Reg. No: 2015/18/E/ST5/00222; Principal Investigator: dr hab. inż. Dominik Jańczewski

Amphiphilic molecules, so molecules possessing both hydrophilic (water-loving, polar) and lipophilic (fat-loving) properties are present commonly in our daily life. We can find them in form of artificial products like soap and detergents or as molecular building blocks of living organisms like e.g. phospholipids present in the cellular membrane. It was observed that many amphiphilic molecules can interact with lipid bi-layer present in the cell membrane leading to its disruption or even cell death. This phenomenon can be utilized for construction of novel antimicrobial agents or as supporting mechanism for transport of other molecules across the cell wall like for example drugs or genes. The aim of this project is to understand mechanism of interactions between certain antimicrobial amphiphilic polymers and cell membrane and in particular to gain insight into the way those polymers are decomposing lipid bilayer. Understanding of how antimicrobial amphiphilic polymers work will help us to develop antibiotics of the future and potentially other active pharmaceutical ingredients.
Our work will investigate two classes of polymers namely co-polymeric derivatives of linear polyethylenimine and co-polymers of maleic anhydride. In the course of research we will synthesize various polymers and test their properties. We also find out if it is possible to construct amphiphilic polymer with switchable antimicrobial activity. It means we will try to construct molecule which cell destroying properties can be switched on and off, at will, under several external parameters like e.g. pH, temperature or redox potential. Finally we will investigate if antimicrobial polymers can be utilized to kill Mycobacteria responsible for such notorious diseases like Tuberculosis or Leprosy. This is important problem since Tuberculosis bacteria with antibiotic resistance is a serious social problem with consequences touching the whole human population. Due to many reasons, like e.g. poor control over the use of antibiotics in many developing countries, Tuberculosis is gaining the field despite achievements of medicine in previous decades. This project has a potential to provide important brick of knowledge to combat Mycobacterium.