

To the 75th anniversary of Mykhailo Arsentiiiovych Tukalo, Academician of the NAS of Ukraine, Director of the Institute of Molecular Biology and Genetics of the NAS of Ukraine



The staff of the Institute of Molecular Biology and Genetics of the NAS of Ukraine congratulates Mykhailo A. Tukalo, the outstanding scientist, Academician of the NAS of Ukraine, Head of the Department of Protein Synthesis Enzymology and Deputy Director for Scientific Work of the IMBG on his anniversary and wishes him good health, well-being, optimism, inspiration, new scientific achievements, and realization of his plans and dreams.

Mykhailo A. Tukalo graduated with honors from Taras Shevchenko Kyiv National University in 1973

After completing postgraduate studies at the IMBG in the specialty “molecular biology” he defended his thesis for the degree of Candidate of Biological Sciences in 1981 and for the degree of Doctor of Biological Sciences in 1989. Since 2006, he has been the Head of the Department of Protein Synthesis Enzymology and Deputy Director for Scientific Work of the IMBG. From 2019 to the present — Director of the Institute.

Academician Mykhailo A. Tukalo made a significant contribution to understanding the molecular basis of protein biosynthesis, in particular, was one of the first in the world to decipher the structure of animal tRNAs, the key components of the translational machinery. Besides, this research enlightened the participation of tRNAs in the regulation of protein biosynthesis at the translational level.

One more exceptionally important area of molecular biology under his investigation was the accuracy of the decoding of genetic information, the violation of which is directly related to aging, oncogenesis and other pathological processes. The decoding mechanism is based on the specific recognition of aminoacyl-tRNA synthetases (aaRSs) for their cognate amino acid and tRNA, following catalysis and editing. In collaboration with Dr. S. Cusack (the European Molecular Biological Laboratory) the 3-dimensional structures of several aaRSs and their complexes with different substrates, including the tRNAs, have been studied. The synthesis of specific products by aaRSs has been shown to depend on the conformational changes in the molecules. The data obtained clarified the mechanism of amino acids activation, recognition of homologous tRNA and



their aminoacylation by aaRSs. Moreover, the original ideas have been proposed and experimentally proved in the Department of Protein Synthesis Enzymology on the extremely important problem of the molecular basis for editing errors by aaRSs. The revealing a special editing mode is of great significance since the affinity difference is not enough for aaRSs to discriminate strictly between similar amino acids. When a tRNA is acylated with a wrong amino acid this would lead to an error in the incorporation of genetically coded amino acids into protein. To overcome this, several aaRSs have developed the ability to hydrolyze the mischarged tRNA in an extra editing domain. On the basis of experimental results and the QM/MM calculations a tRNA-assisted mechanism of post-transfer editing was suggested that made Mykhailo A. Tukalo a world-known leader in this field of protein biosynthesis research.

It is of great importance that the fundamental works of Mykhailo A. Tukalo on the study of the structural and functional features of prokaryotic and eukaryotic aaRSs formed the basis of practically-oriented research to develop a new class of antibiotics against bacterial (*Enterococcus faecalis*, *Mycobacterium tuberculosis*, *Streptococcus pneumoniae*) and fungal infections. As a result, a new promising mechanism of action of antibiotics has been discovered. Using a structurally based target-specific approach, the inhibitors with antituberculosis activity against multidrug-resistant forms are developed.

The scientific achievements of Mykhailo A. Tukalo have wide international recognition. This is evidenced by the high citation index of his works (more than 3600), his designation as a coordinator of a number of international scientific projects, presentations and

lectures at international scientific forums and at leading research centers and universities of France, Germany, Spain, the USA, Canada and Japan.

The scientist's creative output includes more than 300 articles in leading journals such as *Science*, *Nature*, *Structure* and *Molecular Biology*, *Molecular Cell*, *EMBO Journal*, *J. Biological Chemistry*, *Biochemistry*, *J. Molecular Biology*, several chapters in the international monographs, dozens of copyright certificates for inventions and patents. Moreover, he is actively involved in education.

Since 1992 — Associate Professor in the Taras Shevchenko Kyiv National University, 2005 — Lecturer in the Department of Biochemistry of the Educational and Scientific Center “Institute of Biology and Medicine”, 2016 — Lecturer for the training of postgraduate students in the IMBG on the specialty E1 Biology and Biochemistry, 2021 — Founder, Head and Lecturer in the Department of Molecular Biology and Biotechnology in Kyiv Academic University, which on the basis of the IMBG trains applicants for the educational degree “Master” in the specialty E1 Biology and Biochemistry.

The development of science in Ukraine, even during the war, is one of the most priorities of the intensive scientific and organizational activities of Academician Mykhailo A. Tukalo. In particular, he is a member of the Commission on Biosafety and Biological Protection at the National Security and Defense Council of Ukraine (2009-2017); a member of the Commission for the Development of the Methodology for assessing the effectiveness of scientific institutions of the NAS of Ukraine; a member of the Expert Council for evaluation of doctoral and candidate theses in the Ministry of Education and Science of Ukraine; editor-in-chief of the journal “*Biopolymers and Cell*” (Ukraine) *etc.*

The great contribution of Academician Mykhailo A. Tukalo in the scientific and social life of the Ukrainian society has been recognized with many significant state and academic awards, among them State Prize of Ukraine in the field of science and technology; Honorary Diploma of the Verkhovna Rada of Ukraine.

Honored Worker of Science and Technology of Ukraine; Commemorative Award in honor of the 100th anniversary of the National Academy of Sciences of Ukraine, Order of Prince Yaroslav the Wise, 5th degree.