

## SOE 17: Traffic Dynamics, Urban and Regional Systems I

Time: Thursday 9:30–10:15

Location: H 0110

**Invited Talk**

SOE 17.1 Thu 9:30 H 0110

**Common design principles of metabolic networks and industrial production** — ●MARC HÜTT, MORITZ BEBER, TILL BECKER, MIRJA MEYER, and KATJA WINDT — Jacobs University Bremen

Metabolism is a fascinating natural production and distribution process. Metabolic systems need to show high performance under typical environmental conditions and, at the same time, maintain some function under a broad range of perturbations and modified conditions. It is precisely this robustness with respect to large environmental changes that makes metabolic networks a potentially very interesting role model for technical production and distribution systems.

First, we summarize some fundamental design principles of metabolic systems from the perspective of production logistics: just-

in-time production of enzymes in metabolic pathways, categories of enzyme essentiality, topological properties of metabolic networks, and the coexistence of different control types.

On this basis we then perform a detailed comparison of industrial production systems and metabolic systems. While many characteristics of network architecture are similar between the two types of production systems (metabolic and industrial), we find striking differences on the level of dynamical quantities: material flow sizes and paths, robustness against changing environmental conditions and scaling laws relating material flow and regulation.

Guided by simulated evolution studies, we argue that these observations can serve as templates for the design of robust production systems.