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Decoupling tissue and cell scale stresses using embedded oil microdroplets[1] ELIJAH SHELTON, FRIEDHELM SERWANE, ALESSANDRO MONGERA, ADAM LUCIO, OTGER CAMPÀS, University of California Santa Barbara — Embryonic development and organ morphogenesis require mechanical stresses to be patterned in space and time over length scales ranging from cellular to tissue level. While several approaches use 4D live-imaging to infer forces from the observed flow fields, few techniques allow direct measurements of stress in vivo and in situ. We use oil microdroplets injected in between cells as direct stress sensors. Through confocal imaging and custom software for high resolution 3D droplet surface reconstruction, we can directly measure the patterns of stress by looking at the deformations of the drop. This analysis allows us to decouple the stresses at the tissue scale from those generated at cellular scales by disentangling ellipsoidal drop deformation modes from higher order drop deformations. Using this technique we measure both tissue and cell scale stresses within aggregates of mesenchymal cells as well as within developing zebrafish embryonic tissues. The decoupling of mechanical stresses at cell and tissue scales makes our technique uniquely suited for understanding how tissue scale reorganizations emerge from cell scale interactions.

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