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FOUNDER OF MOLECULAR IMMUNOLOGY IN UKRAINE, WELL-KNOWN POLITICAL AND PUBLIC FIGURE

On the 75th birthday of Academician of the NAS of Ukraine S. V. Komisarenko

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July 9 marks the 75th birthday of Serhiy V. Komisarenko – the well-known scientist-biochemist, founder of the scientific school in molecular immunology, diplomat, state and public figure, laureate of the State Prize of Ukraine in the Field of Science and Technology (1979), Honored Science and Technology Worker of Ukraine (2008), Winner of the O.V. Palladin Prize (2003) and I.I. Mechnikov Prize (2012) of the NAS of Ukraine, Academician-Secretary of the Division of Biochemistry, Physiology and Molecular Biology of the NAS of Ukraine, director of the O. V. Palladin Institute of Biochemistry of the NAS of Ukraine, Doctor of sciences (biology), Professor, Member of the NAS and NAMS of Ukraine.

Molecular immunology appeared and was formed as one of the most urgent trends of modern biology and direct "heir" of traditional immunology; it is actively developed in the recent 50 years. This science is integral, since it uses the methods and achievements of biochemistry, molecular biology, genetics and other sciences, though it is directed to studying the immune system only, the maintenance of genetic stability of the internal medium of the organism being its main function. The immune system fights with numerous diseases, beginning with infectious ones and ending with neoplasms in organisms of people, animals, and plants.

Investigations in the field of fundamental immunology are especially important, since they give scientists a unique opportunity to model and study at various levels of organization general biological processes connected with differentiation, proliferation and death of cells, with mechanisms of the inter- and intra-cell signaling, to research structural organization and function of macromolecules in lymphocytes. Immunochemical methods of investigation are the basis for creation and use of highly sensitive and highly specific immunodiagnosticums required for medicine, veterinary, industry, in particular, for development of immunobiotechnology or monitoring of the environment state. This exceptionally important science caused interest of Serhiy Komisarenko, who was the first to initiate a new scientific trend – molecular immunology.

Serhiy Komisarenko

Everything starts from childhood. Serhiy V. Komisarenko was born on July 9, 1943 in the

town of Ufa (Russia), where the institutions of the Academy of Science of the Ukrainian SSR were evacuated for the time of war. His father, Vasyl Pavlovych Komisarenko (1907-1993) – the outstanding Ukrainian pathophysiologist-endocrinologist, a founder of the Kyiv Research Institute of Endocrinology and Metabolism; mother, Lyubov Ilarionivna Drosovska-Komisarenko (1908-1994), was the scientific worker of the Institute of Economics of the Academy of Sciences of the Ukrainian SSR, but she was too wise and preferred her family and upbringing of children to her career prospects; she cultivated in children interest to knowledge and culture legacy, taught them languages, music, good manners. Serhiy Komisarenko notes in his memoirs: "I would like to say that our parents brought up me and my brother rationally – they were fairly strict and fairly liberal with us. We had everything necessary, especially for education, but nothing unnecessary, not a hint of luxury".

Serhiy Komisarenko finished one of the best Kyiv schools – the Ivan Franko school N 92 (the former Pavlo Halagan college). That was the first school in Kyiv with extensive studying the English language. Even at high school, he was interested in mechanisms of vital activity of live beings, and thus he hesitated in his choice – Medical Institute or biological faculty of the University. His father explained that medical education gives extensive knowledge about the highest and most complex creation of nature – a man, and that just this knowledge allows better understanding of the laws of functioning of other live organisms. So, after finishing the secondary school, Serhiy entered the Therapeutic faculty of the Kyiv Medical Institute.

Student years. The years spent at the Medical Institute (1960-1966) were rich not only in training. The main motto of S. Komisarenko then was – don't waste any minute of your life. In his first years he was actively going in for sports; in the third year he worked by nights as a medical attendant at the first-aid station to master a little "practical medicine"; in his fourth year entered the evening department of Mechanical-and-Mathematical Faculty of the T.G. Shevchenko Kyiv State University; simultaneously, he was the member of the biochemical circle.

There were many gifted pedagogues at the Medical Institute – both lecturers and those who taught in practical training, and Serhiy could learn from the best examples. Besides, he had a propensity for the discussion of the modern, something provocative themes, and thus he never missed public

Serhiy Komisarenko — a graduating student of the Medical Institute. Kyiv, 1966

speeches of such outstanding persons as V.M. Glushkov, M.M. Amosov, S.M. Gershenson, et al.

