BP 52: Posters - Multi-Cellular Systems

Time: Wednesday 17:00–19:00 Location: Poster C

BP 52.1 Wed 17:00 Poster C

Signal propagation and summation in *Physarum polycephalum* — •Felix Bäuerle and Karen Alim — Max Planck Institute for Dynamics and Self-Organization, D-37077 Göttingen, Germany

The slime mold *Physarum polycephalum*, among a number of organims growing and sustaining considerably large networks, excels in connecting food sources in a ressource balancing fashion. Furthermore, it was shown that the transport along the tubular body is optimized for dispersing nutrients with a peristaltic wave of contractions matching specimen size. In our research we want to understand the interplay of stimuli reactions, network growth and decision commitment in a context of biochemical and biophysical signals propagating along the network. By stimulation with, i.e., repulsive light illumination or glucose based attractants change in local and global behaviour is studied to gain insight into the slime molds ability to control its own transport mechanism.

BP 52.2 Wed 17:00 Poster C

Morphogenesis Control by Mechanical Stresses — •Jason Khadka and Karen Alim — Max Planck Institute for Dynamics and Self-Organization, D-37077 Göttingen, Germany

A major question in developmental biology is to understand how reproducible shapes arises from the collective behavior of individual cells. Here, we investigate the role of physical forces and mechanical feedback during plant tissue growth. We build a three dimensional vertex model to represent the plant tissue and to simulate its growth including mechanical feedback on individual cell growth. Varying the feedback strength we investigate the role of mechanical feedback on the robustness of tissue shape.

BP 52.3 Wed 17:00 Poster C

Quantifying Cell Volume and Proliferation in MDCK II Model Tissues — •Simone Gehrer[1], Damir Vurnek[1], Sara Kaliman[1], Florian Rehfeldt[2], Diana Dudziak[3], and Ana-Sunčana Smith[1,4] — [1]PULS Group, Institute of Theoretical Physics I, FAU Erlangen — [2]3rd Institute of Physics/Biophysics, GAU Göttingen — [3]University Hospital Erlangen — [4]Division of Physical Chemistry, IRB Zagreb

Multicellular migration of 2D cell sheets is essential for wound healing and organ development. In-vitro model systems show that cell volume and proliferation are key players in active epithelial rearrangement and tissue expansion. Although studied extensively, precise temporal and spatial quantitative analysis of proliferation still remains a challenge.

To reveal the dependence of cell volume and proliferation on different monolayer compartments we droplet seeded MDCK II cells on collagen I coated glass. Grown from subconfluency to fully compartmentalized clusters they were examined on days 1, 2, 4 and 6. Volume studies were carried out on confocal images of actin and DAPI stained samples. As a part of the testing procedures the analysis was repeated on the stably transfected cell line with GFP histones generated in our lab. To visualize proliferation the monolayers were preincubated with EdU, stained, and imaged with fluorescence microscopy. Cells were counted individually with a home-written Matlab routine and the radial distribution of cell proliferation was obtained. For proliferation an inverse dependence on density was confirmed. Surprisingly, we found a direct correlation between the proliferation and the age of the tissues.

BP 52.4 Wed 17:00 Poster C

Simulating multicellular homeostasis with a cell-based discrete receptor dynamics model: the non-mutational origin of cancer and aging — •Yuting Lou[1] and Yu Chen[2] — [1]The University of Tokyo, Japan — [2]The University of Tokyo, Japan

The purpose of the study is to investigate the multicellular homeostasis in epithelial tissues over very large timescales. An agent-based model is constructed based on the receptor dynamics of IBCell model proposed by Rejniak, et al. Instead of observing the multicellular architectural morphologies, the diversity of homeostatic states is quantitatively analyzed through a substantial number of simulations by measuring three new order parameters, the phenotypic population structure, the average proliferation age and the relaxation time to stable homeostasis. Nearby the interfaces of distinct homeostatic phases in 3D phase diagrams of the three order parameters, intermediate quasi-stable phases of slow dynamics that features quasi-stability with a large spectrum of relaxation timescales are found. A further exploration on the static and dynamic correlations among the three order parameters reveals that the quasi-stable phases evolve towards two terminations, tumorigenesis and degeneration, which are respectively accompanied by rejuvenation and aging. With the exclusion of the environmental impact and the mutational strategies, the results imply that cancer and aging may share the non-mutational origin in the intrinsic slow dynamics of the multicellular systems and the two processes are probably two absorbing phase transitions with distinct critical exponents.