Julius-Maximilians-
UNIVERSITÄT WÜRZBURG

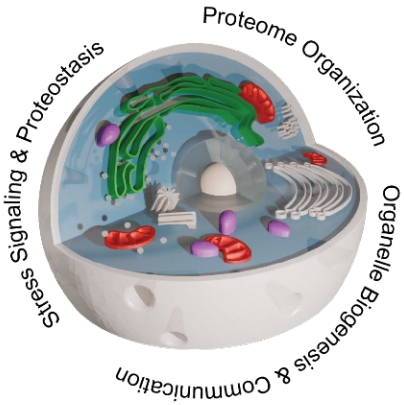
Fakultät für Chemie und Pharmazie
LEHRSTUHL FÜR BIOCHEMIE II

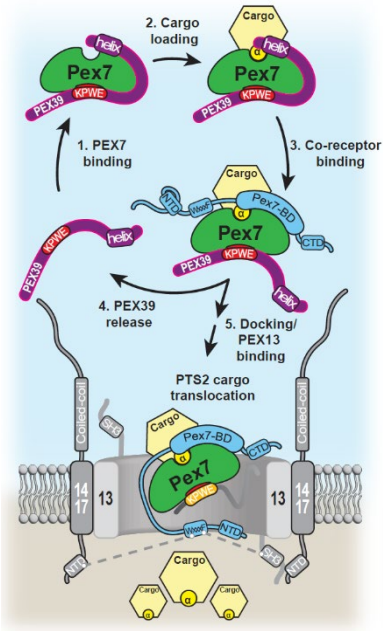
Msc Thesis Project

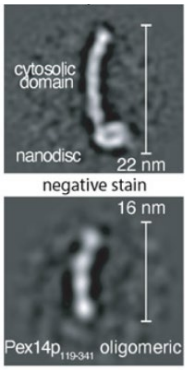
Analysis of Protein Machineries for Peroxisomal Protein Import

WiSe 2025/2026

Background: Peroxisomes are dynamic metabolic organelles with important functions such as the degradation of fatty acids, synthesis of phospholipids and the detoxification of reactive oxygen species. Since peroxisomes do not contain DNA, peroxisomal protein import is essential for their biogenesis. Individuals affected by severe forms of inherited peroxisomal biogenesis disorders (PDBs) often live only for a few months after birth. To gain a deeper understanding of the molecular basis of these human disorders, you will investigate mechanisms of peroxisomal protein import. For this, **you will analyze the dynamic formation and structural arrangement of multiprotein complexes using molecular biology and biochemical methods in combination with chemical crosslinking, protein mass spectrometry (MS), and quantitative proteomics techniques.**







Approach: We use biochemical and high-resolution MS technologies to elucidate the composition and functions of protein-protein networks and intricate molecular machineries in yeast and human cells. In this project, you will recombinantly express, purify, and reconstitute proteins associated with the peroxisomal protein import machinery in human cells. By performing chemical cross-linking MS and native MS analyses you will gain hands-on experience in the structural characterization of proteins and their complexes. You will develop proficiency in thoroughly planning experiments, effectively utilizing modern technologies, performing data analyses, critically evaluating your findings. Additionally, you will learn how to present and discuss your data in weekly group meetings. In this project, you will be part of an international research team and will work together with experts in peroxisome biology and cryo-electron microscopy to unravel the molecular structures and working principles of peroxisomal protein import machineries.

Interested in studying protein machineries with us?

Contact Prof. Bettina Warscheid (l-biochemie2@biozentrum.uni-wuerzburg.de).
Please include a brief (ca. 100 words) description of your research interests.

Collaborators:

Universität Münster

EMBL

TUM

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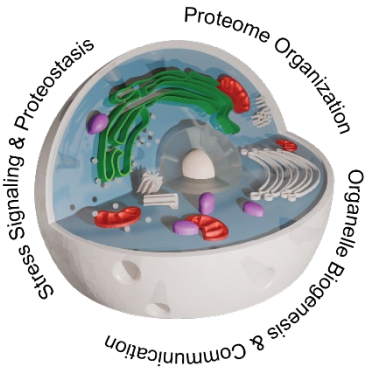
Fakultät für Chemie und Pharmazie
LEHRSTUHL FÜR BIOCHEMIE II

Msc Thesis Project

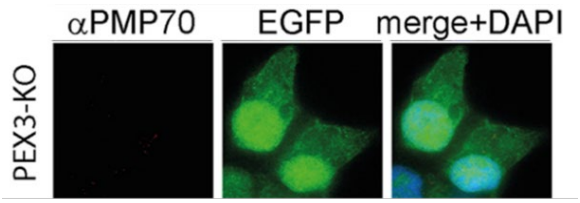
Analysis of Peroxisomal Biogenesis Defects and Proteostasis Responses

WiSe 2025/2026

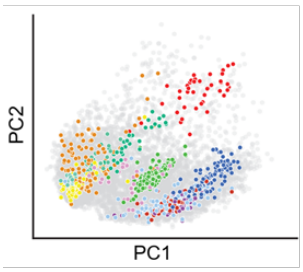
Background: Defects in peroxisomal biogenesis cause severe human diseases typically characterized by malfunctions of the liver, kidneys, brain, and other organs. Individuals affected by severe forms of inherited peroxisomal biogenesis disorders (PDBs) typically live only a few months after birth. Proteins essential for the biogenesis of peroxisomes are called peroxins (abbreviated as PEX). To gain further insight into the molecular processes underlying PDBs, **you will study how cells respond and maintain proteostasis in response to the functional loss of individual peroxins**.

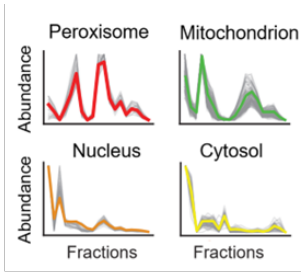


Approach: We employ biochemical and cell biology methods in combination with state-of-the-art proteomics approaches using high-resolution mass spectrometry to study the subcellular organization, regulation and dynamics of the proteome in human cells, specifically focusing on metabolic organelles (peroxisomes and mitochondria) and proteostasis mechanisms to maintain a healthy proteome under stress conditions.



Ott et al., Biol Chem, 2023





In this project, you will cultivate and analyze human PEX knockout cells (generated by CRISPR/Cas9) to investigate dynamic changes in the cellular proteome and proteostasis mechanisms including protein degradation and protein relocalization/mislocalization. For this, you will employ modern biochemical methods and quantitative proteomics techniques. Through bioinformatic and meta-analysis of the proteomics data acquired you will identify and characterize the involved proteostasis networks and cellular stress responses. You will test and validate your findings by biochemical and functional analyses. In addition to practical experience in human cell culture, biochemical and proteomics methods, you will learn how to plan large-scale experiments, critically analyze and evaluate data as well as the generation and testing of new hypothesis in functional proteomics and proteostasis research.

Interested in studying cellular proteostasis with us?

Contact Prof. Bettina Warscheid (l-biochemie2@biozentrum.uni-wuerzburg.de).
Please include a brief (ca. 100 words) description of your research interests.

Collaborators:

RUB

University of Exeter

Amsterdam UMC