

Polytechnic University scientists' project wins international grant competition

An application for joint international research submitted by a group of scientists from the Nanobiotechnology Research Complex led by Professor Mikhail KhODORKOVSKY, together with colleagues from Uppsala University (Sweden), won the competition of the Russian Ministry of Science and Higher Education announced at the end of June 2021. A total of 27 applications were submitted for the selection of grants in the field of science for scientific research by Russian scientific and educational organizations together with organizations of Nordic countries.



The topic of the announced project sounds like 'Regulation of transcription by molecular barriers of different nature', commented Mikhail Khodorkovsky, director of the Nanobiotechnology Research Complex. Together with our university, the Institute of Cell and Molecular Biology at Uppsala University in Sweden will work on the project. We plan that the implementation of this project will contribute to the development of new approaches to inhibiting bacterial transcription, one of the main targets for antibiotics. /p>

The relevance of the international project submitted for the competition is

primarily due to the unique single-molecule methods that allow studying individual molecules - DNA, RNA, or proteins - implemented in the Nanobiotechnologies SRC at SPbPU. Uppsala University also actively uses single-molecule methods for research. Combining the competences of the international team of scientists from the two universities should help to take a new approach to the study of transcription, one of the most important processes of any living cell.

As part of the project presented, Russian participants will develop and create methods for measuring the elongation profiles of transcription at the single-molecule level by acoustic force spectroscopy (AFS) and obtain data on the regulation of transcription in bacteria by molecular barriers of combined biological and chemical nature. Foreign colleagues will develop a methodology and make measurements at the level of individual molecules using the highly sensitive smFRET method of the dynamics of overcoming the collision between the transcriptional complex and the nucleosome.

For the period of the implementation of the grant, young scientists from Polytechnic University will intern in Sweden, during which they will be able to learn the unique research methodology of their Swedish colleagues. Based on the competencies and experience acquired during the joint research, as well as the equipment purchased as part of this international project, SPbPU's Nanobiotechnology Research Center will be the first in Russia to implement these methods for studying transcription processes

One of the most significant practical applications of the project could be the creation of new approaches in the use of antimicrobial agents (drugs) that would allow better control of bacterial infections. Hundreds of thousands of cases of bacterial infections are registered in Russia every year. The most dangerous to humans are such diseases as tuberculosis, meningococcal infection, whooping cough, and bacterial dysentery (shigellosis). Polytechnic scientists believe that the new approach will contribute to a more effective use of antibiotics, resulting in a new way for mankind to fight dangerous diseases.

Another important feature of the project is that its results can be applied to the development of substances that inhibit the transcription of the SARS-CoV-2 virus. For this purpose, it is proposed to use substances that target RNA-dependent RNA polymerase, which can be effective in preventing viral infection while being safe for the human body, since the transcription of human genes is not disrupted.

For reference: The direct executors of the project from the Russian side will be the employees of the [Nanobiotechnology Research Complex of SPbPU](#). This subdivision was established in 2008, and it uses the latest experimental approaches to study the composition and structure of the complex biological objects, to reveal their functions on the cellular and subcellular levels, to determine the trace and quantity of metabolites in the products of human vital functions, to study the complex biochemical processes on the molecular level, to study single-molecule dynamics of nanobionics, etc. The works in the research complex are carried out with financial support from federal target programs of the Russian Ministry of Education and Science and grants from the Russian Foundation for Basic Research and the

Russian Science Foundation. In recent years the staff of the Nanobiotechnology Research and Development Complex has published dozens of articles in leading scientific journals, obtained more than 10 patents and published several know-hows.

Colleagues from Uppsala University, the oldest university in Sweden, work in a laboratory dedicated to studying the mechanisms and regulation of protein machines at the single-molecule level. The laboratory of Professor Sebastian Deindl is one of the world leaders in molecular biology, using single-molecule techniques in combination with smFRET, which does not yet exist in Russia, and also has unique competence in the field of chromatin research. The laboratory staff conducts world-class research, as evidenced by publications in prominent scientific journals such as Nature, Nature Communications, Science, Molecular Cell, and others.

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