UNIVERSITÄT SALZBURG

Fachbereich Mathematik
Hellbrunnerstraße 34
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Gastvortrag

Donnerstag, 28. Mai 2015
11.15 Uhr
Seminarraum II

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The interplay of geometry and signaling in yeast

Abstract:

All cell types polarize during division or generate specialized shapes and functions. Quantitative and qualitative understanding of the underlying mechanisms is important for the comprehension of cell dynamics in health and disease. Eukaryotic cells from fungi to neurons in the human brain must be able to acquire polarity which leads to subsequent changes of cell morphology. This becomes obvious in several situations: cells need to divide, grow and differentiate into distinct directions guided by a diverse set of extracellular cues.
A prominent example for the study of cell polarization and morphogenesis is S. Cerevisiae, which is also known as baker's or brewer's yeast. In S. Cerevisiae shape changes occur during budding, mating or filamentous growth. In all of these processes the key molecule during polarization is the small GTPase Cdc42, which occurs in an active membrane bound and an inactive cytosolic form. Localization of active Cdc42 can be induced by G-Protein coupled receptors (GPCRs), which sense molecules outside the cell. The underlying system is highly conserved among eukaryotic cells such as neurons, neutrophils or epithelial cells.
Partial differential equations are used to model reaction-diffusion processes on the membrane, which induce subsequent shape changes. In particular, reaction-diffusion processes are modeled via nonlinear kinetics and surface diffusion. The equations are solved using a surface finite element method (SFEM). The distribution of signaling molecules causes forces, changes of material properties as well as localized growth of the cell wall. In in silico experiments are used to investigate the interplay of shape changes and signaling during the growth process and test different hypotheses. The results are compared to experimental measurements and open questions are discussed..

Einladender: Andreas Schröder