First steps in science. The year 1966 came... Studies were behind; he faced the choice of the course of life. After graduating from the Medical Institute with a first-class honors degree, Serhiy Komisarenko had to choose between practical medicine and scientific activities. And he chose the path of science, entered the post-graduate courses at the Institute of Biochemistry of AS of the Ukrainian SSR, the Department of Protein Biosynthesis and Biological Properties, where Academician Maksym F. Gulyi, the outstanding biochemist, became his supervisor.

S. Komisarenko defended his thesis for the Candidate's degree in 1970. His work was dedicated to the important problem – to determine the role of intermediate products of the tricarboxylic acid cycle (Krebs cycle) in the biosynthesis of proteins in animal organisms. And that was the latest in science.

After the post-graduate courses Serhiy Komisarenko was left at the Department of Protein Biosynthesis and Biological Properties, he first worked as a junior and then a senior scientific researcher, in 1972-1974 he was a Scientific Secretary of the Institute, combining organizational work with scientific activities.

In that period S. Komisarenko, on the advice of his scientific supervisor and teacher M.F. Gulyi, chose an entirely new trend of research – biochemistry of immunity. He dwelled on two problems: a possibility to regulate metabolism by cells-phosphonates – the derivatives of inorganic pyrophosphate, which are not hydrolyzed and on the problem of

regulation of biosynthesis of antibodies. There arose a lot of questions, which were the leading ones for understanding the immune system functioning, with few answers; maybe that was because practically nobody in Ukraine studied the modern fundamental immunology. There was also a lack of special literature in immunology. That is why Komisarenko had to study immunochemistry and to master immunochemical methods of research himself, as well as to create the corresponding methodical base. Such a base was absent both at the Institute of Biochemistry and at other institutions of Ukraine.

It should be remembered that S.V. Komisarenko always paid the greatest heed to the most uptodate methods of investigation, and owing to his organizational skills and good knowledge of English he succeeded to organize at the Institute of Biochemistry regular seminars of the leading foreign companies in the field of new methods in biochemistry and cell biology, which played a significant part in methodical training and equipping academic institutions with the most modern facilities.

But return to immunochemistry. The official journey of Serhiy Komisarenko to the Laboratory of Immunocytochemistry of the Pasteur Institute in Paris (1974-1975) had a decisive role in his formation as immunochemist. At that time the Pasteur Institute (especially its Department of Molecular Biology) was one of the leading centers of biological science. There, his supervisors were: Member of the French Academy of Medicine Pierre Grabar, one of the founders of immunochemistry and former Kyivan, and his follower and a discoverer of “peroxidase” methods Stratis Avrameas. In the course of his work at the Pasteur Institute S. Komisarenko mastered a number of the modern immunochemical methods, extended his knowledge in immunology and molecular biology; he synthesized and studied properties of various immunosorbents. He gave special attention to studying the biosynthesis of immunoglobulins. Thus, using the immunoenzymatic method he had found out the dynamics of biosynthesis of antibodies and nonspecific immunoglobulins in lymphocytes *in vivo*, studied the effect of methylenephosphonic acid on these processes and stimulation of blast-transformation of lymphocytes by concanavalin A.

The important result of this official journey was that Serhiy Komisarenko (for a rather short period of intensive work) became a biochemist and immunologist with molecular-biological thinking and one of the then most erudite immunologists in the USSR. By the decision of Yu. A. Ovchinnikov, Vice President of the Academy of Sciences of the USSR, a young Candidate of Sciences S. Komisarenko was introduced into the prestigious Council of Molecular Biology of the AS of the USSR. He also received a proposition to head the Laboratory of Immunology at the Shemyakin Institute of Inorganic Chemistry of the USSR Academy of Sciences, but Komisarenko declined the proposition.

After a while a monument to our great compatriot I.I. Mechnikov, made by the Ukrainian sculptor Valentyn Znoba, was set up in 1986 in front of the new I.I. Mechnikov Immunologic Building of the Pasteur Institute as a token of gratitude for the acquired “high science”. The monument was created

Gratitude to the teacher – flowers for Academician Gulyi M.F. after the defense of the thesis. Kyiv, 1970

Near a bust of I.I. Mechnikov at the Pasteur Institute. Paris, 1986

by the petition of S. Komisarenko and to some extent by his design.

