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**The Fast and Non-capillary Fluid Filling Mechanism in the Hummingbird's Tongue** ALEJANDRO RICO-GUEVARA, Department of Ecology and Evolutionary Biology, University of Connecticut, CT 06269, TAI-HSI FAN, Department of Mechanical Engineering, University of Connecticut, CT 06269, MARGARET RUBEGA, Department of Ecology and Evolutionary Biology, University of Connecticut, CT 06269 — Hummingbirds gather nectar by inserting their beaks inside flowers and cycling their tongues at a frequency of up to 20 Hz. It is unclear how they achieve efficiency at this high licking rate. Ever since proposed in 1833, it has been believed that hummingbird tongues are a pair of tiny straws filled with nectar by capillary rise. Our discoveries are very different from this general consensus. The tongue does not draw up floral nectar via capillary action under experimental conditions that resemble natural ones. Theoretical models based on capillary rise were mistaken and unsuitable for estimating the fluid intake rate and to support foraging theories. We filmed (up to 1265 frames/s) the fluid uptake in 20 species of hummingbirds that belong to 7 out of the 9 main hummingbird clades. We found that the fluid filling within the portions of the tongue that remain outside the nectar is about five times faster than capillary filling. We present strong evidence to rule out the capillarity model. We introduce a new fluid-structure interaction and hydrodynamic model and compare the results with field experimental data to explain how hummingbirds actually extract fluid from flowers at the lick level.

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