Healthcare professionals are constantly struggling with the number of patients suffering from chronic kidney disease (CKD). Statistically, around 4.2 million people in Poland suffer from the condition - CKD is the second most commonly diagnosed condition in Poland after hypertension. Electrochemical biosensors are an excellent alternative to classically performed laboratory tests.

Researchers are looking for a better, more accurate, and faster way to diagnose kidney conditions in patients struggling with this disorder. The traditional diagnostic process requires the patient to obtain a referral from a doctor and go to a laboratory, which often involves waiting in a queue for several hours and waiting for the result for even a few days. Furthermore, it is costly and often has to be repeated several times a month. The whole process can take up to 2-3 days. Reducing that time may offer a chance to stop inflammation or improve filtration before it is impaired.

This research is not just about developing a new electrochemical sensor. It is about empowering patients with the ability to monitor their own health. This sensor, which will detect markers directly related to specific CKD conditions, is designed to provide an instant response, be more cost-effective than traditional laboratory tests, and offer the same or even better quantifiability. It is intended to be used not only by qualified healthcare professionals but also by patients themselves, potentially revolutionizing the way CKD is diagnosed and managed.

The project aims to develop an innovative nanobiosensor for the detection of the biomarker of chronic kidney disease, the central fragment of adrenomedullin propeptide (MR-proADM). The nanobiosensors electrode is based on a Ti-Cu-Ag ternary alloy with surface modification in the form of titanium dioxide nanotubes. The detection method used in the nanobiosensor is an electrochemical impedance spectroscopy technique.

The main objective of the project is to electrochemically assess the potential use of a ternary Ti-Cu-Ag alloy functionalized with nanotubes for quickly determining, testing concentration, and monitoring selected markers that undergo overexpression as a result of kidney dysfunction. The project's process includes developing a ternary Ti-Cu-Ag alloy with nanostructures on the surface and thermally modifying it using specific methods while optimizing the parameters of these methods. The effect of anodizing parameters on the properties of TNT on the surface of Ti-Cu-Ag alloy will also be determined. Furthermore, the project aims to evaluate the mechanism of protein immobilization on the surface of the new biosensor platform.

These stages constitute the preparation of the nanobiosensor electrode, which will later be utilized to develop an electrochemical detection method enabling qualitative and quantitative assessment of MR-proADM concentration in the patient organism.

The projects potential impact includes advancements in CKD diagnostics, offering a sensitive and rapid detection method. Its interdisciplinary nature, leveraging nanotechnology and biosensing, not only contributes to the development of science but also presents a promising investment opportunity. By addressing a significant health challenge, our project has the potential to make a substantial difference in the lives of millions of people.