First, there was a laboratory. After S. Komisarenko's returning from the official jour-ney, the Laboratory of Biochemistry was founded in September 1975 at the Institute of Biochemistry. The laboratory was headed by S. Komisarenko and its staff numbered 8 persons. He concentrated there on more or less achievable tasks – immunochemical analysis of proteins and introduction of the methods of immunoenzymatic analysis mastered by him at the Pasteur Institute. Most of them, especially immunoperoxidase and electrophoretic methods, were very successful.

The internship at the Sloan-Kettering Anticancer Center in New York (USA) in 1981 was also of benefit to Serhiy Komisarenko. There he studied the role of cyclic nucleotides and protein kinases in the proliferation of lymphocytes, acquainted with the organization of immunologic research in this country.

Over a short period, the Laboratory of Immunochemistry became a leader in the USSR in immunoperoxidase labeling of antibodies and antigens; its researchers were the first in the USSR who initiated immunochemical analysis of peptides and proteins. Certainly, the Laboratory potentialities were limited because of the lack of equipment, media and high-quality reagents for the cultivation of cells, qualitative lines of experimental animals, etc. However, despite all difficulties, owing to the efforts of the young chief, the Laboratory developed, its personnel became stronger, there appeared the Laboratory own post-graduate students and those working on graduating thesis. In 1979 it numbered 15 researchers and 4 post-graduates.

In the early 1980's it became evident that the Laboratory of Immunochemistry had acquired such a potential which allowed it to be transformed into the scientific department at the Institute of Biochemistry: it has its own themes, additional financing through the State Committee in Science and Technology of the USSR, qualified scientific workers, energetic and gifted young chief. That is why in 1982 the then director of the Institute Academician V.K. Lishko decided to give the Laboratory status of the Department of Molecular Immunology

The Department of Molecular Immunology at Its Start. The main scientific trends of investigations at the Department were the same, but interests and potentialities extended, owing to the improvement of the material base as well. That was, first of all, favored by the collaboration with Swiss companies Pharmacia and LKB. However, Serhiy Komisarenko understood that it was not enough, and thus he, with the support of Academician B.E. Paton, President of the Academy of Sciences of the Ukrainian SSR, submitted a petition to H.I. Marchuk, the head of the State Committee on Science and Technology of the USSR, about the targetoriented allotment of currency for purchasing equipment for the Department of Molecular Immunology. Just this acquired equipment for cultivation of cells and the only in the USSR flow cytofluorimeter Coulter-EPICS C became the foundation of the material and technical base of the Department for many years ahead, in particular, for obtaining hybridomas – producers of monoclonal antibodies.

In the view of the fact that the investigation of structural genes, encoding the structure of immunoglobulins was impossible in Kyiv (though there were feeble attempts), the main trends of scientific research for some years in succession were as follows: study of mechanisms of immunotropic and antitumor effect of organophosphorous derivatives of inorganic pyrophosphate as well as the development and use of the methods of immunochemical analysis of proteins for further determination of the mechanisms of molecular identification of antigens by the immune system of the organism.

Bisphosphonates and phosphonates – structural analogs of inorganic pyrophosphate (PP_i) and phosphate, respectively, were chosen for a priory investigation, proceeding from the fact that PP_i as the product or substrate was used in numerous enzymatic reactions. The investigations of immunotropic action of bisphosphonates, which were conducted by researchers of the Department, headed by Serhiy Komisarenko, were just the first in the world. They established immunomodulatory activity of methylenebiphosphonic acid (MBPhA) and showed that tropism to lymphocytes was the basis of its immunomodulatory action. Antitumor effect of MBPhA, which called for analysis, as well as corresponding preclinical investigations discovered by them also proved to be important.

The results of these scientific investigations became the basis of Komisarenko's thesis for the Doctor's degree Biological Effect of Bisphosphonates and Regulation of the Immune Response, defended by him in 1989.

As a result of these fundamental studie, several prototypes of medical preparations on the basis

The Department of Molecular Immunology. Kyiv, 1982

of bisphosphonates were created at the Department headed by S. Komisarenko. E.g., the polyurethane composition, which worked as an immobilized immunomodulator with a local anti-inflammatory and immunosuppressive effect, was synthesized at the Department. Anti-tumor activity of disodium salt of methylenebisphosphonic acid had been proved, and a new antitumor drug Mebifon was proposed. It has stood all clinical tests and is produced by Joint-Stock Company Farmak. That is the innovational home drug with anti-tumor and immunomodulating effect used in the struggle with tumors of the mammary gland in women and prostate in men. It is especially important to use Mebifon for the control of tumor metastases in bones.

