

Fruit flies, fighter jets use similar nimble tactics when under attack (w/ Video)

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A fruit fly, *Drosophila hydei*, flaps its wings 200 times a second during normal flight and even faster when taking evasive action. Credit: F. Muijres and F. van Breugel, University of Washington

When startled by predators, tiny fruit flies respond like fighter jets – employing screaming-fast banked turns to evade attacks.

Researchers at the University of Washington used an array of high-speed

video cameras operating at 7,500 frames a second to capture the wing and body motion of flies after they encountered a looming image of an approaching predator.

"Although they have been described as swimming through the air, tiny flies actually roll their bodies just like aircraft in a banked turn to maneuver away from impending threats," said Michael Dickinson, UW professor of biology and co-author of a paper on the findings in the April 11 issue of *Science*. "We discovered that [fruit flies](#) alter course in less than one one-hundredth of a second, 50 times faster than we blink our eyes, and which is faster than we ever imagined."

In the midst of a banked turn, the flies can roll on their sides 90 degrees or more, almost flying upside down at times, said Florian Muijres, a UW postdoctoral researcher and lead author of the paper.

"These flies normally flap their wings 200 times a second and, in almost a single wing beat, the animal can reorient its body to generate a force away from the threatening stimulus and then continues to accelerate," he said.

The fruit flies, a species called *Drosophila hydei* that are about the size of a sesame seed, rely on a fast visual system to detect approaching predators.

"The brain of the fly performs a very sophisticated calculation, in a very short amount of time, to determine where the danger lies and exactly how to bank for the best escape, doing something different if the threat is to the side, straight ahead or behind," Dickinson said.

"How can such a small brain generate so many remarkable behaviors? A fly with a brain the size of a salt grain has the behavioral repertoire nearly as complex as a much larger animal such as a mouse. That's a

super interesting problem from an engineering perspective," Dickinson said.



Time lapse images from a high speed video shows how a fruit fly startled by a looming shadow (off camera at the bottom right) performs a rapid roll to bank away from the threat. Credit: F. Muijres, University of Washington

The researchers synchronized three high-speed cameras each able to capture 7,500 frames per second, or 40 frames per wing beat. The cameras were focused on a small region in the middle of a cylindrical flight arena where 40 to 50 fruit flies flitted about. When a fly passed through the intersection of two laser beams at the exact center of the arena, it triggered an expanding shadow that caused the fly to take evasive action to avoid a collision or being eaten.

With the camera shutters opening and closing every one thirty-

thousandth of a second, the researchers needed to flood the space with very bright light, Muijres said. Because flies rely on their vision and would be blinded by regular light, the arena was ringed with very bright infrared lights to overcome the problem. Neither humans nor fruit flies register infrared light.

How the fly's brain and muscles control these remarkably fast and accurate evasive maneuvers is the next thing researchers would like to investigate, Dickinson said.

More information: "Flies Evade Looming Targets by Executing Rapid Visually Directed Banked Turns," by F.T. Muijres et al. *Science*, 2014.

Provided by University of Washington

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