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EDITORIAL

Glimpses on microtubule accessory proteins

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Microtubules allow cells to regulate their architecture, movement, and division in a very flexible manner and in concert with the signals and challenges they perceive from the environment. Surprisingly, this versatile tool basically consists of heterodimers of two very similar proteins that are even fairly conserved over evolution. What qualifies these organelles to fulfill so many tasks and functions? Due to the molecular conservation of their building elements, the tubulins, it is generally believed that the functional specificity of microtubules is mediated by associated proteins. In fact, there exists a wealth of such accessory proteins that, during evolution, have diversified considerably. Two contributions in the present issue address functional and evolutionary aspects of such microtubule accessory proteins.

The maize mutant *brick1* is affected in epidermal morphogenesis as result of altered WAVE/ARP2/3 function. In an attempt to understand the role of the BRICK1 protein in cell division, Panteris et al., in the current issue, follow mitotic actin arrays and observe that, in contrast to the wild type, actin accumulates in the preprophase band of dividing protodermal cells of the mutant. In addition, actin accumulates in mutant spindles after treatment with taxol. Interestingly, this does not affect neither spindle structure nor division activity. This work contributes to the discussion on the role of actomyosin in mitosis (see editorial of the last issue). Based on evolutionary considerations, it is argued that, most likely, cells adopted pre-existing systems of interphase motility to generate the forces required for chromosomal translocation. In fact, there is evidence from insect cells for a role of actomyosin in mitosis. In plant cells, the colocalization of the so-called phragmosome with the preprophase band has been known for a long time. However, the link between microtubules and actin disappears during establishment of the division spindle, but is re-established during late anaphase, when the formation of the phragmoplast is initiated. This shows that, in plant cells as well, mitotic microtubule arrays are acting in concerted action with actin filaments and that BRICK1 is a key regulator for this interaction. On the other hand, the supernumerous actin filaments in preprophase band and spindle seem to have little effect neither for function and organization of mitotic microtubules nor cell division. This, at first glance, would contradict the spindle matrix model. However, it would be naive to assume a homogenous population of actin filaments. The effect of altered BRICK1 function in the mutant is mainly expected for filaments endowed with high nucleation dynamics, whereas functions driven by stable actin filaments (as those participating in myosin-driven movement) should remain largely untouched. The findings reported by Panteris et al. indicate, therefore, that we might be able to dissect the cross-talk between microtubules and actin filaments with respect to functionally and dynamically different subpopulations of actin.

The evolutionary origin of microtubule organization has been associated with the basal body. This organizer of the flagellar apparatus is designed to ensure multiple functions such as locomotion, sensory perception, and cell division. In many flagellate species, these basal bodies are tethered by a relatively stiff, noncontractile structure to the plasma membrane of the cell. These so-called striated roots accompany microtubules in green algae and are composed of striated fiber assemblin, an acidic protein structurally related to β-giardin. In addition

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to green algae, this ancient microtubule-interacting protein has been identified in various apicomplexan parasites. By in silico analysis, Harper and Hardham, in the current issue, demonstrate putative homologs to striated fiber assemblin in ciliates, dinoflagellates, oomycetes, and diatoms. By immunofluorescence with antibodies raised against algal striated fiber assemblin, they demonstrate the presence of corresponding epitopes in the two basal bodies and an anteriorly directed striated fiber in the flagellar apparatus of the oomycete *Phytophthora nicotianae*. Thus, striated fiber assemblin homologs are present and may play an important role in flagella function in the four major eukaryotic lineages of green algae, diplomonads, alveolates, and stramenopiles. This is evolutionarily interesting because, during the evolution of land plants, microtubule nucleation by centrioles is progressively replaced by acentrosomal nucleation, raising the question, what happened to ancient microtubule accessory proteins?