# Dragonflies: The flying aces of the insect world

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Next time you see a dragonfly, try to watch it catch its next meal on the go. Good luck!

"Unless we film it in high speed, we can't see whether it caught the prey, but when it gets back to its perch, if we see it chewing, we know that it was successful," says Stacey Combes, a biomechanist at Harvard University. With support from the National Science Foundation (NSF), she and her team are studying how dragonflies pull off complicated aerial feats that include hunting and mating in mid-air. She set up her lab in typical "dragonfly country."

"Our lab is at the Concord Field Station in Bedford, Mass. This is a field station of Harvard University about a half-hour from the main campus," says Combes. "We're surrounded by woods and ponds, which is an ideal habitat to find dragonflies."

The researchers have already identified 20 species at the pond so far. On this outing, they hope to net a few to study. But, it's not easy to catch a dragonfly.

"Alright, I got one ... I lost it," exclaims team member and biomechanist Jay Iwasaki. "It's a Libellula cyanea," he notes when he finally catches one. "It's in the family of Libellulidae, which are dragonflies known as skimmers; this is a male. You can tell this species in particular from the white dots on its wings."

The team takes two dragonflies back to a specially built, netted enclosure. It's large, about one and a half stories high. "We built this especially to look at predation in dragonflies. One of the problems with studying dragonflies is they tend to not go after prey if the lighting is not just right. If they're not in a large enough space where they're comfortable, they'll just starve because they only will eat this prey in midair," explains Combes.

In the enclosure, her team has set up eight high-speed cameras. They release a dragonfly along with some tasty fruit fly prey to see what happens next. The high-speed cameras catch what the human eye can't.

"They'll go up in midair, catch the prey with their feet, turn upside down and glide back to the stick, and the whole capture will take maybe a second, or a second and a half," says Combes. She points to one of the high-speed images: "This one is missing about half of its left front wing and yet, it still does an amazing job catching the fruit fly in midair."

"That particular maneuver takes only a half second to happen," adds Iwasaki.

"They're amazing fliers," explains Combes. "They're fun to watch and it's something you can't really see with your naked eyes. We look at them in high speed and look at the angles in flight as they catch prey. They flip upside down, it's just amazing and they do it time after time, hundreds of times, like it's nothing. In the enclosure they caught about 90 percent of the prey that we gave them."

Dragonflies have had a long time to evolve their skills as predators. They have been on the planet for about 300 hundred million years and predate dinosaurs. They can fly straight up, straight down, hover like helicopters and disappear in a blur.

"Dragonflies have two sets of wings and they flap in different phases," says Combes. "Sometimes they flap together; sometimes they're offset and we're seeing with our predation videos that they change this all the time."

Biomechanist Amber DesLauriers points to a dragonfly sitting on a thick blade of grass. You can see its head moving back and forth looking for its next meal. "They can pretty much see all the way around their head except right behind them," she says.

Combes says engineers are looking to the dragonfly for inspiration in small-scale aircraft design. "There's a lot of interest in building small robotic devices and when you get down to the size scale of insects, you really can't build mini airplanes. The physics don't work well to have a little, tiny airplane. You really need to have flapping or rotating wings. So, we can learn a lot from these insects," she explains.

Combes is also exploring the idea of using dragonflies for mosquito control. "They may consume 30 mosquitoes a day. They could even consume hundreds a day," she notes.

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