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Exploring Kupffer's Vescicle Through Self Propelled Particle Simulations KASSIDY LUNDY, Syracuse Univ, AGNIK DASGUPTA, JEFF AMACK, SUNY Upstate Medical University, M. LISA MANNING, Syracuse Univ
— Early development is an important stage in the formation of functional, relatively healthy organisms. In zebrafish embryos, a transient organ in the tailbud called Kupffer's Vescicle (KV) is responsible for the initial left-right (L-R) asymmetry that results in asymmetric organ and tissue placement in the adult zebrafish. Originating as a collection of symmetrically organized monociliated cells, the KV experiences a shift in cell shapes over time that leaves more cells on the anterior or top side of the KV. This arrangement helps to generate a stronger counter-clockwise fluid flow across the anterior side of the organ, which is required for L-R asymmetry. In seeking to understand the source of the shape changes occurring within the KV, we simulate a Self Propelled Particle (SPP) model that includes parameters for cell polarization and speed. We model the KV as a large particle moving in a straight line with constant velocity to mimic the physical forces of the notochord acting on this organ, and we model the surrounding tailbud cells as smaller, slower active particles with an orientation that changes over time due to rotational noise. Our goal is to calculate the forces exerted on the KV by the surrounding tissue, to see if they are sufficient to explain the shape changes we observe in the KV that lead to L-R asymmetry.

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