

Abstract Submitted
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The role of flow in the morphodynamics of embryonic heart

MORTEZA GHARIB, California Institute of Technology — Nature has shown us that some hearts do not require valves to achieve unidirectional flow. In its earliest stages, the vertebrate heart consists of a primitive tube that drives blood through a simple vascular network nourishing tissues and other developing organ systems. We have shown that in the case of the embryonic zebrafish heart, an elastic wave resonance mechanism based on impedance mismatches at the boundaries of the heart tube is the likely mechanism responsible for the valveless pumping behavior. When functioning normally, mature heart valves prevent intracardiac retrograde blood flow; before valves develop there is considerable regurgitation, resulting in oscillatory flow between the atrium and ventricle. We show that reversing flows are particularly strong stimuli to endothelial cells and that heart valves form as a developmental response to oscillatory blood flow through the maturing heart.

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