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Dynamics and Mechanics of Zebrafish Embryonic Tissues. EVA-MARIA SCHOETZ, R.D. BURDINE, M.S. STEINBERG, Princeton University, C.-P. HEISENBERG, MPI-CBG, R.A. FOTY, UMDNJ, F. JULICHER, MPI-PKS — In early zebrafish embryonic development, complex flows of cell populations occur, which ultimately lead to the spatial organization of the three germ layers: Ectoderm, mesoderm and endoderm. Here, we study the material properties of these germ layer tissues which are important for their dynamics and spatial organization in the embryo. In general, tissues can be classified as inherently active complex fluids. However, here we present examples of observed tissue behavior, which can be described satisfactorily in terms of passive visco-elastic fluids. We determined the material properties of the germ layer tissues quantitatively and found that differences in their properties influence tissue interaction. Specifically, quantitative differences in tissue surface tension result in tissue immiscibility and cell sorting behavior analogous to that of ordinary immiscible liquids. Surface tensions were measured with a tissue surface tensiometer. Furthermore, by tracking individual cells in the developing zebrafish embryo, we found differences in the migratory behavior of the different tissue types, which are, to some extent, governed by their mechanical properties. Finally, we generated a 3D velocity flow profile describing the tissue movements during zebrafish embryonic organizer development.

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