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A 4 dimensional analysis of actomyosin dynamics during extraembryonic tissue development in Tribolium castaneum

Extra embryonic tissues in insects show highly diverse morphogenetic strategies. Unlike *Drosophila melanogaster*, the short germ insect *Tribolium castaneum* undergoes dramatic epiboly like extraembryonic tissue expansion and ventral window closure. This offers exceptional material to study the interplay of conserved cellular and molecular mechanisms in creating novel tissue morphologies. We imaged live *Tribolium* embryogenesis using multi-view fluorescence light-sheet microscopy(SPIM), and characterized nuclear, membrane and actomyosin dynamics in wild type and genetically perturbed conditions. We unfold our 3D data into 2D cartographic maps to compare and quantify cellular events across tissues in the entire embryo. Using our 4D imaging and image analysis pipeline, we report a contractile actomyosin cable that forms during serosa window closure and shows unprecedented cellular dynamics. It appears as a 3D enrichment spanning the dorsoventral axis of the embryo, initially demarcating the boundary between the embryonic and extraembryonic tissues, showing diverse shape changes over time. Laser ablations of the serosa tissue indicate that it expands due to a pull generated by the embryonic region, leading to an increase in membrane tensions at the cable as the window closure proceeds. Interestingly, the actomyosin cable is formed as a shifting boundary of autonomously contractile cells, which intercalate into the serosa contributing to its area. Genetic perturbations of serosa affect the cable and embryo morphology, indicating towards a morphogenetic role of serosa in embryo development. Together, our results indicate towards a novel actomyosin cable type that could show conserved cellular dynamics across insects which undergo serosa window closure.

Affiliation

MPI-CBG

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Primary author(s) : JAIN, Akanksha; MUKHERJEE, Arghyadip (MPI-PKS); ULMAN, Vladimir; Dr MUENSTER, Stefan (Biotec, TUD); Dr PAVLOPOULOS, Anastasios (HHMI Janelia Research Campus); TOMANCAK, Pavel

Presenter(s) : JAIN, Akanksha

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