Immunovector molecules – immunotoxins for selective ruining of cell-targets were also created under the supervision of Serhiy Komisarenko. The efficiency of specific immunotoxins proved to be 25 times higher than that of the "pure" toxin.

Besides, the investigations of the immunochemical structure of proteins and peptides were carried out at the Department; they started from the analysis of neurotoxin apamin – one of the components of the bee venom and cytochrome C. These fundamental investigations headed by Komisarenko in analysis of apamin and cytochrome C were the first works in the USSR devoted to investigation of proteins and peptides.

S. Komisarenko has made several interesting hypotheses based on the data of immunochemical analysis of cytochrome C and dynamics of forming antibodies to this protein. Considering that cytochrome C comes out of mitochondria under ischemia, it would be logic to suppose that it appears in the blood flow, under myocardium infarction in particular, and can stimulate the formation of specific antibodies which, in their turn, will affect its course. In this connection, a method for determining cytochrome C and antibodies to it in human blood was developed at the Department headed by Serhiy Komisarenko. The method was approved successfully at the M.D. Strazhesko Institute of Cardiology to diagnose the complicated course of myocardial infarction. Unfortunately, the works in immunochemical analysis of cytochrome C were stopped for different reasons, first of all, because of breaking off scientific relations with Russia in the early 1990's and because of the lack of necessary peptides.

The method for determining neurospecific proteins S-100 and 14-3-2 in the *liquor* and blood of patients with brain tumors and traumas was created on the basis of immunochemical analysis of these proteins. That was significant for the diagnosis of the above diseases.

The use of the current methods of molecular and cell immunology, flow cytofluorimetry in particular, allowed researchers of the Department headed by S.V. Komisarenko not only to perform the quantitative analysis of antigens, to localize antigens and antibodies at the surface of cells and in intracellular structures, but also to isolate separate cells for their further analysis and cloning. However it has become evident that the investigation of im-

Pesident of AS of the Ukr.SSR Academician B.E. Paton at the Department of Molecular Immunology; from left to right: director of IBCh V. Lishko, head of the Department S. Komisarenko, B. Paton, Chief Scientific Secretary of AS of the Ukr.SSR V. Tonkal, Vice President of AS of the Ukr.SSR K. Sytnyk, deputy director of IBCh V. Kokunin, Vice President of AS of the Ukr.SSR V. Skok. 1986

munologic phenomena, as well as the obtaining of monoclonal bodies is practically impossible without the cell culture.

So Serhiy Komisarenko has again taken the initiative. He was one of the first researchers in the USSR who introduced a hybridoma technology for the production of monoclonal antibodies (mcAB). The extensive introduction of this method (that is trivial now) became possible after purchasing the corresponding laboratory equipment and culture media.

This in mind the so-called "hybridoma" group headed by I.M. Kolesnikova, Candidate of Sciences in biology, was created at the Department. They produced the great number of hybridoma clones – producers of mcAB. Several antibodies with unique properties were distinguished among antibodies with a great spectrum of specificity: against certain chains of human insulin, peroxidase obtained from horse-radish, horse cytochrome C, neurospecific proteins, against unique antigen determinant of purified protein derivate of tuberculin of cattle mycobacteria, against various ecotopes of molecules of plasminogen, fibrinogen and/or fibrin and their fragments, etc. The latter antibodies are especially important for studying antigen structure of proteins and mechanisms of blood coagulation and fibrinolysis. The above investigations also formed the basis of immunobiotechnological methods of creation of immunodignostic and immunotherapeutic preparations.

The Chornobyl Accident. S.V. Komisarenko made important investigations of the immune system after the accident at the Chornobyl NPP. Already in late 1986 contrary to the then official conception, using the most modern methods of research, S. Komisarenko and his colleagues proved for the first time that small doses of total radiation (25 rem) inhibit sufficiently the system of natural immunity, in particular, decrease the number and activity of natural cells-killers, responsible for the anti-tumor and antiviral immunity. Then Serhiy Komisarenko called the existence of radiation immunodeficiency "the Chornobyl AIDS". These data caused the violent negative reaction of authorities of the Ministry of Public Health of the USSR and Ukr.SSR that continued up to 1991.

