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Elastohydrodynamics of the heart VAMSI SPANDAN, EMMANUEL VIROT, LAUREN NIU, Harvard University, WIM VAN REES, MIT, L MAHADEVAN, Harvard University — Animal hearts are deformable shells pumping large volumes of blood which guarantees oxygen for cells. Here we suggest a scaling for the heart rate based on a simple idea: Elastohydrodynamic resonance of a fluid-loaded soft elastic shell that is capable of bending and twisting as it ejects fluid over a contraction cycle. Such a mechanism can yield ejection fractions of 40% with relatively small strains, suggesting a solution to a long-standing puzzle in heart physiology. Our study provides a general principle to characterize the heart rate of an organism as a function of its geometry, while suggesting design principles for artificial pumps made of soft shells, and may even shed light on their pathologies.

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