Popular science description of the research project OPUS 13 – dr hab. Robert Czajkowski Intercollegiate Faculty of Biotechnology University of Gdansk and Medical University of Gdansk

Host receptors involved in bacteriophage adsorption to *Dickeya solani* and *Pectobacterium parmentieri* cells and the ecological costs of phage resistance *in vitro* and *in planta*

Bacteriophages (phages) are viruses that attack and kill bacteria. They were discovered in the early XX century by Frederick W. Twort in England in 1915 and Felix d'Herelle in France in 1917 and since then, they are a subject of scientific investigations. Firstly, the discovery of phages was believed to solve all problems connected with treatment of bacterial infections in humans. However, due to the initial failure in their up-scaled production, activity and stability as well as because of the discovery of the first natural antibiotic (penicillin) this idea has been almost completely abandoned. In the XXI century, thanks to the technical advances in research methodology, the idea to study bacteriophages and their global influence on bacteria came back to fashion.

Bacteriophages are present in most, if not all, natural environments in which bacteria exist and can infect the great majority (if not all) bacterial species. The accepted paradigm of the phage-host interaction states that the susceptibility of a bacterium to a particular bacteriophage is dependent on whether or not the virus can attach to specific sites named receptors on the host surface. A fundamental understanding of this mechanism is prerequisite to establish the nature of viral infection as this step remains crucial for the efficient propagation of the infection as well as it determines the infection fate.

Despite the fact that phage-bacterial interactions have been studied for more than a century, still little is known about their molecular basis. Only limited number of bacteriophage receptors were found, crystalized and characterized in detail, and the majority of those examples came from model systems including bacteria such as *Escherichia coli* and their corresponding bacteriophages: λ and T4.

The proposed project is conducted to determine the molecular mechanism by which bacteriophages specifically attach to and infect their bacterial hosts, the pectinolytic Soft Rot *Enterobacteriaceae* (SRE) (*Pectobacterium* spp. and *Dickeya* spp.). These bacteria are important plant pathogens cause soft rot diseases on a great variety of crops and ornamentals worldwide leading to increasing losses in agriculture of ca. 250 million Euro annually. Little is known about receptors used by bacteriophages to infect plant pathogenic bacteria and in case of SRE-associated bacteriophages this knowledge is almost totally absent.

With the use of the current state-of-the-art forward genetics and reverse genetics methods, the molecular mechanism by which bacteriophages infects SRE bacteria as well as the nucleotide and amino acid sequences of the putative receptors for phage attachment on the surfaces of *Pectobacterium* spp. and *Dickeya* spp. cells will be characterized in detail. Furthermore, the project aims to address the question of the ecological costs of gaining phage-resistance by *Pectobacterium* spp. and *Dickeya* spp. bacteria and how this relates to virulence-associated phenotypes.

This project will result in a development of a molecular (comparative) model describing interaction of lytic bacteriophages and soft rot *Enterobacteriaceae* (SRE) hosts in the presence of potato plants (natural environment for SRE bacteria) and will further contribute to the disease management strategies applicable in phytopathology (the use of phages as biological control agents), and by extent, also in veterinary and human medicine (the use of bacteriophages against human and animal pathogens). What is more, it may additionally strengthen research groups in Europe working on phage adsorption/attachment and the molecular background of phage-host interaction.