Abstract Submitted
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Flight testing of live Monarch butterflies to determine the aerodynamic benefit of butterfly scales[1] AMY LANG, University of Alabama, JACOB CRANFORD, University of Alabama Huntsville, JASMINE CONWAY, Tennessee State University, NATHAN SLEGERS, George Fox University, NICOLE DECHELLO, Smith College, JACOB WILROY, University of Alabama — Evolutionary adaptations in the morphological structure of butterfly scales (0.1 mm in size) to develop a unique micro-patterning resulting in a surface drag alteration, stem from a probable aerodynamic benefit of minimizing the energy requirement to fly a very lightweight body with comparably large surface area in a low Re flow regime. Live Monarch butterflies were tested at UAHuntsville's Autonomous Tracking and Optical Measurement (ATOM) Laboratory, which uses 22 Vicon T40 cameras that allow for millimeter level tracking of reflective markers at 515 fps over a 4 m x 6 m x 7 m volume. Data recorded included the flight path as well as the wing flapping angle and wing-beat frequency. Insects were first tested with their scales intact, and then again with the scales carefully removed. Differences in flapping frequency and/or energy obtained during flight due to the removal of the scales will be discussed. Initial data analysis indicates that scale removal in some specimens leads to increased flapping frequencies for similar energetic flight or reduced flight speed for similar flapping frequencies. Both results point to the scales providing an aerodynamic benefit, which is hypothesized to be linked to leading-edge vortex formation and induced drag.

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