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Three-dimensional quantitative analysis of cardiovascular flow and heart wall motions in living zebrafish embryos JIAN LU, Option of Bioengineering, California Institute of Technology, SCOTT FRASER, Biological Imaging Center, California Institute of Technology, MORTEZA GHARIB, Option of Bioengineering, California Institute of Technology — Progenitor factors such as blood flow induced mechanical forces play a key role in vertebrate heart development. However, three-dimensional (3-D) characteristics of in vivo cardiovascular flow and heart wall motions are not well understood due to the lack of proper imaging tools with sufficient spatial and temporal resolutions for quantitative analysis. In this study, a real-time high-speed 3-D imaging system based on defocusing digital particle image velocimetry was used to study dynamic cell motions in living zebrafish embryos. 500-nm fluorescent microspheres were injected into the blood stream to label the cardiovascular flow. Cardiac blood flow velocities were measured during a cardiac cycle at various early embryonic stages. The heart wall of a zebrafish embryo was labeled by a few fluorescent microspheres adhered to the wall. 3-D dynamic motions were reconstructed and quantitative analysis such as strain measurement was performed.

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