One of the greatest problems of today's World is the energy crises. A constant and significant shortage in energy sources, developing global warming and increasing pollution calls for a search for new environmentally friendly sources for energy and remediation technologies. One of the most promising alternatives are bioelectrochemical systems (BESs) – a group of technologies and platforms that utilize microorganisms in order to catalyze either oxidation or redox reactions happening in the system. Among various setups, microbial fuel cells (MFCs) and microbial electrolysis cells (MECs) are the most promising and evolving areas of research.

On the one hand, microbial fuel cells are being studied for their potential for the energy production. On the other hand, when microbial electrolysis cells are considered, production of hydrogen or other valuable compounds is possible. Despite an increasing number of systems and solutions proposed in the literature, there are still some drawbacks that need to be overcome in order for the above-mentioned systems to work efficiently. Briefly, an anode material, bacteria species and setup configuration enabling the highest possible current generation and/or chemicals production rate must be provided. Additionally, human and environmentally friendly systems would be also a great advantage. Moreover, an understanding of mechanisms responsible for electron transfer between microorganism and surface of the electrode is extremely important.

For the reasons mentioned above, a novel and promising bioanode based on metal/polycation substrate with human and environmentally friendly lactic acid bacteria (LAB) biofilm is proposed for the very first time. Therefore, the main aim of this project will be to synthesize and comprehensively characterize bioanodes and to investigate mechanisms occurring at the electrode surface/biofilm interface. What is more, it is hypothesized that by combining electrochemical and biochemical methods, determination of electron transfer mechanism and an influence of several parameters on system's performance will be possible.

The results obtained within this project will give an upright description of the novel, environmentally friendly bioanodes that may have a potential use in bioelectrochemical systems. Furthermore, an insight into processes happening at the electrode/microorganism interface may be of crucial importance when planning a construction of microorganism-based systems for energy or chemicals production.