

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 structured, multi-species networks where interactions and metabolic specialization shape their function. Understanding these interactions is key to optimizing biotechnological processes. Co-cultures and the division of metabolic tasks offer great potential for biotechnological applications, but their efficiency depends on a comprehensive understanding of key performance indicators. To explore these interactions, a synthetic co-culture of *Corynebacterium glutamicum* strains with complementary amino acid auxotrophies is used. Studying their growth under varying environmental conditions, can provide valuable insights into their full biotechnological potential.

Project aim: This project focuses on single-cell-level microbial growth dynamics, investigating how auxotrophic *C. glutamicum* strains respond to nutrient and pH fluctuations under industrially relevant conditions. The influence of process parameters is examined with high spatio-temporal control, even at limiting nutrient concentrations, revealing microbial growth responses that remain undetected by bulk measurements.

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
- Structured, independent and meticulous working method

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