



Research Training Group 1962

Dynamic Interactions at Biological Membranes from Single Molecules to Tissue

Speaker: Prof. Dr. Rainer Böckmann, Computational Biology

Invitation to RTG 1962 – Guest Talk

Wednesday, 15th January 2020 at 17.00 (s.t.)

Dr. Sabine Müller

(University of Tübingen)

“Molecular mechanisms of cellular morphogenesis in plants”

Control of cell morphology is a fundamental property of life, essential to the form and function of all organisms. Polarized cell division and cell expansion are the key determinants of plant cellular morphogenesis and constitute prerequisites of three-dimensional organ development, tissue functionality and adaptations to changing environmental conditions on multiple scales. Research in my lab focuses on molecular mechanisms involved in division plane maintenance. Using advanced imaging techniques, we characterized the spatio-temporal dynamics of the *Arabidopsis* kinesin-12 class motor proteins PHRAGMOPLAST ORIENTING KINESIN (POK) 1 during cell division¹. We proofed the essential role of kinesin POK1 and its close relative POK2 as core components and master-regulators of the division site, a polarized plasma membrane region that predicts and preserves the division plane throughout cell division. Analysis of spatio-temporal localization patterns, biochemical and genetic interaction assays support POK kinesins function as a scaffold that maintains a number of division site resident proteins. In addition, we revealed their importance for phragmoplast guidance on a multi-scale level and uncovered the contribution of POK2 to phragmoplast stability and expansion². Furthermore, we characterized novel interactors of POK1/2, designated PHGAP³. These proteins belong to a family of GTPase activating proteins (GAP) that deactivate the cell polarity signaling molecules Rho of plants (ROP). PHGAPs enrich at the division site in a POK-dependent manner only after prophase. Analysis of the *phgap1 phgap2* root meristem revealed a failure in division plane selection during prophase that also affects POK localization. In brief, our work suggests that cell polarity cues impact division plane selection not only in asymmetrically, but possibly also in symmetrically dividing cells. In addition to cell division, PHGAPs are involved in the establishment of cell polarity in pavement cells of the leaf epidermis. This finding suggest that cell division and cell polarity signaling share molecular components.

- 1 Lipka, E. *et al.* The Phragmoplast-Orienting Kinesin-12 Class Proteins Translate the Positional Information of the Preprophase Band to Establish the Cortical Division Zone in *Arabidopsis thaliana*. *Plant Cell* **26**, 2617-2632, doi:10.1105/tpc.114.124933 (2014).
- 2 Herrmann, A. *et al.* Dual localized kinesin-12 POK2 plays multiple roles during cell division and interacts with MAP65-3. *EMBO reports*, doi:10.15252/embr.201846085 (2018).
- 3 Stöckle, D. *et al.* Putative RopGAPs impact division plane selection and interact with kinesin-12 POK1. *Nature Plants* **2**, 16120, doi:10.1038/nplants.2016.120 (2016).

Guests are welcome!

gez. Prof. Dr. R. Böckmann

→ Venue: Department Biology, Seminar Room Cell Biology (00.581),
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