EMBO meeting 2009 in Amsterdam

Sub-group meeting 2 (14:30 – 17:30):

"Principles of microtubule regulation"

Focus of the subgroup:

Microtubules are involved in a wide range of different cellular functions. They organize the intracellular space, serve as tracks for intracellular transport, build the mitotic apparatus that separates the chromosomes during cell division, and they are the major building blocks of complex structures such as the cilia, flagella and the centrosome. Many if not all of the functions of microtubules are mediated by interactions with specific proteins, commonly referred to as microtubule-associated proteins (MAPs), which range from simple microtubule binders to motile proteins (molecular motors) and proteins that are specifically localized to parts of the microtubule, such as the plus end. The functions of many MAPs have been explored in the past; however, it still is not well understood how different MAPs can selectively bind to subsets of microtubules, or only two a portion of a single microtubule filament. In this subgroup meeting we want to discuss new discoveries on mechanisms that could underlie selective interactions of MAPs with microtubules.

Organizer:

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Schedule:

14:30 Opening of the subgroup meeting

14:35 – 15:00
Jonathon Howard (MPI-CBG Dresden, Germany)

"Regulation of microtubule dynamics by polymerases and depolymerases"
Microtubules are highly dynamic polymers that transition between phases of growth and shortening. While this so-called dynamic instability is observed for purified tubulin in the presence of GTP, in cells the transitions are regulated by a large number of proteins that interact with the microtubule's plus end. Recent single-molecule in vitro experiments with the polymerase XMAP215 and the depolymerizing kinesin-8, KIP3p, have elucidated the mechanisms by which these proteins regulate the polymer dynamics and length.

15:00 – 15:25
Carsten Janke (CRBM, Montpellier, France)

"Tubulin modifying enzymes"
Microtubules are subject to a range of posttranslational modifications. Some of these modifications have been initially discovered on tubulin and are thought to play an important role in regulating microtubule functions. We have now discovered most of the enzymes that add and remove these modifications on tubulin, and first functional studies with these enzymes brought new insights into the functions of tubulin modifications.

15:25 – 15:50
Didier Job (Institute of Neuroscience, Grenoble, France)

"Tubulin tyrosination in cell division and morphogenesis: two faces for one cycle"
In most eukaryotic cells, alpha-tubulin contains a C-terminal tyrosine residue, whose presence or absence has dramatic consequences for both tumour progression and neuronal organization. Tubulin detyrosination in cells induces an apparent disruption of microtubule interactions with the cell membrane and anomalies in microtubule dynamics. Recent progress towards the identification of the molecular origins of these two types of microtubule perturbations will be briefly discussed. Possible mechanisms linking microtubule defects to cancer or neuronal development will be proposed.

15:50 – 16:15
Michel O. Steinmetz (Paul Scherrer Institut, Villigen, Switzerland)

“Structure-function relationship of CAP-Gly domains”

In all eukaryotes, CAP-Gly proteins such as the microtubule plus-end tracking proteins CLIP170 and dynactin/p150glued control important cellular processes including cell division, cell migration, and intracellular transport. Using a multidisciplinary approach, we recently established a structure-function relationship of CAP-Gly mediated protein interactions. The results of these studies and their implications for the tubulin detyrosination/tyrosination cycle will be presented.

16:15 – 16:40
Franck Perez (Institute Curie, Paris, France)

“A GTP-island model for microtubule dynamic instability”

Microtubules display dynamic instability, a process that is controlled by plus end tracking proteins like CLIP170. The localisation of these proteins at the plus ends of polymerizing microtubules might be linked to the presence of a GTP-bound tubulin at the ends of growing microtubules. We visualized GTP-tubulin in living cells with a recombinant antibody and found that GTP-tubulin was indeed present at the plus end of growing microtubules. Unexpectedly, GTP-tubulin remnants were also present in older parts of microtubules suggesting that GTP hydrolysis is sometimes incomplete during polymerization. Observations in living cells suggested that these GTP-remnants might be responsible for the rescue events in which microtubules recover from catastrophe.

16:45 – 17:00
Iva Tolić-Nørrelykke (Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany)

“Nuclear centring mediated by microtubules and kinesin-8 motors”

How does a cell find its centre? In fission yeast, the nucleus is positioned at the cell centre by microtubule pushing against the cell ends. A key question is how these pushing forces are regulated to achieve proper centring. We report a novel centring mechanism based on kinesin-8 motors (Klp5/6). The motors increase the rate of microtubule catastrophe in a microtubule length- and contact-dependent manner. Our experimental and theoretical results show that the motors induce a longer contact between a microtubule and the proximal than the distal cell end, which leads to efficient centring.

17:00 – 17:15
Nadav Elad (Ben-Gurion University of the Negev, Beer-Sheva, Israel)

“**Microtubule organization at final stages of cytokinesis”**

Following the separation of the genomes at anaphase, the remaining non-kinetochore microtubules are gradually condensed at telophase to form a tightly packed array known as the midbody. Using cryo-electron tomography we preformed a structural analysis of isolated midbodies, providing new insights to their organization and to cytokinesis completion. We find that the midbody is not constructed of only polar, interdigitating microtubules that terminate at the overlap region as thought before, but rather contains a core bundle of microtubules that cross the bridge and are continues from one daughter cell to the other. Additionally we identify microtubules with minus-end-capping, the actin-based contractile ring and MT-associated proteins.

17:15 – 17:30
Leticia Peris (Grenoble Institute of Neurosciences, Grenoble, France)

“**Motor-dependent microtubule disassembly driven by tubulin tyrosination”**

Are detyrosinated microtubules more stable? ....or stable microtubules become detyrosinated?...or maybe both… We report a direct inhibition of microtubule depolymerizing motors by tubulin detyrosination with resulting inhibited disassembly of cellular microtubules. In cells, the detyrosination of transiently stabilized microtubules may give rise to persistent subpopulations of disassembly-resistant polymers to sustain subcellular cytoskeletal differentiation.