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A Methodology for Quantifying Heart Function in the Embryonic Zebrafish[1] BRENNAN JOHNSON, DEBORAH GARRITY, LAKSHMI DASI, Colorado State University — Several studies have linked epigenetic factors such as blood flow dynamics and cardiac function to proper heart development. To better understand this process, it is essential to develop robust quantitative methods to investigate the blood dynamics and wall kinematics in vivo. Here, we develop a methodology that can be used throughout the early stages of development which requires no specialized equipment other than a bright field microscope and high-speed camera. We use the embryonic zebrafish as our model due to its superb optical access and widespread acceptance as a powerful model for human heart development. Using these methods, we quantify blood flow rates, stroke volume, cardiac output, ejection fraction, and other important parameters related to heart function. We also investigate the pumping mechanics from heart tube to looped configuration. We show that although the mechanism changes fundamentally, it does so in a continuous fashion that can incorporate combined pumping mechanisms at intermediate stages. This work provides a basis for quantitatively comparing normal and abnormal heart development, and may help us gain a better understanding of congenital heart defects.

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