## DESCRIPTION FOR THE GENERAL PUBLIC

Rhizobia are soil bacteria establishing symbiosis with legume plants, in which they are able to fix nitrogen and provide it to the host plant. Symbiosis is an efficient natural system that allows for a significant reduction of artificial nitrogen fertilizers, and thus important for the so-called sustainable agriculture. Basic research on various aspects of symbiosis is of great importance for agrobiotechnology, as it gives rise to the possibility of using selected or appropriately modified strains as natural fertilizers. Extracellular polysaccharides, including exopolysaccharides (EPS), are the key players in the exchange of signals between bacteria and plants and are necessary to establish the effective symbiotic relationship.

Bacteria produce a variety of polysaccharides. They are stored in the cell, form the outer leaflet of the outer membrane, or are secreted outside the cell in a form that is either bound to a cell surface and forms a capsule or is a loosely bound layer of mucus. Due to its location polysaccharides perform a variety of functions related to the uptake of nutrients, protection against environmental stressors and antibacterial compounds, as well as adhesion to different surfaces. A huge structural variety leading to the vast diversity of the polysaccharides properties, especially extracellular heteropolysaccharides produced by many species of bacteria, opened up their commercial applications in food industry, cosmetics and medicine. Given the enormous structural potential that contributes to different physical and chemical properties, microbial polysaccharides are an attractive class of macromolecules with which to generate novel structures via synthetic biology approaches.

**The aim of the project is to examine the enzyme complex of glycosyltransferases responsible for the biosynthesis of the exopolysaccharide (EPS) in the model of soil bacterium *Rhizobium leguminosarum* bv. *trifolii*.** We are planning to investigate the relationships between the glycosyltransferases, their localization within the cell, their activities, and interactions with each other as well as with other proteins in the EPS biosynthesis/transport system. We assume the identification of thus far unknown components of the EPS biosynthetic pathway. The research will be carried out, among others, by purification of glycosyltransferases and measuring their activities *in vitro*, using the specific precursors and acceptors. We also intend to carry out mutagenesis of selected genes to determine their function. We will explore the interactions between glycosyltransferases active at different stages of the synthesis of oligosaccharide EPS subunits and identify proteins interacting with them.

**Because of the prevalence of exopolysaccharides in bacteria, developing a comprehensive model of their synthesis would be of great cognitive importance with versatility extending beyond the group of soil bacteria.** The project is expected to result in identification and description of new proteins and enzymes involved in the biosynthesis and transport of exopolysaccharides. The results are expected to broaden the knowledge of the key steps in this process i.e. specificity of the proteins and their reciprocal interactions. Thus, we expect to deepen the overall understanding of the mechanisms governing synthesis of these diverse and heterogeneous macromolecules.