DESCRIPTION FOR THE GENERAL PUBLIC

The goal of every living organism is to reproduce and pass on its genetic material to the next generation. In bacteria, due to the lack of the nuclear envelope, duplication of genetic information (replication) occurs in the cytoplasm, and is coupled with the simultaneous segregation of newly replicated DNA molecules into daughter cells. With few exceptions, in bacteria, chromosome segregation is mediated by the ParA and ParB proteins and short *parS* sequences located on the chromosome (ParABS system). The ParB protein binds *parS* sequences, and, due to CTP hydrolysis, it spreads along the DNA molecule. ParB spreading leads to bridging of distant chromosomal fragments and promotes formation of a segregation complex named segrosome. At the same time, the ParA protein, using the energy derived from ATP hydrolysis, actively separates and transfers segrosomes to opposite poles of the cell. Recently, ParB has been shown to play an additional role in bacteria by recruiting DNA condensins. Condensins, by binding to DNA, lead to a reduction the chromosome volume in the bacterial cell. Although in general terms the ParA and ParB-dependent chromosome segregation and condensin-dependent chromosome compaction follow similar rules, the details may vary significantly, addressing the challenges posed by cell shape, genome organization and life cycle.

Our research focuses on soil bacteria of the genus *Streptomyces*, known as producers of a range of compounds with antibacterial and anticancer activities. *Streptomyces* resemble simple filamentous fungi with their elongated and branched hyphae growth and their the ability to produce spores. Interestingly, in *Streptomyces*, the temporal and spatial separation of chromosome replication in the vegetative mycelium, and synchronized chromosome segregation in the sporogenic mycelium, requires a different mechanism of ParA and ParB cooperation than in other bacteria. Additionally, the global rearrangement of the spatial structure of the chromosome accompanying the transformation of the vegetative mycelium of *Streptomyces* into the sporogenic mycelium, also suggests a different mechanism of ParB cooperation with condensins.

The aim of our project is to study in detail the molecular mechanisms that control the activity of the ParB protein during the sporogenic growth of *Streptomyces*, especially in terms of its cooperation with condensins. Our research will be the first to explain the phenomenon of bacterial chromosome remodelling, similar to processes well known for eukaryotic chromosomes, and so far described only for bacteria of the genus *Streptomyces*.