AN INTEGRATIVE MODEL OF AXONEME MECHANICS IN CILIARY AND SPERM MOTILITY

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We present a fluid-mechanical model of an individual cilium or sperm flagellum which incorporates discrete representations of the axoneme's dyneins, microtubules and nexin links. This model, based on the immersed boundary method, couples the internal force generation of the molecular motors and the axoneme's passive elastic structure with the external fluid mechanics governed by the Navier-Stokes equations. We choose a simple mechanism in which dynein activation depends on the local curvature. The model can generate ciliary and flagellar beats. The waveforms are not preset, but are an emergent property of the interacting components of the coupled fluid-mechanical system.