MIM General Assembly, Wednesday, 6 April, 2011
ETH Hönggerberg, building HCI , floor J, room 7, at 17:15

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„Retrofitting microbial systems for the production of chemicals
and in the battle of infection"

In systems engineering, retrofitting is the process of reengineering an existing chemical plant for the production of novel chemicals, not previously produced by this plan, the optimization of its current operation of the plant, or the recovery of optimal performance in case of malfunction. In these aspects, the engineering of microbes for the improved production of native or new chemicals, and the identification of targets for treating disease and infection is conceptually a very similar problem to retrofitting chemical plants.
However, in the case of a chemical plant, a detail flowchart of the plant design is available, whereas the microbial flowchart is only partially known. In addition, the engineering of cells for the production of fuels and chemicals or for the treatment of disease involves simultaneous redesign and optimization of multiple objectives, such as specific productivity, extended substrate range, and stress tolerance. The achievement of these objectives under physiological and environmental constraints will be impossible without the use of mathematical modeling and analysis. The limited information and the uncertainty in the available information about the cellular processes require new methods for modeling and simulation that will characterize the uncertainty and will quantify the expectations of success of alternative cellular engineering strategies.

We will discuss how concepts from cellular engineering and methods derived from network thermodynamics, systems engineering and risk analysis can provide guidance on developing cost-effective biocatalysts for the production of fuels from renewable resources and strategies for disease treatment. We will illustrate the application of the methods using two case studies from the optimization of biofuel production in yeast and from the identification of drug targets for infectious diseases.