of Nobel"

To conclude, it is appropriate to once again quote Nobel Prize laureate Aaron Ciechanover, a well-known supporter of Ukrainian biochemists, who, in his welcoming speech to the participants of the XII Ukrainian Biochemical Congress (Ternopil, 2019), stated: "…The root of all modern inventions at the end is basic sciences. If we shall not do basic science, we shall never get any products. I want to bring you an example of our own studies. We were interested in how proteins are degraded in the body. We had no clue about diseases; we had no clue about drugs. We just identified a niche in biology to which there was no answer, and that is how proteins are degraded in a specific manner, how the cell can identify a protein that it doesn't need anymore, either the protein completed its function, or it became denatured or mutated, sparing all other proteins in the cell. So, we were interested in specific degradation; we discovered the ubiquitin system, and only 28 years later, people discovered that aberrations in the system lead to diseases, and as a result, a pharma company came in and developed a drug. So, again, it was basic science driven by curiosity that at the end of the road led to the development of drugs. If we start from the will to develop a drug, the drug will never be developed…".

This idea, expressed by a prominent scientist, is especially relevant today, as it convincingly confirms the key conclusion of our research - it is fundamental science that serves as the source from which all major innovations and practical achievements emerge.

Conflct of interest. Authors have completed the Unified Conflicts of Interest form at http://ukr-biochemjournal.org/wp-content/uploads/2018/12/coi_disclosure.pdf and declare no conflict of interest.

НА ПЕРЕТИНІ ІСТОРІЇ ТА СУЧАСНОСТІ: СИСТЕМНИЙ АНАЛІЗ НОБЕЛІВСЬКИХ ПРЕМІЙ У ДОСЛІДЖЕННЯХ ВІДДІЛУ НАУКОВО-ІНФОРМАЦІЙНИХ ТА ІННОВАЦІЙНИХ ДОСЛІДЖЕНЬ

С. В. Комісаренко, В. М. Данилова[✉]*,*
О. П. Матишевська, М. В. Григор'єва

Інститут біохімії ім. О. В. Палладіна
НАН України, Київ;
[✉]e-mail: valdan@ biochem.kiev.ua

Представлено результати системних історико-наукознавчих досліджень проривних досягнень лауреатів Нобелівської премії в галузях хімії, фізіології та/або медицини. Аналіз охоплює увесь період існування цієї найпрестижнішої наукової відзнаки – від часу її заснування до сьогодення – і дозволяє визначити та оцінити вплив нобелівських відкриттів на розвиток сучасних знань і технологій. Особливу увагу приділено їхній ролі у розвитку медико-біологічних наук, або наук про життя, зокрема біохімії, молекулярної біології, імунології, генетики, генної інженерії та молекулярної медицини. Здійснений аналіз сприяє виробленню стратегії подальшого прогресу та визначенню пріоритетних напрямів у сфері медико-біологічних досліджень, а також забезпечує більш глибоке розуміння еволюції наукового знання в цілому.

К л ю ч о в і   с л о в а: Нобелівська премія, проривні відкриття, біохімія, молекулярна біологія, науки про життя, науковий прогрес, пріоритети досліджень.

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