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IM GROßEN HÖRSAAL

PATTERN FORMATION AND COLLECTIVE PHENOMENA IN BIOLOGICAL SYSTEMS

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Reaction-diffusion dynamics provide a versatile framework for intracellular self-organization phenomena, which endows cells with the capacity for accurate positioning, control of length, and timing of processes. The Min protein system in E. coli employs such mechanisms to ensure precise cell division by its ability to dynamically adapt to cell geometry. Cell polarization, a prerequisite for processes such as stem cell differentiation and cell polarity in yeast, is also mediated by a diffusion-reaction process. Moreover, the length of microtubules is regulated by the interplay between polymerization kinetics and patterns of molecular motors which act as depolymerases. Under which conditions protein patterns emerge, and how these patterns are regulated by biochemical and geometrical factors are major aspects of current research. We will discuss general design principles of such cellular pattern forming systems and show how these are implemented for the respective specific biological function in cell division of E. coli, cell polarization in yeast, and length control of microtubuli.