How a bat drinks on the wing

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Abstract

Bats possess remarkable flight capabilities that rely on the many degrees of freedom in their skeletal wing structures and flexible wing membranes. Drinking during flight is a particularly intriguing maneuver that requires specialized kinematics. In this study, we conduct a comparative analysis between straight flight and drinking flight modes in bats, employing a combined experimental and theoretical approach. High-speed video recordings are conducted on two bat species, *Hipposideros pratti* and *Rhinolophus ferrumequinum*, in a controlled flight room. Through kinematic analysis and 3D reconstruction of landmark points on the bat, we observe that during drinking flight, bats reduce flapping amplitude while increasing flapping frequency compared to straight flight. Additionally, aerodynamic analyses based on quasi-steady lift and drag force models are performed for both forward flight and maneuvering flight during drinking. If time allows, we will also discuss the aerodynamics and kinematics of a bat-inspired robot. Our research highlights the significance of studying different flight maneuvers in bats, shedding light on how modifications in wing kinematics and morphology actively influence body posture for specific tasks.

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