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Flow within Physical Models of the Vertebrate Embryonic Heart NHI NGUYEN, ARVIND SANTHANAKRISHNAN, LAURA MILLER, UNC Chapel Hill — Vertebrate cardiogenesis is believed to be partially regulated by fluid forces imposed by blood flow in addition to myocardial activity and other epigenetic factors. Recent in vitro studies in embryonic cardiogenesis (see Hove et al., Nature, 2003) show that blood flowing through the embryonic heart tube creates shear forces necessary for the formation and development of the heart values. It is suggested that these flow driven forces provide a biomechanical stimulus to the endothelial surface layer, which then feed into the biochemical regulatory networks that initiate heart looping and chamber ballooning. To understand the flow field within the embryonic heart, flow visualization experiments were performed on a series of physical models that represent the different morphological stages of early heart development. The chamber and valve depths of the models as well as the Reynolds numbers were varied in this study. Different compositions of solutions consisting of corn syrup and water were used as the fluid media to examine Reynolds numbers from 0.01 to 1000, corresponding to a scale of the early heart tube to the adult heart. The observed results showed that vortex formation within the chambers occurred for Reynolds numbers in the range of 1-10. This transition to vortical flow appears to be highly sensitive to the chamber and valve depths within the model.

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