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Sychronization of flagella and cilia due to viscous interactions¹ DAVID GAGNON, BIAN QIAN, HONGYUAN JIANG, THOMAS POWERS, KENNETH BREUER, Brown University — Motivated by the observed coordination of nearby beating cilia and rotating bacterial flagella, we use a scaled model experiment to show that hydrodynamic interactions can cause synchronization between rotating paddles driven at constant torque in a very viscous fluid. Systems with two and three paddles are explored, and interactions between symmetric and asymmetric paddles are tested. For two-paddle systems, synchronization is only observed when the shafts supporting the paddles have some flexibility, and the phase difference in the synchronized state depends on the symmetry of the paddles. Calculations using the method of regularized stokeslets and simple analytic theory match the experimental observations well.

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