BP 18: Cell Mechanics IV

Time: Tuesday 11:00–12:00 Location: BPc

BP 18.1 Tue 11:00 BPc

Direct measurements of interactions between intermediate filaments — •Anna V. Schepers[1], Charlotta Lorenz[1], Peter Nietmann[2], Andreas Janshoff[2], Stefan Klumpp[3], and Sarah Köster[1] — [1]Insitute for X-Ray Physics, Georg August University Göttingen — [2]Institute of Physical Chemistry, Georg August University Göttingen — [3]Institute for Dynamics of Complex Systems, Georg August University Göttingen

The cytoskeleton consists of F-actin, microtublues and intermediate filaments (IFs), which form a complex composite network. F-actin and microtubule networks have been studied extensively and a large variety of cross-linkers are known. By contrast, the interactions in reconstituted IF networks are less well understood. It has, however, been shown that multivalent ions cause bundling and network stiffening. While rheological experiments give insight into the slow stiffening and mechanics of vimentin IF networks, it is challenging to distinguish the contributions of filament stiffening and of increased attraction. Combining optical trapping and fluorescence microscopy enables us to bring two single vimentin IFs in contact and directly study the interactions between the filaments. By amplifying electrostatic attraction or diminishing the hydrophobic interactions we are able to study the nature of the interactions between IFs. These results, in combination with studies of the mechanical properties of single IFs, allow us to model the interactions with Monte-Carlo simulations, thereby gaining a deeper understanding of cytoskeletal structures.

BP 18.2 Tue 11:20 BPc

Stiffening of the Ndc80 complex, the main mirotubule-kinetochore linker — •Felix Schwietert and Jan Kierfeld — TU Dortmund University, 44221 Dortmund, Germany

In the mitotic spindle microtubules attach to chromosomes via kinetochores, whose molecular structure and mechanical properties are not completely understood. Over the past years, it became evident that the Ndc80 complex plays a major role for attaching microtubules to the kinetochore and transmitting forces from depolymerizing microtubules to the chromosome. The Ndc80 complex is a rod-like coiled-coil with globular end domains that bind to the kinetochore and the microtubule, respectively. Due to its force transmitting function, its elastic properties are of great interest for modeling and understanding chromosome dynamics in the mitotic spindle. Here, we theoretically explain the recent experimental result that the effective stiffness of a Ndc80 complex increases under tension [1]. Our model is based on the specific architecture of the Ndc80 complex, which has a characteristic flexible kink at approximately one third of its length.

[1] V. A. Volkov, P. J. Huis in 't Veld, M. Dogterom, and A. Musacchio, eLife 7:e36764 (2018)

BP 18.3 Tue 11:40 BPc

Development of microtentacles in suspended cells upon weakening of the actin cortex — •Lucina Kainka, Reza Shaebani, Ludger Santen, and Franziska Lautenschläger — Saarland University, Center for Biophysics, 66123 Saarbrücken

Circulating Tumor Cells (CTCs) pose a significant threat due to their role in metastasis: It has been proposed that CTCs are able to escape the blood stream and reattach to the tissue by the formation of so-called microtentacles (McTNs). McTNs are microtubule based membrane protrusions with a diameter of less than 1 μm and a length of tens of μm.

In CTCs the balance of the outward growing microtubule and the contractive forces of the actin cortex is disrupted enabling microtubules to form these kind of protrusions. Using cytoskeletal drugs which are targeting the actin cortex integrity we induce McTNs even in non-cancerous RPE1 cells. We investigate the presence of microtubules and actin as well as vimentin under those conditions. Furthermore, we established a statistic over the number and lengths of McTNs depending on different drug concentrations applied.

Scanning electron microscopy images of the cytoskeleton beneath the plasma membrane of McTNs give further insight into their cytoskeletal composition.