

Review on the research topic " High-sensitivity sense based on molecular recognition for viruses detection "

1.1. Theme code - 07-5-1131-2017

1.2. Project code - 07-5-1131-3-2025/2029

1.3. Laboratory - Flerov Laboratory of Nuclear Reactions

The project proposed by the Nechaev AN and Zavyalova EG team is particularly important due to its apparent simplicity and extraordinary importance in the molecular diagnosis of viruses and not only viruses.

Prevention of epizootics and zoonotic infections

application in the prevention of epizootics such as the one caused by the African swine fever virus will lead to the limitation of these epizootics of economic importance but also of possible zoonotic infections , from pigs to humans, infections that can have the effect of real "biological bombs", generating diseases for which, at this moment, humanity is not prepared to diagnose, monitor or treat them.

Application of ion- track technology

Beyond these aspects, the application of ion- track technology for the production of membranes with nanopores and micropores, a sufficiently well-controlled technology in our times to be able to develop membranes engraved with traces of an architecture that allows composite/hybrid structures necessary for the development of these functional membranes , development which, as described by the esteemed authors of the project proposal, seems not to have high costs and allows, in a later commercial stage, large-scale application at the level of extensive geographical, social and economic regions .

Diagnostic tool and knowledge

Another quality of this project is that it does not only propose a diagnostic tool, but also a knowledge tool addressing the levels of chemical, biochemical and genetic knowledge .

We consider that this instrument, beyond its quality as a biological sensor necessary for human and veterinary medicine (with active Raman labels or fluorophores), the addition of SERS and the combination with ultrafiltration and microfiltration membranes , presents a profoundly innovative aspect because it adds to the previously described properties , those of molecular affinity with immobilized antibodies and aptamers mark

These qualities allow the development of others, namely those of plasmonic and dielectric resonance, especially through addition gold and silver nanoparticles , dielectric structures modulated on a nanoporous polyester support , all of which lead to the amplification of the electromagnetic field and hence to the increase the sensitivity and specificity of the method and the developed tool.

New methods of cancer detection

Even if, due to the robustness of the instrument, its sensitivity and specificity, the described biosensor can be *applied in field conditions* , I insist on the fact that in fact this instrument is only an example of the development of a new detection method , useful not only in detecting various viruses but also fragments of circulating tumor DNA (ctDNA) as well as exosomes from **the blood of cancer patients** .

This observation can be used to study the mutagenic effect of these DNA and RNA molecular fragments, resulting together from circulating tumor cells, possibly opening a new way for the study of malignant tumor relapses, even when solid tumors are macroscopically, apparently, completely destroyed .

Other reasons that support the opening of this research topic

The rationale and objectives of the project are convincing both theoretical and applied, which convinces about the realism and success of the proposed research . The equipping of each research team **with the necessary equipment and the adequate financing of the project** as well as the previous concerns of the authors are again convincing factors on the future success of the project.

On the other hand, **the urgent need for more precise tools, usable in viral detection** , tools that the Covid infection pandemic would have greatly needed, shows the great potential of the demand for these methods and tools for working in virology.

The risk analysis is correctly done , a subchapter that additionally supports the viability of the research theme.

Considering the listed arguments, I support the opening of this research topic.

Prof. Nicolae Verga MD, PhD

"Carol Davila" University of Medicine and Pharmacy, Bucharest , Romania

June 19, 2024