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Mechanical signaling coordinates the embryonic heart KEVIN CHIOU, JASON ROCKS, Department of Physics and Astronomy, University of Pennsylvania, BENJAMIN PROSSER, Department of Physiology, Penn Muscle Institute, University of Pennsylvania Perelman School of Medicine, DENNIS DISCHER, Molecular Cell Biophysics Lab, University of Pennsylvania, ANDREA LIU, Department of Physics and Astronomy, University of Pennsylvania — The heart is an active material which relies on robust signaling mechanisms between cells in order to produce well-timed, coordinated beats. Heart tissue is composed primarily of active heart muscle cells (cardiomyocytes) embedded in a passive extracellular matrix. During a heartbeat, cardiomyocyte contractions are coordinated across the heart to form a wavefront that propagates through the tissue to pump blood. In the adult heart, this contractile wave is coordinated via intercellular electrical signaling.Here we present theoretical and experimental evidence for *m*echanical coordination of embryonic heartbeats. We model cardiomyocytes as mechanically excitable Eshelby inclusions embedded in an overdamped elastic-fluid biphasic medium. For physiological parameters, this model replicates recent experimental measurements of the contractile wavefront which are not captured by electrical signaling models. We additionally challenge our model by pharmacologically blocking gap junctions, inhibiting electrical signaling between myocytes. We find that while adult hearts stop beating almost immediately after gap junctions are blocked, embryonic hearts continue beating even at significantly higher concentrations, providing strong support for a mechanical signaling mechanism.

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