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**What causes periodic beating in sperm flagella: synchronized internal forcing or fluid-structure interaction?** RANGANATHAN PRABHAKAR, Dept. of Mech. Aerosp. Eng., Monash University, ASHWIN NANDAGIRI, IITB-Monash Research Academy, SAMEER JADHAV, Dept. of Chem. Eng., Indian Institute of Technology Bombay — Eucaryotic cells such as sperm propel themselves using internally driven flagella. Two different models for the origin of the whip-like beating observed in such flagella are compared. The first model assumes that internal protein motors actuate synchronously to cause a traveling active-force wave within the filament. The forcing wave is chosen such that its resultant and the total torque on the filament are zero. In contrast, the second model assumes that forces and torques exerted by the motors locally sum to zero across the scale of the filament diameter. The only effect of the motor activity is to give rise to a stresslet distribution across the filament length. In either model, the slender filament is modeled as a bead-spring chain with hydrodynamic interactions. Flagellar waveforms and trajectory patterns obtained are compared systematically while keeping the dissipation rates the same for the two models. Periodic beating emerges in freely swimming filaments with the second model without any imposed periodicity in the stresslet distribution. This suggests that periodic waveforms in eucaryotic flagella can emerge by fluid-structure interactions alone without significant internal synchronization of protein motor activity.

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