

# Butterfly Antennas Key to Navigating in Migration

By RANDOLPH E. SCHMID, AP Science Writer Thu Sep 24, 2009, 2:17pm ET

WASHINGTON – Millions of Monarch butterflies migrate to Mexico for the winter and scientists have long speculated on how the insects find their way. Turns out, their antennas are the key.

How do we know? Well, researchers painted butterfly antennas black, and the insects got lost.

Managing to fly south may not sound like a big deal to people armed with maps and GPS receivers, but all butterflies have for navigation is the sun in the sky.

And the sun keeps moving, so the little creatures have to constantly adjust to stay on course throughout the day.

Like most animals, Monarchs have a so-called circadian clock in their brain that helps them know what time it is. Knowing the time and the position of the sun allows them to orient to the south.

But Monarch butterflies have a second clock based in their antennas, which also sense light, according to the new study led by Dr. Steven M. Reppert, chairman of neurobiology at the University of Massachusetts Medical School.

"Whatever we learn about the insect ... is going to tell us a little bit more about how our brain works," said Reppert, who studies the internal clocks in the brains of animals, including people.

Plus, he added in a telephone interview, "It's fascinating biology that's begging to be understood."

Researchers had thought the navigation took place in the brain of the butterfly, but this experiment shows that the brain and antenna each has a circadian clock and they work together, he said.

The researchers, whose study appears in Friday's edition of the journal *Science*, did the test by holding the butterfly wings gently and dipping their antennas in enamel paint.

The ones with black paint were unable to orient to the south, they found, while butterflies whose antennas were coated with clear paint had no trouble navigating.

That not only showed the antennas were sensing light for navigating, it also showed that the sense of smell isn't involved in finding the way, since both paints blocked that ability.

And, since the animals with black paint got lost even though their eyes were able to see light, the researchers concluded the antennas were vital to finding the way.

Butterflies whose antennas were surgically removed also became disoriented.

Charalambos P. Kyriacou of the University of Leicester, England, said the experiment indicates that the antennas serve as a sort of stand-alone global positioning system for the insects.

"The antenna clock appears to override any input from the brain clock for navigation," Kyriacou, who was not part of Reppert's research team, said in a commentary on the report.

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Science: <http://www.sciencemag.org>