CSC-RUB PhD Project Proposal

Title: Functional characterization of a protein interaction network at the outer and inner chloroplast envelope membrane

Sector of research: Biology, Biochemistry, Biotechnology, Plant Biology

Degree awarded: PhD in Biology (Integrated Graduate School of Biology, IGB)

Keywords: Proteomics, mass spectrometry, chloroplast biogenesis, protein import, photosynthesis

Supervisor of PhD project:
Prof. Dr. Sacha Baginsky (e-mail: sekretariat-bpf@ruhr-uni-bochum.de), Dr. Birgit Agne

Research focus of supervisor:
The laboratory is interested in chloroplast biogenesis and the regulation of plastid functions. We have a strong background in mass-spectrometry based proteomics, analysis of posttranslational modifications and organellar protein import. Using the tools of mass spectrometry, we elucidate mechanisms and players of chloroplast biogenesis by the comprehensive characterization of chloroplast biogenesis mutants. Our current research focus is on chloroplast protein import. We have recently identified a protein interaction network at the chloroplast outer and inner envelope membrane systems that we dissect step by step to address its functional implications.

Publications: H-index Baginsky: 41 (Google scholar), Agne: 16 (Google scholar)


Second Supervisor of PhD project
Berit Ebert, Molecular Plant Evolution, Biology and Biotechnology

Summary of research plan:

Background: Plastid protein import is essential for plant growth and development. Owing to the diverse nature of plastids a complex protein import system operates in plant cells to accommodate the requirements for fine-tuned regulation. We set out to characterize a
previously established protein interaction network at the outer and inner chloroplast envelope membrane to understand its functional implications.

**Study objective:** We have identified a new component of the import machinery at the chloroplast envelope membrane whose exact function within the import process is elusive. We generated inducible amiRNAi lines that fully deplete the expression of the protein and propose to characterize these lines with respect to import efficiency and TIC and TIC/TOC super-complex assembly and stability. The expression profile of the new translocon component suggests a connection to heat stress. We will investigate the function of this protein in adaptation to elevated temperatures and analyze its function for the stability of the TOC/TIC machinery under heat stress conditions. This will be accompanied by proteome analyses to identify cytosolic folding stress. Collectively, the expected outcome of this project will be a deeper insight into the functional integration of chloroplasts with cellular adaptation processes in response to elevated temperature, that are expected in the course of climate change.

**Expected Results:** We expect to identify the function of the new import component for the stability of TOC and TIC complex formation. Furthermore, we will characterize its implication in heat stress.

**Methods:** In this project large-scale quantitative proteomics plays an important role for mutant characterization. We have a functional proteomics unit with state-of-the-art equipment available, staffed with two technical assistants and one permanently employed postdoc for guidance. In addition, basic cell biology techniques will be necessary to assess organellar protein import deficiencies.

**Candidate Requirements:** MSc Biology or Biochemistry, good practical background in basic protein research, ability and motivation to develop an independent scientific career, good English language skills.

**Motivation for CSC application:** The PhD candidate will be embedded in the strong research environment at the Ruhr University Bochum and the Faculty for Biology and Biotechnology. Here, structured PhD programmes are offered, providing the opportunity to acquire interdisciplinary skills (e.g. IGB, RUB Research school [https://www.research-school.rub.de/]). The methodological training in the chair of Plant Biochemistry (Prof. S. Baginsky) will include photosynthesis, general molecular biology methods and most importantly proteomics and mass spectrometry. Prof. Baginsky is an expert in the latter and has made several influential contributions to the field of plant proteomics and data analysis, e.g. the first proteome of different organs of *Arabidopsis thaliana*, the first phosphorylation site map for chloroplasts and de novo sequencing tools and other software solutions for the matching of MS data in an expanded search space. Dr. Agne is an expert in protein import and cell biology and has made important contribution to understanding chloroplast and peroxisomal protein import.