New technologies and methods for analysing and modelling dynamics of eukaryotic metabolism involved in compartmentation (SysCompart)

Team member at TUHH: Dipl.-Ing. Sabrina Kayo, Dipl. Biotech. M. Wurm
M. Sc. Janina Bahnemann
Coordinator: Prof. Dr. An-Ping Zeng

Project term: 2009 - 2012
Financed by: BMBF (SysTec)

Description:

This project aims to develop new experimental methods and theoretical concepts for systems biology study of metabolism associated with compartmentation in eukaryotic cells. The focus of the scientific question will be on expanding our knowledge of *in vivo* dynamics of key metabolic reactions in the conjunction of glycolysis and tricarboxylic acid cycle which take place in both cytosol and mitochondria.

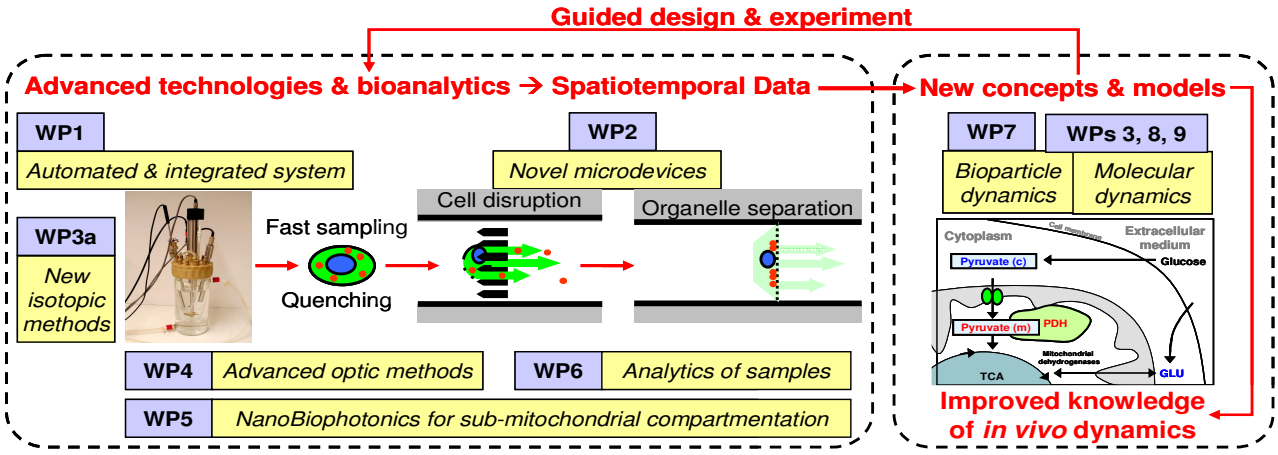

Fig. 1. Objectives, tasks and interactions of work packages within SysCompart. Working within this consortium are 8 institutes from the Technical University of Hamburg, University of Hannover, University of Saarbrücken and Max-Planck Institute in Göttingen.

WP 1 – Cultivation and system integration

The central task of this WP is the integration of an automated cultivation system with a rapid sample processing unit. This WP is responsible for standardization of experimental conditions and will provide samples and data for WP3, WP6, WP7, WP8 and WP9. Hereby a real time computer controlled bioreactor will be set up, which allows on-line monitoring of all relevant cultivation parameters. In collaboration with WP2, WP4, and WP5 new microfluidic and optical technologies will be developed and added to the bioreactor system to obtain accurate samples representing physiological condition inside the cells.

WP 9 – Spatiotemporal modeling

A new concept of modeling is to be developed within this WP to elucidate the compartmentalized mitochondrial metabolism. The model will incorporate the transport metabolic species into the mitochondria as well as dynamic regulation of the involved enzyme. In cooperation with WP3 and WP6 flux analysis data and the *in vitro* enzyme kinetic data will be used to validate the model. Key subjects in this project are the closely related multi-enzyme complexes of pyruvate dehydrogenase (PDH) and α-ketoglutarate dehydrogenase (KDH), which are central components of the energy metabolism of aerobic organism.

References (selected)

M. Wurm, B. Schöpke, D. Lutz and A.-P. Zeng (2010). **Microtechnology meets systems biology: The small molecules of metabolome as next big targets.** J. Biotechnol. 149,33-51.

A.-P. Zeng, J. Modak and W.-D. Deckwer (2002) **Nonlinear dynamics of eukaryotic pyruvate dehydrogenase multi-enzyme complex: Decarboxylation rate, oscillations and multiplicity.** Biotechnol. Prog. 18: 1265-1276.

Contact: Prof. Dr. An-Ping Zeng
Institute of Bioprocess and Biosystems Engineering, Technical University Hamburg-Harburg.
Denickestrasse 15, D-21073 Hamburg, Germany.
Phone: +49-40-42878-4183 Email: aze@tu-harburg.de Web: www.tu-harburg.de/ibb