Microorganisms have been a serious threat to the health and life of both humans and animals for centuries. Since the discovery and isolation of penicillin, antibiotics have become an effective tool to combat pathogenic pathogens. However, their too common and often irresponsible use caused that microorganisms created a number of defense mechanisms against them, such as transforming the antibiotic into a harmless form through enzymatic modifications, active removal of antibiotics from the cell, or modification of its components. Additionally, the recent epidemiologic situation with SARS-CoV and SARS-CoV-2 has revealed that the fast and relevant detection of the infection is one of the most effective ways to prevent its distribution and reduce the ravages caused by the epidemic . Rapid identification of both bacterial and viral infections is a strategic stage in the fight for the patient's life because only a thorough understanding of the source of the disease allows for the implementation of proper life-saving therapy. Unfortunately, currently used for this purpose methods based on molecular biology, despite their high accuracy, are expensive, time-consuming, and can be performed only in specialized laboratories with qualified staff and specialized equipment, access to which is limited in many regions of the world. Taking this into consideration, today's world of science faces a huge challenge, which is to develop a new fast, cheap and easy to perform, as well as accurate and repeatable methods for microorganisms identification.

Against this challenge is the use of innovative technology such as matrix-assisted laser desorption/ionization–time-of-flight mass spectrometry (MALDI-TOF MS). This technique, thanks to the use of soft ionization enables for both identification of native bacterial cells as well as the selected expression proteins, and tracing the lipid profiles Bacterial identification using MALDI-TOF MS has revolutionized the world of microbiological diagnostics, offering species level identification within minutes with accuracy that matches, and often outperforms, conventional identification systems. Furthermore, an innovative strategy that allows to improve the analysis of microorganisms may be application of nanotechnology-assisted laser desorption/ionisation time-of flight mass spectrometry (NALDI-TOF MS). On the other hand, another group of analytical techniques which can find an application in microbial diagnostics are electromigration techniques. Nowadays, the use of capillary electrophoretic (CE) techniques for separation, characterization and identification of the wide types of microorganisms has received growing attention. Pioneering work carried out in the team of prof. Buszewski showed that capillary electrophoresis is an effective tool for identifying *S. aureus* and *E. coli* strains, as well as identification of *Proteus vulgaris*. Another work done at the Department of Environmental Chemistry and Bioanalytics at the Nicolaus Copernicus University in Toruń presents the clinical application of a rapid screening test based on CZE analysis to identify *Escherichia coli* infection in biological samples such as infected wounds and ulcers. In addition, electrophoretic methods can be an excellent technique for preparation and pre-concentration of clinical samples, and their combination with mass spectrometry appears to be essential for microbiological analysis. Therefore, the procedures proposed in the project should act as a rapid, screening identification of individual etiological factors of many microbial infections.