Review of the proposal to open a new theme

"Highly sensitive sensor based on molecular recognition for viruses detection"

The proposed topic is interdisciplinary and combines the areas of production and application of multifunctional track membranes, the development of new diagnostic tools and the inhibition of viral infections, and the creation of molecular recognition elements based on aptamers.

The use of track etched membranes in combination with virus-specific aptamers opens the way to the development of new technologically advanced diagnostic systems with high sensitivity and specificity of detection. To functionalize track membranes with aptamers and detect by surface-enhanced Raman scattering, the authors propose to create new track membranes based on micro- or nanoporous polymer carriers carrying gold or silver nanoparticles functionalized with aptamers. Such membranes will increase the sensitivity of the analysis due to a combination of the effects of dielectric and plasmon resonance. The project plans to develop flow sensors based on multifunctional track membranes suitable for point-of care use outside specialized laboratories. It should be noted that currently there are no industrial samples of sensors of the described type in the world.

The development of new aptasensors in this project will be carried out using the proteins of the African swine fever virus (ASFV) as an example. Timely detection of this dangerous animal infection is important from the point of view of veterinary medicine and agriculture. It will help to control the spread of the disease and carry out preventive measures, which is especially important in light of the fact that a vaccine against ASFV does not yet exist. During the project, the authors plan to select new aptamers for proteins exposed on the surface of the viral particle. At the same time, the use of aptamer-modified track membranes will develop in two directions: the creation of specific antiviral filters to capture ASFV particles and the creation of diagnostic systems. As part of the first direction, the effect of membranes modified with aptamers on the DNA-damaging genotoxic and mutagenic activity of the ASFV in cell cultures will also be studied. Therefore, the experimental base of the project includes not only the unique capabilities of ion irradiation, but also a wide range of physicochemical and molecular biological methods for studying and modifying polymer materials.

The project brings together two scientific teams from Russia: specialists in the generation and application of aptamers and aptasensors, including using SERS (Faculty of Chemistry, Moscow State University) and specialists in the field of producing track etched membranes (Laboratory of Nuclear Reactions JINR). The competencies and areas of interest of these teams are strengthened by a third party: scientific teams from the Institute of Molecular Biology and the University of Yerevan (Republic of Armenia), which will provide studies of the antiviral effects of aptamer-modified track membranes. In general, the composition of the research team and the equipment available to the participants will ensure the solution of all the tasks set in the project and the achievement of the expected results.

It is planned to use modern research methods that meet world standards.

The project plan is logical and consistent with the goals and objectives, the risks of non-fulfillment are adequately assessed.

The requested amount of funding is justified.

The expected results of the project have a clear potential for practical use both in the medium term (development of new methods for diagnosing and preventing an infection important for agriculture, ASFV), and also in the long term, since the methods and approaches developed in the project can be adapted to identify and prevent other viral diseases of humans and animals.

Thus, I consider it appropriate to support the opening of this theme.

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