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# Orientational Order in Biological Development – Superfluid Shrimp

Morphogenesis, the process through which genes generate form, establishes tissue scale order as a template for constructing the complex shapes of the body plan. The extensive growth required to build these ordered substrates is fueled by cell proliferation, which, naively, should disrupt order. Understanding how active morphogenetic mechanisms couple cellular and mechanical processes to generate order remains an outstanding question in animal development. I will review the statistical mechanics of orientational order and discuss the observation of a fourfold orientationally ordered phase (tetratic) in the model organism Parhyale hawaiensis. I will also discuss theoretical mechanisms for the formation of orientational order that require both motility and cell division, with support from self-propelled vertex models of tissue. The aim is to uncover a robust, active mechanism for generating global orientational order in a non-equilibrium system that then sets the stage for the development of shape and form.

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