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Light at the End of SARS-CoV-2 Pandemic: Integration of Light-Sheet and Light-Field to Uncover Cardiac Morphogenesis

Tzung Hsiai

During cardiac development, peristaltic contraction of the embryonic heart tube produces time-varying hemodynamic forces and pressure gradients across the atrioventricular canal. However, the relative importance of myocardial contraction and hemodynamic force to modulate cardiac morphogenesis remain poorly understood. By using dual illumination and dual detection light-sheet system, we recapitulate flow-mediated Notch1b-Nrg1-ErbB2 signaling underlying the initiation of endocardial trabeculation for contractile function. We demonstrate myocardial contractile force-mediated Notch1b-endothealial mesenchymal transition underlying valvulogenesis in the ventricular outflow tract. Overall, we integrate advanced optics with zebrafish genetics to provide biomechanical insights into cardiac development with translational implications to congenital heart disease.

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