

## Discrete Mathematics Seminar

Time: Friday, 5 November 2010, 12:30-1:30 PM

Room: 238 Derrick Hall

Title: Compact energy metabolism model: Brain controlled energy supply

Speaker: Britta Göebel, Department of Mathematics, University of Luebeck

Abstract:

The regulation of the human energy metabolism is crucial to ensure the functionality of the entire organism. The decisive role of the brain as active controller and heavy consumer in the complex whole body energy metabolism is subject to recent research activities. Latest studies suggest the priority of the brain energy supply in the competition for energy within the organism.

We develop and investigate a model which describes the energy metabolism in a novel and compact dynamical system. The model takes into account the two central roles of the brain in the energy metabolism as consumer and superior regulatory instance. We integrate energy fluxes and their control signals such as glucose fluxes, hormone signals and the ingestion momentum in our dynamical system. As one novel characteristic, insulin is regarded as central feedback signal of the brain. Consequently, our model contains the competition for energy between brain and body periphery.

The model realistically reproduces the qualitative and quantitative behavior of the energy metabolism. Short time observations demonstrate the physiological periodic food intake. Integration over the daily cycle yields a stable long-term model in accordance with the homeostatic regulation of the energy metabolism on a long time scale.

The presented model is a step towards a systemic understanding of the energy metabolism and thus sheds light onto deregulations causing metabolic diseases such as diabetes mellitus and obesity.

Bio:

Britta Göbel graduated from Lübeck University, Germany in 2007 with a M. Sc. in Computational Life Science. During her studies, she conducted internships at Bayer Technology Services, Leverkusen, Germany, at the German Sport University Cologne, and at the Forschungszentrum Jülich, Germany. Currently, she is doing her Ph.D. in the Graduate School for Computing in Medicine and Life Sciences, and she is a member of the Institute of Mathematics and Image Computing and Fraunhofer MEVIS, Project Group Image Registration at the University of Lübeck. Her advisors are Bernd Fischer and Kerstin M. Oltmanns. Britta receives a fellowship of the German Research Foundation. As a graduate student, Britta conducted a research internship at Emory University, working with Matthias Chung, which was funded by a scholarship of the German Academic Exchange Service. Her research interests include mathematical modeling of physiological systems, dynamical systems theory, and inverse problems.