

It has been known for a dozen or so years that not individual microbial cells, but entire microbial communities, called biofilms, are responsible for the majority of infections. These communities are covered by the extracellular matrix, which may consist of polysaccharides (the matrix is then of a mucous nature) or of proteins and/or extracellular DNA. The aforementioned matrix makes it much harder for antibiotics and antiseptics to reach bacterial cells hidden within it. Therefore, cells in a biofilm are characterized by a 1000-fold increased resistance to antimicrobial agents than cells of the same microorganism in the free-swimming (aka.planktonic) form avoid of protective matrix layer. Currently, there are no good methods of preventing and combating infections caused by biofilms. The essence of a problem can be proved by the fact that about 5% of health budgets of the European Union countries is absorbed by the fight against chronic wounds complicated by biofilms. However, one should be aware that biofilms also cause infections of the skin, bones and organs as well as internal systems. In our previous, published studies, we have shown that the use of rotating magnetic field coupled with antibiotics or antiseptics - significantly increases the activity of these antimicrobial compounds. The observed effect is of very promising nature, but all the more it requires explanation of mechanism standing behind it. Therefore, the main aim of the current proposal is explanation of the mechanism of significantly increased activity of antimicrobial compounds - antiseptics and antibiotics - against bacterial biofilms in the presence of a rotating magnetic field, which the applicants observed in their previous studies. We hope that explanation of this mechanism will pave the way for the development of new methods for safe biofilm removal in clinical setting. We believe, that results obtained in this project will have significance not only for the scientific community but also virtually for the whole of humanity. The research we want to perform includes culturing biofilms of *Pseudomonas aeruginosa* and *Staphylococcus aureus* in vitro and then placing them to the patented by us rotating magnetic field generators in the presence of antibiotics and antiseptics. Using state-of-the-art research devices, such as the electron microscope, confocal microscope, high-resolution mass spectrometer, nuclear magnetic resonance, we intend to analyze the impact of antimicrobial field and antimicrobial agents on the chemical composition and physical parameters of the biofilm matrix as well as on the metabolomic and proteomic processes occurring in biofilm cells. Analysis of the obtained data using biostatistical methods will allow us to understand the mechanism standing behind observed, fascinating effect of biofilm destruction.