# BP 47: Cell Adhesion

Time: Thursday 9:30–10:45 Location: ZEU 250

**Invited Talk** BP 47.1 Thu 9:30 ZEU 250

**Mechanotransduction in Collective Cell Migration** — •Joachim Spatz — Max Planck Institut for Medical Research, Dept. Cellular Biophysics, Jahnstr. 29, 69120 Heidelberg

The collective movement of epithelial cells drives essential multicellular organization during various fundamental physiological processes like embryonic morphogenesis, cancer, and wound healing. Two hallmarks of collective behavior in migrating cohesive epithelial cell sheets is the emergence of so called leader cells and the communication between adjacent cells to move correlated to each other. Here we discuss these two phenomena: 1. The geometry-based cue imposed by the matrix environment like local curvature of the collective*s perimeter is capable of triggering leader cell formation and promoting enhanced motility at defined positions. Cytoskeletal tension was found to be important for geometry induced leader cell formation. Together our findings suggest that high curvature leads to locally increased stress accumulation, mediated via cell-substrate interaction as well as via cytoskeleton tension. The stress accumulation in turn enhances the probability of leader cell formation as well as cell motility. 2. Within this cohesive group each individual cell correlates its movement with that of its neighbours. We investigate the distinct molecular mechanism that links intercellular forces to collective cell movements in migrating epithelia. More specifically, we identified the molecular mechanism whereby Merlin, a tumor suppressor protein and Hippo pathway regulator that functions as a mechanochemical transducer, coordinates collective migration of tens of hundreds of cells.

BP 47.2 Thu 10:00 ZEU 250

**Adhesion of *Chlamydomonas* microalgae to surfaces is switchable by light** — •Christian Kreis, Marine Le Blay, Christine Linne, Marcin Makowski, and Oliver Bäumchen — Max Planck Institute for Dynamics and Self-Organization (MPIDS), Am Faßberg 17, D-37077 Göttingen, Germany

Many microalgae live in complex confined geometries, such as soil and temporary pools, consisting of water inclusions and a plethora of surfaces. They have adapted to these habitats by developing planktonic (freely swimming) and surface-associated states. While the swimming of microalgae has been widely studied in recent years, the mechanism that triggers the adhesion to surfaces remains elusive. We performed *in vivo* force spectroscopy experiments on the unicellular biflagellated microalga *Chlamydomonas*, a prime model organism in cell- and microbiology, and discovered that the flagella-mediated adhesion to surfaces can be switched on and off by light [1]. The light-switchable adhesiveness of the flagella is a completely reversible process based on a redistribution of adhesion-promoting flagella-membrane proteins. This functionality enables the cell to regulate the transition between planktonic and surface-associated state, which possibly represents a significant biological advantage for photoactive microorganisms. Gaining control of the initiation of biofilm formation bears an immediate relevance in technological applications, including the production of biofuel as a renewable source of energy in microalgae photo-bioreactors. [1] C. Kreis, M. Le Blay, C. Linne, M. Makowski, and O. Bäumchen, in review (2016).

BP 47.3 Thu 10:15 ZEU 250

**Measuring the contact area of *Staphylococcus aureus* to solid substrates using single-cell force spectroscopy** — •Christian Spengler, Nicolas Thewes, and Karin Jacobs — Saarland University, 66123 Saarbrücken

Bacteria adhere to virtually every surface and promote the formation of - desirable or unwanted - biofilms. Therefore, in many fields, like engineering, medicine, and biology, understanding bacterial adhesion is of great interest in order to support or inhibit the formation of biofilms. Consequently, there exist different models that describe the process of bacterial adhesion. In these models, besides direct values, like adhesion force and rupture distance, also more indirect quantities, like the size of the contact area between bacterial cell and surface, play a crucial role. We present a method to measure the radius of this circular contact area for *Staphylococci* by taking advantage of the fact that the adhesion force of these cells differs strongly between surfaces with different surface energies[1]. We collect multiple force/distance curves with single-cell AFM probes at a very sharp interface between hydrophilic silicon and a hydrophobic self assembling monolayer of silanes. The measured radii of the contact area range from tens of nanometers up to 300 nm and differ strongly between individual cells. Our results also give new insights into the properties and distribution of surface molecules in the bacterial cell wall.

[1] N. Thewes et al., "Hydrophobic interaction governs unspecific adhesion of staphylococci: a single cell force spectroscopy study"; Beilstein J. Nanotechnol. 5(2014) 1501

BP 47.4 Thu 10:30 ZEU 250

**Measuring Cell Dynamics at the Substrate-Interface with Surface Plasmon Resonance Miscroscopy** — •Eva Kreysing, Hossein Hassani, and Andreas Offenhäusser — ICS8/PGI8, Forschungszentrum Juelich, 52425 Juelich

In neuroelectronics the cell-electrode distance is one of the most critical parameters during cell recordings. Cardiomyocyte-like cells are among the most popular model systems because they periodically generate an action potential. This feature also leads to a cell contraction which affects the cell-electrode distance. To achieve a qualitative and quantitative characterization of the dynamics at the interface in vitro and lable-free, we built a surface plasmon resonance microscope (SPRM). Using gold coated sapphire chips as the substrate for cell culture it is possible to excite plasmons in the gold layer due to specific illumination. The resonance frequency of the plasmons depends strongly upon the dielectric constant of the gold's environment. In turn the angle spectrum of the reflected light depends upon said resonance frequency. Due to these dependencies it is possible to deduce the cell-substrate distance. Our microscope is capable of imaging the interface in a live-imaging mode where we can observe cell dynamics qualitatively. A scanning mode uses localized surface plasmons to measure the cell-substrate distance. The resolution in z-direction lies in the nanometer range. This allows us to measure the movement of the cell membrane at each scanning point with a time resolution of 150 ms. Using this method we have been able to record the dynamics of multiple cardiomyocytes.