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Myosin II Dynamics during Embryo Morphogenesis

KAREN KASZA, Sloan-Kettering Institute

During embryonic morphogenesis, the myosin II motor protein generates forces that help to shape tissues, organs, and the overall body form. In one dramatic example in the *Drosophila melanogaster* embryo, the epithelial tissue that will give rise to the body of the adult animal elongates more than two-fold along the head-to-tail axis in less than an hour. This elongation is accomplished primarily through directional rearrangements of cells within the plane of the tissue. Just prior to elongation, polarized assemblies of myosin II accumulate perpendicular to the elongation axis. The contractile forces generated by myosin activity orient cell movements along a common axis, promoting local cell rearrangements that contribute to global tissue elongation. The molecular and mechanical mechanisms by which myosin drives this massive change in embryo shape are poorly understood. To investigate these mechanisms, we generated a collection of transgenic flies expressing variants of myosin II with altered motor function and regulation. We found that variants that are predicted to have increased myosin activity cause defects in tissue elongation. Using biophysical approaches, we found that these myosin variants also have decreased turnover dynamics within cells. To explore the mechanisms by which molecular-level myosin dynamics are translated into tissue-level elongation, we are using time-lapse confocal imaging to observe cell movements in embryos with altered myosin activity. We are utilizing computational approaches to quantify the dynamics and directionality of myosin localization and cell rearrangements. These studies will help elucidate how myosin-generated forces control cell movements within tissues. *This work is in collaboration with J. Zallen at the Sloan-Kettering Institute.*