The standard statement of that time opponents that the immunity inhibition in liquidators was not caused by radiation but by stress was disproved by analogous results of repeated study of their immune system a year later, when they had no stress, and by investigation of infrastructure of different subpopulations of immunocompetent cells, isolated by cytofluorimeter (jointly with Laboratory of Prof. K.P. Zak).

Life confirmed the rightfulness and opportuneness of the conducted work, which became the first objective investigation of the immune system of people irradiated during the accident at ChNPP. However in the further estimation of researches connected with medical after-effects of the Chornobyl tragedy the works by S.V. Komisarenko with colleagues were not practically mentioned, and rewards were given those who in 1986-1991 objected vigorously negative after-effects of the Chornobyl catastrophe that was then typical of our country. True enough, in 1997 the Scientific Council of the Kingston University (Great Britain) elected Serhiy Komisarenko the Honored Doctor of their University for the works in ecology, devoted to the investigation of the Chornobyl catastrophe.

The Department of Molecular Immunology in its development. Several groups which worked on different subjects and were united by the ideas of S. Komisarenko were formed at the Department of Molecular Immunology in the mid80's. As early as 1975, after his return from France, S. Komisarenko offered Member of AS of the Ukr.SSR V.O. Belitser, who headed then the Department of Protein Structure and Function, to perform joint immunochemical research of the fibrinogen-fibrin system.

The idea of Serhiy Komisarenko consisted in the use of, firstly, monospecific and then also mcAT as molecular probes for studying the structure of fibrin(ogen), search for neoantigen determinants exposed in the process of fibrinogen transformation into fibrin, reveal of unknown centers of fibrin polymerization and study of molecular mechanisms of this process. Volodymyr O. Belitser took a great interest in this work, but for the organization reasons it was started only in 1985 when Cand. Sc. E.V. Lugovskoy (now – Corr. Member of the NAS of Ukraine) with his group joined the Department of Molecular Immunology. United with the above mentioned "hybridoma" group headed by S.V. Komisarenko they obtained a number of their own mcAT to isolated fibrinogen, fibrin and their fragments, taking part in its polymerization, and to their fragments. These antibodies allowed revealing new unknown sites on the fibrin molecule which are involved in its polymerization and to propose certain mechanisms of fibrin polymerization. The obtained

E.V. Lugovskoy, S.V. Komisarenko and Ye. Makogonenko. Kyiv, 2013

results are of fundamental importance for the idea of fine mechanisms of formation of three-dimensional fibrin network creating the thrombus frame. For this work S.V. Komisarenko with colleagues were awarded O.V. Palladin Prize of the NAS of Ukraine in 2003.

The mcAT synthesis and use for theoretical research of molecular mechanisms of thrombogenesis made it possible to find and then use those of them which reacted with high specificity and affinity with fibrinogen, soluble fibrin or dimer D of fibrinogen fragment (D-dimer). This allowed creating modern immunoenzyme diagnostic methods of quantitative analysis of soluble fibrin, fibrinogen and D-D dimmer for monitoring the state of the blood coagulation system and thrombosis danger, as well as proposing the therapeutic agents to prevent thrombogenesis based on peptides, calixarenes, and recombinant single-chain antibodies.

In 2015 a group of the Institute researchers were awarded the State Prize of Ukraine in the Field of Science and Technology for investigations of the system of human homeostasis and creation of home diagnosticums, with the help of mcAT in particular, obtained under the supervision of S.V. Komisarenko.

Presentation of the I. I. Mechnikov Prize of the NAS of Ukraine to S. Komisarenko by B.E. Paton, President of the NAS of Ukraine. Kyiv, 2012

Even since the middle 70's S. Komisarenko considered that the elucidation of molecular mechanisms of lymphocyte activation (lymphocyte signaling) is one of the most important tasks in molecular immunology since the nature and mechanism of signal transfer from the plasmatic membrane of immunocompetent cell to its nucleus were unknown then. It was impossible to raise these questions independently in Kyiv. In 1981, working at the Sloan-Kettering Anticancer Center in New York in the Laboratory of J. Hedden, who jointly with R. Coffy was known for his works of studying the role of cGMP in activation of lymphocytes, S. Komisarenko started the cytofluorimetric investigation of lymphocyte, using differential coloration of cell RNA and DNA by acridine orange that allowed evaluating the passing by lymphocytes of the phases of the cell cycle and the effect of calcium ions on activation of cells.

