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Emergent mechanical behavior in a minimal model for embryonic tissues LISA MANNING, Department of Physics, Syracuse University, MARCOS LANIO, JARED TALBOT, EVA-MARIA SCHOETZ, Lewis-Sigler Institute for Integrative Genomics, Princeton University — We develop a minimal model for the mechanical properties of embryonic tissues that contains only three parameters and yet accurately reproduces many structural and dynamical features in zebrafish embryonic tissue explants. We verify model predictions for tissue surface tensiometer experiments and fusion assays, and contrast our model with existing models that are either difficult to constrain experimentally or insufficient to explain our experimental observations. The model tracks one degree of freedom per cell and introduces several types of interactions between cells to capture intracellular degrees of freedom, such as single cell viscoelasticity, adhesion, and active force generation. A key observation is that the motion of cells past one another, which must be generated by cells actively exerting tension on contacts, is best described by a special type of structured noise (both multiplicative and colored), instead of the white noise typically used in Brownian dynamics simulations. With such a noise term we can reproduce the glassy, viscoelastic dynamics in the bulk and explain how this new type of active "droplet" with very short-range interactions manages to have no "vapor pressure." We discuss how this well-calibrated model can be used to study morphogenesis and pattern formation in developing tissues.

Lisa Manning
Syracuse University

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