Bacteria living in natural environments very rarely occur as planktonic, “swimming”, cells, that are usually cultured in research laboratories. Much more often they form multicellular consortia attached to various surfaces, both artificial (metal, glass, plastic, dental prosthetics, dialysis catheters) and natural (e.g. plant and animal tissues), building complex structures known as biofilms. Whether the bacteria will settle on the given surface depends on many environmental factors, such as availability of certain nutrients, temperature, presence of other organisms (e.g. host plants or competing strains of bacteria, including pathogenic ones), and also factors connected to the genetic background and morphology of the bacterial species or genus. The mechanism of biofilm formation is therefore very complex and diverse, described partially only for the best-studied bacterial species.

The presented project aims to identify genes and mechanisms driving the process of biofilm formation by a beneficial, isolated from rhizosphere of tomato, strain of bacteria *Pseudomonas donghuensis* P482 on various types of surfaces (plastic, glass, plant tissues) in relation to varying influence of the environment. This strain is very interesting as an object of research, since it efficiently suppresses the growth of many bacterial and fungal pathogens of plants and the background of this activity is so far unknown – it does not produce substances of antibiotic character, typical for other bacterial species of the *Pseudomonas* genus. Our initial studies demonstrate that the strain can form biofilm on the surface of glass and plastic, and also efficiently colonize roots of many cultivable plants, such as potato, tomato, maize, what may facilitate their protection against pathogens. Within the proposed research we plan to find out on what does the ability to form biofilm on different surfaces depend on and how would it be modulated if we change the conditions in which the our analyzed strain will reside. To accomplish the research aims we will use methods of molecular biology, to be able to obtain mutants of the P482 strain with knocked-out genes, which products may be responsible for biofilm formation. These mutants will be analyzed towards their ability to form biofilm, with the use of modern methods of confocal fluorescence microscopy, allowing for observation of fluorescently tagged (“glowing”) bacteria on various surfaces. We will also analyze the level of expression of individual genes, that is the changes in the amount of matrix RNA synthesized in the cell (what may reflect the amounts of synthesized proteins), in response to varying culture conditions and/or contact with a plant or pathogenic bacteria, with the use of quantitative polymerase chain reaction with reverse transcriptase (RT-qPCR).

The results obtained in the course of this research should broaden our knowledge concerning the mechanisms involved in the process of biofilm formation by the investigated *P. donghuensis* P482 strain, but also the general regulation of this process in bacteria. The experiments performed in the presence of host plants should shed more light on the process of colonization of plant tissues by beneficial strains of bacteria, and also allow us to better understand interactions (competition) with pathogens. Those results may also contribute to better understanding of the bacteria-plant interactions on the cellular and molecular level.