S.V. Komisarenco continued these works in Kyiv at the Department of Molecular Immunology with allowance for available methodical possibilities. Then the works were performed by a group of researchers headed by S. Komisarenko's disciple M.V. Skok (now – Academician of the NAS of Ukraine), but now they concerned the role of nicotine acetylcholine receptors (nAChR) in lymphocytes. Since then the object of the study (now of the Laboratory of Immunology of Cell Receptors at the Department of Molecular Immunology) was nAChR, expressed in the central nervous system, in immune cells and on intracellular organelles – mitochondria, as well as antibodies to nAChR, as the factors of the effect on nAChR under physiological conditions and as a tool for the investigation. In particular, the role of antibodies against α7 of subtype nAChR in the development of neuroinflammation and neurodegenerative pathologies such as the Alzheimer disease is studied. For these works S. Komisarenko with coauthors were awarded the I.I. Mechnikov Prize of the NAS of Ukraine in 2012.

The original data obtained in the Laboratory which discovered a cholinergic mechanism of regulation apoptosis induction mitochondrial way became an innovation in science.

Scientific interests of one more group (today – the Laboratory of Immunobiology of the Department of Molecular Immunology) headed by the follower of S. Komisarenko – D.V. Kolybo are concentrated

on studying the antigenic structure and immunobiological properties of pathogenicity and virulence factors of the agents of infectious diseases. Researchers of this group have obtained a series of recombinant antigens, antigens of mycobacteria in particular, which cause tuberculosis in people and cattle, separate subunits of diphtheria toxin and recombinant antibodies to these antigens that allowed creating modern diagnosticums for tuberculosis and diphtheria analysis. The methods of gene engineering were used to create the library of recombinant single-chain antibodies of a man (with the power of 10 billion specificities) and of a mouse that became the basis of the collection of monoclonal and recombinant antibodies which were included in the State Register of the National Property of Ukraine.

It should be noted that the overwhelming majority of fundamental research of S.V. Komisarenko is always practice-focused. "Science – for the benefit of people" – is one more life motto followed by S.V. Komisarenko. Maybe that is because of his medical education and strong desire to contribute to the sociely.

Already in 1979, he was awarded the state Prize of the Ukr.SSR for the work on the creation of high-quality dairy products for babies (immunochemical research of milk proteins in particular). In its turn, the investigation of biological influence of bisphosphonates and the discovery of antitumor effect of methylenebisphosphonic acid (MBPhA) allowed him to offer a medical preparation Mebifon.

The current work on the creation of the novel complex of the preparation of MBPhA and vitamin D_3 – Mebivid, which promises to become probably the most efficient drug against osteoporosis, is also hopeful. Adding the prospect of creation of unique drugs, it becomes clear that the fundamental researches in the fight with hemophilias under the supervision of S. Komisarenko are continued in medical institu-tions and on the shelves of pharmacies.

To date S. Komisarenko has authored an impressive collection of approximately 500 scientific works, including 6 monographs, about 80 national and international patents and inventions as well as numerous articles on political and cultural issues of Ukraine. He is the Editor-in-Chief of the Ukrainian edition of the worldwide known manual in biochemistry *Principles of Biochemistry* by Lehninger.

The pedagogical activity of S. Komisarenko is also of exceptional importance. He gives lectures at the universities in Ukraine and abroad. He has trained a Pleiad of specialists of the highest qualification, which work actively in various scientific and educational institutions of Ukraine, USA, Germany, etc. Being a director of the Institute and Academician-Secretary of the Division of Biochemistry, Physiology and Molecular Biology of the NAS of Ukraine, S.V. Komisarenko supports in every way possible the scientific youth. He has one more life motto "We should do science together. There must be unity of the youth and experience". He thinks, and not unfoundedly, that the age of 30-50 is the most fruitful one for a scientist in experimental biology. That is the period when people make their most important contribution to the scientific legacy. The experience, achievements and traditions gained by an elder generation of scientists should be passed on to young scientists coming up to take the place of the elder ones.

