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Phase separation and self-organized structures of actin cytoskeleton

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Biological cells are able to autonomously organize into various dynamical modes as a result of the force generation of their cytoskeleton. The involved cytoskeleton molecules are of nanometer length scale and thus quite small compared to the typical micrometer length scale of cells. To understand how the dynamics on these two levels are connected, a meso-scale level description needs to be developed. In this talk I will introduce my recent studies on the self-organization of actin cytoskeleton structures using a coarse-grained molecular dynamics simulation model. The first study addresses the assembly of actin cytoskeleton into a structure resembling the actin cortex. The assembly is caused by the activity of myosin motors, that lead to propulsion of actin filaments. The second study is a joint project with my experimental collaborators Sayaka Sekine (Tohoku Univ.) and Shigeo Hayashi (RIKEN BDR, Kobe). Here, I discuss the self-organization mechanism of cortical actin structures, including nanometer-scale clusters and stripes, that are found during treacheal tube development in the *Drosophila* fly. The numerical simulation results demonstrate that these structures are self-organized through microphase separation.