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Butterfly proboscis as a biomicrofluidic system KONSTANTIN KORNEV, Clemson University, DARIA MONAENKOVA, STEVEN REA, CAMPBELL YORE, CALEB KLIPOWICS, KARA EDMOND, VIJOYA SA — It looks amazing how butterflies and moths with their thin feeding trunk are being able to sip very thick liquids like nectar or animal extractions. Their sucking ability goes beyond that: one can observe butterflies and moths probing liquids from porous materials like fruit flesh or wet soils. This suggests that the suction pressure produced by these insects is sufficiently high. The estimates based on engineering hydraulic formulas show that the pressure can be greater than one atmosphere, i.e. it can be greater than that any vacuum pump could supply. In this experimental study, the principles of interfacial flows are used to carefully analyze the feeding mechanism of butterflies and moths. We document the feeding rates and proboscis behavior of Monarch butterflies (Danaus plexippus) in different situations: when butterfly feeds from droplets, from vials modeling floral cavities, and from porous materials modeling fruits, wet soils, or dung. Using high speed imaging and simple models, we propose a scenario of butterfly feeding which is based on capillary action. According to the proposed mechanism, the trunk of butterflies and moths works like a fountain pen where the air bubbles play a significant role in controlling fluid flow.

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