Laboratory of cell cycle of algae, head (Katerina BISOVA)

Supervisor: Rabinder Singh, rabindersingh@alga.cz

Title of the project: Global proteomic dissection of nitrogen starvation responses in *Chlamydomonas reinhardtii*

For how many student/s: 1

Description of the project: Nitrogen availability is a critical determinant of cellular growth, metabolism, and productivity in photosynthetic organisms. In the model microalga *Chlamydomonas reinhardtii*, nitrogen deficiency triggers extensive physiological and metabolic reprogramming, including altered cell cycle progression, lipid accumulation, and remodeling of the photosynthetic apparatus. However, a comprehensive understanding of protein-level regulation underlying these responses is crucial for engineering these photosynthetic microorganisms for improved yield and metabolic performance.

This project aims to perform a **systems level proteomic dissection** of the cellular response to nitrogen deficiency in *Chlamydomonas reinhardtii*. Using qualitative mass spectrometry–based proteomics (e.g., LC–MS/MS), the student will analyze global protein abundance changes under nitrogen-replete and nitrogen-depleted conditions. The study will focus on identifying key regulatory pathways associated with nitrogen sensing, carbon reallocation, ribosome biogenesis, and stress adaptation.

The student will be involved in:

- Cultivation of *Chlamydomonas* under controlled and nitrogen deficient conditions.
- Perform cell cycle analysis, including commitment point determination; quantify DNA, RNA, and protein levels; measure starch and lipid content; and assess cell size and cell number using a Coulter counter.
- Sample preparation for proteomic analysis
- Data processing and statistical analysis of proteomics datasets
- Functional annotation and pathway enrichment analysis
- Integration of proteomic data with available physiological datasets

Requirements:
The student should be comfortable communicating in English, both spoken and written, and able to understand basic scientific literature. Prior laboratory experience is advantageous

but not required. As a substantial portion of the project involves wet-lab work, the student should be comfortable handling laboratory equipment, including glassware, and performing tasks requiring fine motor skills. There is no strict degree requirement; however, preference will be given to advanced bachelor-level students.