Over the past 10,000 years, human attitudes toward disease have changed dramatically. Technological advances have made it easy for people to move around the globe. More than half of the world's population now lives in urban areas, where there is no shortage of new diseases resulting from environmental pollution, shabby housing and inadequate sanitation. In addition, changes in agriculture and new infrastructure projects continue to open up new pathways for disease, and global processes such as climate change are affecting the geography and ecology of our planet in dramatic ways. Given that humans, animals and microorganisms form a common ecosystem, the likelihood of virus transmission from animals to humans and vice versa increases, and a virus that is harmless to an animal does not necessarily remain so to a human. Examples of such a disease pathway include: HIV, influenza, Ebola, chikungunya, dengue or zika. Viral diseases pose a huge threat to humans due to their high infectivity (ease of spread). Due to the high infectivity and unpredictable dynamics of viral diseases, there is a real danger that local outbreaks of infection will turn into an epidemic or even a pandemic. Therefore, a key factor in the fight against viral diseases is the number of tests for the virus in the body, their availability to as many people as possible, and the speed with which they are performed. The COVID-19 pandemic demonstrated the importance of testing patients. The number of tests performed for a given virus in the body, their availability to as many people as possible, and the speed with which they are performed - knowing the number of cases in a given area is crucial to taking preventive measures to limit the speed of expansion of the epidemic. Current polymerase chain reaction (RT-PCR) reverse transcription and antigen tests do not satisfactorily meet the above criteria. Tests performed by RT-PCR technique are the most trusted, but despite their numerous advantages, i.e.: wide range of concentrations determined, high sensitivity and throughput, they are unfortunately ineffective in detecting the virus in the early stages of infection. In addition, these tests are costly, time-consuming, analyses are performed only by qualified personnel, and are prone to interference due to the presence of dead virus fragments from past infections in the sample. What's more, there are relatively few laboratories stocked with the equipment necessary to perform this type of testing. Therefore, there is a constant search for alternative solutions that are more efficient, accurate, cheaper and more readily available. The above conditions are definitely met by voltammetric detection sensors.

The goal of this project is to design fully innovative diagnostic devices to identify viruses specific to tropical diseases such as Chikungunya, Zika and Dengue. These viruses will be detected in blood samples, urine or nasopharyngeal swabs. Antibodies specific to the proteins of the respective viruses will be used as receptors. In order to control the orientation of the receptor molecules (antibodies/nanobodies) on the electrode surface, the electrode will be suitably modified with an intermediate layer, which will further ensure optimal packing density of the receptor molecules in the layer and adequate sensitivity. To adequately meet the requirements of *in vitro* diagnostic guidelines, the proposed diagnostic devices must rigorously fulfill the following tasks: (i) low sample consumption, (ii) ability to use readily available (non-invasive) samples such as blood, urine or nasopharyngeal swabs; (iii) simple system; (iv) short turnaround times; and (v) accurate and quantitative results. The developed voltammetric immunosensors will enable sensitive, selective and accurate detection of viruses. The biggest novelty of this project will be the simplification of the detection procedure by determining when the analytical signal is generated. The analytical signal will appear only after the receptor recognizes the analyte.

The expected final results of the proposed project will provide new insights into the rapid diagnosis of viral infections. Our proposal is for a very ambitious research, development and innovation program in nanochemistry and nanomedicine for early diagnosis of viruses using next-generation voltammetric nanosensors. The main goal and achievement of the project will be the development of universal diagnostic protocols easily adaptable to different types of viral infections.