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The aerodynamic cost of flight in bats—comparing theory with measurement RHEA VON BUSSE, RYE M. WALDMAN, SHARON M. SWARTZ, KENNETH S. BREUER, Brown University — Aerodynamic theory has long been used to predict the aerodynamic power required for animal flight. However, even though the actuator disk model does not account for the flapping motion of a wing, it is used for lack of any better model. The question remains: how close are these predictions to reality? We designed a study to compare predicted aerodynamic power to measured power from the kinetic energy contained in the wake shed behind a bat flying in a wind tunnel. A high-accuracy displaced light-sheet stereo PIV system was used in the Trefftz plane to capture the wake behind four bats flown over a range of flight speeds (1–6m/s). The total power in the wake was computed from the wake vorticity and these estimates were compared with the power predicted using Pennycuick's model for bird flight as well as estimates derived from measurements of the metabolic cost of flight, previously acquired from the same individuals.

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