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Flow in Insect Hearts

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A common solution for moving internal fluids in animals is peristaltic contraction of a tube. Insect hearts are a typical example of such a structure. It is basically a long narrow tube that drives hemolymph towards the anterior end of the organism. In this study, we use an elastic tube of constant diameter to model the insect heart. The pumping mechanism is peristalsis whereby a region of active contraction moves from the posterior and anterior ends of the body. Flow velocities and pressures are numerically solved using the immersed boundary method in both two- and three-dimensions employing parameters within the range of those observed for *Zophobas morio* adult. The relationship between fluid flow and heart kinematics, such as the occlusion ratio, compression wave speed, and heartbeat frequency is quantified. Our results show that sufficiently high occlusion ratios create fluid velocities greater than the speed of the compression wave. Flow speed is nonlinearly related to the frequency of the heartbeat at constant compression wave speeds. Pulsatile flow and reversals in the flow direction are other flow characteristics observed in the numerical simulations of *Z. morio* adult hearts.