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A new fluid dynamics model to evaluate the contractile force of a biological spring, *Vorticella convallaria*[1] SANGJIN RYU[2], PAUL MATSUDAIRA[3], Massachusetts Institute of Technology and Whitehead Institute for Biomedical Research — *Vorticella convallaria*, a sessile peritrich having a body and spring-like stalk, is a model for a bioinspired actuator because of its remarkably fast (msec) and powerful contractions (nN). An example of a biological spring, the stalk converts biochemical energy to physical motion, but the mechanics of contraction are poorly understood. To evaluate contraction force, past models have assumed the body to be a sphere moving in quiescent water and have equated contraction force to drag force on the body described by Stokes' law. However, flow induced by contracting *Vorticella* does not satisfy conditions of Stokes' law because the flow is unsteady (Womersley number > 1) and bound with a solid substrate to which the cell is tethered. We develop a more rigorous model for contraction force evaluation by assuming the body to be a sphere unsteadily moving perpendicularly toward a solid surface. The model comprises quasi-steady drag force, added mass force and history force with wall effect correction terms for each force. *Vorticella* not only generates a maximum contraction force greater than Stokes' drag, but it also experiences drag force in the direction of contraction in the later stage of contraction due to the memory effect of water.

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