Computer model illuminates critical moment in Drosophila development

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Drosophila sp fly. Credit: Muhammad Mahdi Karim / Wikipedia. GNU Free Documentation License, Version 1.2

A computer model of forces exerted by cells during development of a fertilized egg into a fruit fly larvae holds promise to help scientists understand the morphogenesis of organisms that are much more complicated.

Shane Hutson, professor of physics and biological sciences and chair of the Department of Physics and Astronomy, said the model sought to illuminate *Drosophila* embryogenesis about 7-9 hours after fertilization during the process of germband retraction happening at that stage of development. He and postdoc W.T. "Ty" McCleery found that mechanical stress in the amnioserosa, an epithelial tissue that covers the dorsal side of the embryo, was tensile and varied greatly by direction.

Their findings appear today in the *Biophysical Journal* in a paper titled "Elongated cells drive morphogenesis in a surface-wrapped finite element model of germ band retraction." The team was able to validate the computer model's accuracy by making tiny laser holes in embryos and tracking those visually to show how forces drive cell movements.

"Embryos, whether human or flies, are three-dimensional objects," McCleery said. "Within them are forces that determine how the cells are going to interact with each other. The field has been able to take snapshots of this and look at small patches of cells with microscopy, looking at one side of the fly at a time, but that requires a lot of assumptions. Having a model with cells wrapped around an ellipsoid, we get to see all of the cells that are interacting and start to get a sense of what the in vivo stresses are actually like."

Hutson said this sort of research into cells interacting during morphogenesis is important to the field of developmental biology and translational to many areas.

More information: W. Tyler McCleery et al. Elongated Cells Drive Morphogenesis in a Surface-Wrapped Finite-Element Model of Germband Retraction, *Biophysical Journal* (2019). DOI: 10.1016/j.bpj.2019.05.023

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