# Scientists are first to discover sensory system that detects air humidity

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This image shows a 0.1 x 0.03 inch (2.5 x 0.8 mm) small Drosophila melanogaster fly. Image: Wikimedia Commons

Humidity can make us feel miserable—think of sultry summer days in Chicago, for example—but humans do not have dedicated sensory systems in the skin to detect water vapor in the air. Most insects, for whom humidity levels can mean life or death, do have such systems, but little has been known about how they work.

Now, a research team from Northwestern University and Lund University in Sweden is the first to discover a sensory system that directly detects air humidity. The scientists have identified key genes involved in the fruit fly's ability to detect changes in external humidity, and they also discovered the sensory neurons—the fly's humidity

receptors—in a strange, small sac in the insect's antennae.

"That insects are able to detect humidity levels has been known since the beginning of the 20th century, but how they do it has remained enigmatic," said Marcus C. Stensmyr, associate professor at Lund University and co-corresponding author. "Our study reveals for the first time the genes and neurons that underlie this ability, which is very exciting."

What the researchers have learned about Drosophila melanogaster—a major model system for the genetics of behavior—could help scientists better understand the mosquito and improve mosquito population control by preventing the insects from finding suitable bodies of water in which to lay their eggs.

"Insects are generally very small, and humidity is a very big deal for them," said Marco Gallio, assistant professor of neurobiology in Northwestern's Weinberg College of Arts and Sciences and a co-corresponding author of the study. "They are careful to not lose moisture, which could cause them to die, and they also use humidity detectors to find water. Our discovery is very important for sensory biology and offers a possible tool for fighting mosquitos and the disease they can carry."

The findings were published online today (May 5) in the journal *Current Biology*. The study also will appear as the cover story in the May 23 print edition.

Stensmyr, Gallio and their colleagues identified the neurons in the antenna that respond to humidity by using a variety of genetic methods.

"Human engineers have devised a few different ways to measure air humidity," Gallio said. "The oldest relies on a human hair under tension.

The hair retains moisture, so its length changes with humidity, and that can be easily measured. It turns out the fly may use a very similar strategy to measure humidity: the mechanical deformation of a specialized little organ inside the antenna, called the sacculus, could tell the brain about humidity levels."

The researchers also directly investigated how the fly brain responds to humid stimuli and found that humidity activates a region of the brain right next to the one activated by temperature. "Yet the fly's response to humidity and temperature are separate, and this may allow the animal to better adapt its behavior to the changing environment," Gallio said.

Indeed, the researchers believe that understanding how animals detect and respond to environmental conditions such as temperature and humidity also may help scientists better predict what will happen to the distribution and survival of different species under global warming.

**More information:** Anders Enjin et al. Humidity Sensing in Drosophila, *Current Biology* (2016). DOI: 10.1016/j.cub.2016.03.049

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