A lot of young scientists are working and studyin at the Department now. They are ready to take the relay from the elder generation, to learn their scientific achievements and go forward to new ones. Scientific achievements of the Department of Molecular Immunology are weighty and known not only in Ukraine but also beyond its borders. Researchers of the Department cooperate successfully with well-known scientific centers, fulfill international grants, publish their works in the leading Ukrainian and foreign scientific journals, go for intership abroad. For example, on the initiative of S. Komisarenko and with his participation, the international school-seminar of the Federation of European Biochemical Societies FEBS Advanced Courses Modern Techniques in Molecular Immunology was

The success is the unity of the youth and experience, 2013

held in 2003 on the basis of the Department of Molecular Immunology of the Institute of Biochemistry. Leading scientists of the world, in particular, old friends of S. Komisarenko: K. Raevsky, former director of the Institute of Molecular Genetics at the University of Keln (FRG); M. Sela, former President of the Weizmann Institute (Israel); P. Rud (Great Britain); W. Helman (Sweden), R. Merno (USA).

Serhiy Komisarenko himself is a gifted and many-sided scientist with extremely broad circle of interests far beyond the limits of biological and medical science. His scientific polyvalency (medicine, biochemistry, molecular biology, immunology, biotechnology, nanobiotechnology) is supplemented with irreproachable erudition, and investigations are oriented not only to the development of fundamental science, but also to practical settlement of the acute problems of human health care. And he passes these values to the young generation of scientists, supports them in every possible way, he shares new knowledge, considerations, plans with them. In so doing Komisarenko uses any occasion: whether it is the meeting of the Scientific Council of the Institute, or tribune of the Ukrainian Biochemical Congress, which he calls regularly as the President of the Ukrainian Biochemical Society, or regular Parnas Conference held on his initiative every two years under the aegis of the Polish and Ukrainian societies and Israel Society of Biochemists and Molecular Biologists.

The high international authority of S. Komisarenko as a scientist, his close relations with the world level researchers raise the status of Ukrainian science considerably, help our scientists to join the general world scientific space. It is even difficult to remember and enumerate foreign colleagues, including numerous Nobel laureates, with whom S. Komisarenko maintains friendly and professional relations.

Visit of the Nobel laureate Aaron Ciechanover (Israel) to Palladin Institute of Biochemistry, 2008

The experiment results are discussed with the Nobel laureate Jean-Marie Lehn (France). Palladin Institute of Biochemistry, 2008

One can tell long about S. Komisarenko as a gifted scientist and organizer and give a lot of interesting impressive facts from his scientific biography, but unfortunately, it is impossible to embrace everything in one journal article. However, it would be fair to mention even in brief his great civil and political work that calls for a separate essay.

S. Komisarenko has made a significant contribution to the development of independent Ukraine and its capital, combining the scientific work with activities as the state official. In 1990 he was elected by the Verkhovna Rada (Supreme Council) of the Ukrainian SSR a Deputy Head of the Council of Ministers of the Ukr.SSR. Holding this post and the post of Deputy Prime Minister of Ukraine for almost two years S.V. Komisarenko initiated and took an active part in the development of some first archimportant Laws of Ukraine in humanitarian problems.

As a true patriot who loves Kyiv and cherishes its history when holding the post of Deputy Prime Minister of Ukraine, he initiated marking the 50th anniversary of the Babiy Yar tragedy at the international level and dignifying the location of the hornific events with a memorial. He also initiated the restoration of the Kyiv-Mohyla Academy, organization of the Ivan Honchar Museum, transfer of the Lenin Museum building to the Ukrainian House, the return to a Jewish community of the Brodsky Synagogue building in Shota Rustaveli Street that was used for the puppet theatre, etc.

In May 1992 Serhiy Komisarenko was appointed the First Ambassador of independent Ukraine to Great Britain, and from 1995 pluralistically to Ireland. Holding this post Serhiy favored the development of bilateral relations: he founded a charity fund to help the Chornobyl liquidators in London and Britain-Ukrainian Chamber of Commerce, initiated the inclusion of Ukraine to Directorate of the European Bank for Reconstruction and Development and to International Maritime Organization, organized free transfer to Ukraine of the British Antarctic Station Faradei (now Akademik Vernadsky), which became a center of polar research in our country. As the Ambassador he lobbied the maintenance by British delegation of Ukraine adoption to the Council of Europe, ratification by British Parliament the Partnership and Cooperation Agreement EU and Ukraine, etc.

