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Fluid-structure interaction and electrophysiology of the embryonic heart LAURA MILLER, ARVIND SANTHANAKRISHNAN, ANIL SHENOY, UNC Chapel Hill — The morphology, muscle mechanics, fluid dynamics, conduction properties, and molecular biology of the developing embryonic heart have received much attention in recent years because of the importance of both fluid and elastic forces in shaping the heart as well as the striking relationship between the heart's evolution and development. Very few studies, however, have investigated the coupling between each of these components. In this presentation, the fully coupled fluid-structure interaction problem of the embryonic heartbeat will be investigated over a range morphological phenotypes and Reynolds numbers. The immersed boundary method was used to numerically solve the Navier-Stokes equations with immersed elastic boundaries. Flow visualization was carried out in corresponding physical models using particle image velocimetry, dye injection and pH indicator methods. For select problems, the Fitzhugh-Nagumo equations were solved separately to generate action potentials along the heart's surface, which were then used to drive contractions in the immersed boundary simulations.

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