GENETICS

Biosynthetic genes coding for bioactive anthraquinones in *Hypericum* plants and *Hypericum*-borne endophytic microorganisms – *„a possible crosstalk“.*
supervisor: prof. RNDr. Eva Čellárová, DrSc. (eva.cellarova@upjs.sk)
study form: full time
Annotation: Endophytic fungi belong to the most important producers of bioactive anthraquinones. Their occurrence in plants is scarce, however, there is one exception represented by some species of the genus *Hypericum* which are the only producers of bioactive napthodianthrones and bisanthraquinones, especially hypericin and skyrin with enormous pharmacodynamic potential. The aim of this work is to ascertain whether candidate biosynthetic genes/gene clusters of the polyketide pathway leading to the production of anthraquinones are present in both, *Hypericum* plants and *Hypericum*-borne endophytic isolates and how their products communicate in the course of biosynthesis.

The role of cytochrome P450 monooxygenase in hypericin biosynthesis.
suvervisor: doc. RNDr. Katarína Bruňáková, PhD. (katarina.brunakova@upjs.sk)
study form: full time
Annotation: In relation to a wide range of secondary metabolism reactions mediated by a cytochrome P450 monooxygenase, the function of this enzyme in the biosynthesis of anthraquinone derivatives in the genus *Hypericum* has been proposed. The aim of this work is identification of P450 genes associated with hypericin biosynthesis. The anthraquinone derivatives will be determined in the extract of *Herba Hyperici* using High Performance Liquid Chromatography (HPLC-DAD, HPLC-MS). Plant material will include hypericin-producing *Hypericum* representatives cultivated *in vitro*; the control plants and plants with modified hypericin biosynthesis using the (a)biotic elicitors or inhibitors. We assume that the results will help to evidence the key role of cytochrome P450 monooxygenase in hypericin biosynthesis.

Spatial isolation as driving force of bacterial speciation.
supervisor: doc. RNDr. Peter Pristaš, CSc. (peter.pristas@upjs.sk)
consultant: RNDr. Mária Piknová, PhD.
study form: full time
Annotation: The importance of spatial isolation in evolution of organisms has been well studied in plants and animals but its significance regarding bacterial evolution has not been fully appreciated. Mechanisms of divergence associated with physical isolation, like genetic drift, or founder effect have not been generally considered in prokaryotic evolution, as evidence for prokaryotic population bottlenecks and/or population isolation events in nature have rarely been observed. Instead, the spatial distribution of bacteria on our planet is formulated in the Baas Becking hypothesis as “everything is everywhere but the environment selects” proposing that the dispersal potential of bacteria leads to distributions generally shaped by environmental factors rather than geographical distance. The role of spatial isolation in bacterial speciation will be analysed using cultivation and non-cultivation approaches in selected rare (extreme) well separated environments with subsequent genetic and metagenomic analysis.