S.V. Komisarenko is the author of numerous articles about culture, politics, and public life of Ukraine. His contemplations concerning these problems are the thoughts of a not indifferent person, a citizen with active life position. He is a true patriot of Ukraine with a sense of high responsibility and cares for the state and its future. Thus, he was invited in 2001 to make the keynote speech at the International Conference dedicated to the 15th anniversary of the accident at the Chornobyl NPP in the UN headquarter. In 2002 he spoke on behalf of Ukraine in Brussel at the International Conference Several Europes and Transatlantic Relations, in 2003 he made a report at the Kennan Institute in Washington Ukraine between Elections of 2002-2004, and at the University of Kent (USA) he was an honored speaker with the lecture about the influence of the accident at ChNPP on the environment all over the world. In 2005 The Royal Academy of Sciences in Canada invited S. Komisarenko to appear with a cycle of reports at the different universities of their country.

S.V. Komisarenko also gives much attention to public activities. Every year, beginning from 2005, he represents Ukraine as the expert and speaks on its part at International forums of the highest level on the problems of biological safety and biological protection, holds international conferences and seminars Biosafety and Bioprotection in Ukraine. By Decrees of the President of Ukraine of September 2007, June 2009 and November 2017 S.V. Komisarenko was appointed head of the Commission in Biosafety and Bioprotection at the National Security and Defense Council (NSDC). He is a Chief Expert in Biosafety in Ukraine. He was elected First Deputy Head of the

The Ambassador of Ukraine to Great Britain Serhiy Komisarenko opens the exhibition of the arts of Ukraine in the Cork Gallery in the presence of the member of British Royal Family Prince Richard, 2nd Duke of Gloucester. London, 1995

Ukrainian Peace Council, President of the Ukrainian Institute of Peace and Democracy, Head of the Supervisory Board of The Charity Fund of National Memory of Ukraine, Honorary Member and Member of the Board of Directors of British-Ukrainian Chamber of Commerce.

Advocating the philosophy of good and charity, S. Komisarenko also takes care of the activity of Ukrainian center of International Charity Organization Special Olympics, takes a direct part in the organization athletic competitions for people with intellectual disabilities and makes everything possible to popularize this charity mission in Ukraine.

Today S. Komisarenko is a Full Member of the National Academy of Sciences of Ukraine (1991), and of the National Academy of Medical Sciences of Ukraine (1993), Laureate of the State Prize of Ukraine (1979) and Prizes of the NAS of Ukraine named after O.V. Palladin (2003), I.I. Mechnikov (2012), Member of the Presidium and Academician-Secretary of the Division of Biochemistry, Physiology and Molecular Biology of the NAS of Ukraine. He is responsible at the NAS of Ukraine for medical and biological investigations and rela-tions with the National Academy of Medical Sciences of Ukraine where he is also a Member of the Presidium. Besides, he is the Editor-in-Chief of the Ukrainian Biochemical Journal and the journal Biotechnologia Acta, Member of Editorial Boards of the International journal Evropa (Poland) and a Journal in Immunopharmacology (Italy), Member of the Board of International Society of Immunopharmacologists (USA).

S.V. Komisarenko was awarded the First Class Order of Yaroslav Mudry (2005), the Third (1996), Second (1998), and First (2013) Class Order for Services, Diploma of the Verkhovna Rada (Supreme Council) of Ukraine (2003), he was given the title of the Honored Scientist and Technologist of Ukraine (2008), the People's Republic of China Highest Award of Friendship (2012) and many other awards. S. Komisarenko possesses the rank of the Ambassador Extraordinary and Plenipotentiary of Ukraine to Great Britain and Ireland. He is also the Honorary Doctor of the Kingston and North-London Universities (1997), Honorary Professor of the Odessa Mechnikov National University (2010), Mechnikov Institute of Microbiology and Immunology of NAMS of Ukraine (2011), Honorary Member of the Polish Biochemical Society and the World Organization of Immunopathologists.

However the most important and convincing vital achievement of S.V. Komisarenko is the founding of a new trend of research in Ukraine – molecular immunology, as well as the new scientific school; its representatives, in their turn, have become the worldwide known scientists and won the international recognition.

Everyone, who consorted, at least once, or settled some problems (scientific, organizational, or social) with Serhiy Komisarenko or listened to his speeches, felt the attractiveness of this outstanding personality, highly educated and very talented man who possesses well-grounded, encyclopedic knowledge in various fields of natural and social sciences, literature, arts, knows several foreign languages. S. Komisarenko meets his 75th birthday full of new ideas, projects and plans. On behalf of the collective of researchers of the Palladin Institute of Biochemistry, we wish him and his command great success in following the thorny path to new knowledge and new scientific achievements.

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