Staying the course: Fruit flies employ stabilizer reflex to recover from midflight stumbles

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Observing the aerial maneuvers of fruit flies, Cornell University researchers have uncovered how the insects - when disturbed by sharp gusts of wind - right themselves and stay on course. Fruit flies use an automatic stabilizer reflex that helps them recover with precision from midflight stumbles, according to observations published online today (March 1, 2010) in *Proceedings of the National Academy of Sciences*.

Learning from the biological world could help the mechanical, as the research on insect flight could help engineers simplify the design of maneuverable and stable flapping-wing aircraft.

The team led by Cornell doctoral candidate Leif Ristroph made its observations with three high-speed (about 8,000 frames per second) video cameras that recorded every slight motion of the insects. Ristroph is a student in the laboratory of Itai Cohen, assistant professor of physics.

To unlock the secrets of flight stability in these flies, the researchers devised a way to trip them up in midflight. They glued tiny magnets to the backs of flies sedated by a dunk into ice water. When the insect came to and flew around, the researchers turned on magnetic fields that zapped the magnet, nudging the insect off its flight path.

The researchers found that the insects paddled their wings to steer while flying, delicately adjusting the inclination of their wings by miniscule amounts - as little as 9 degrees - at a remarkable rate of 250 times a second.

Thus, the insects took the disturbance in stride, quickly paddling their wings so that they could recover their original posture with pinpoint accuracy. All this is possible because of two small, vibrating sense organs called halteres, which millions of years ago evolved from what used to be a pair of hind wings. Mathematical models show how the halteres ultimately tell the wings to paddle.

Without flight, life as humanity knows it would not be possible. Cohen says: "The ability to control flight profoundly changed the evolution of our planet. About 350 million years ago, the world was devoid of the many trees and flowers of today. Once insects figured out how to maneuver through the air, these pollinators enabled the Earth to blossom with life."

More information: The paper is titled "Discovering the flight auto-stabilizer of fruit flies by inducing aerial stumbles."

Provided by Cornell University