Master Project

Karlsruhe Institute of Technology

Microsystems in Bioprocess Engineering, Institute of Process Engineering in Life Sciences
Karlsruhe Institute of Technology, Fritz-Haber-Weg 2, 76131 Karlsruhe, Germany

Single-cell analysis of kinetic parameters in precisely controlled environments

About Us: The "Microsystems in Bioprocess Engineering" group is situated within the Chemical Engineering (CIW) Faculty of the KIT. Our goal is to bridge the gap between microfluidic technologies and bioprocess development. We develop novel microfluidic tools (*e.g.*, single-cell cultivation systems) and apply them to investigate research questions relevant to bioprocessing. Utilizing the acquired knowledge, our aim is to pioneer the development and establishment of new bioprocesses. Our work is conducted in a highly interdisciplinary manner, involving collaboration with experts in *e.g.* microbiology, physics, material and data science.

Background: Microorganisms live in their natural habitats in multi-species communities within a structural network driven by complex microbial interactions and specific metabolic tasks. The potential of co-cultures and the cellular distribution of workload can be exploited in biotechnological processes but requires comprehensive understanding and characterization of performance indicators to improve the efficiency and development of bioprocesses. As a model system, a synthetic co-culture of *Corynebacterium glutamicum* strains with complementary amino acid auxotrophies is investigated across different environmental conditions.

Project aim: This project aims to investigate microbial growth characteristics on the single-cell level. Therefore, growth of auxotrophic *C. glutamicum* strains will be studied under different nutrient and pH conditions to investigate pH dependencies and quantify fundamental kinetic parameters. The setup enables high spatio-temporal control over environmental conditions even under limiting nutrient concentrations enabling to study the microbial condition-dependent growth response.

Your tasks:
- Fabrication of microfluidic cultivation devices
- Sterile cultivation of auxotrophic bacteria
- Microfluidic single-cell cultivation under different cultivation conditions combined with time-lapse imaging
- Analysis, evaluation and interpretation of single-cell imaging data

Your qualification:
- Background in bioengineering, bioinformatics, biotechnology or similar
- Knowledge of microbiological methods, sterile working
- Interest in multidisciplinary research
- Good written and spoken English skills
- Structured, independent and meticulous working method

Contact:
Judith Wegmann
E-Mail: judith.wegmann@kit.edu