

Researchers gain focus on a bug with bifocals (w/ Video)

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Photo of third instar larva by Annette Stowasser

(PhysOrg.com) -- University of Cincinnati researchers are reporting on the discovery of a bug with bifocals - such an amazing finding that it initially had the researchers questioning whether they could believe their own eyes. "To the best of our knowledge, this is the first demonstration of truly bifocal lenses in the extant animal kingdom," the researchers state in the Aug. 24 cover feature of the premier life-science journal, *Current Biology*.

The article is an exploration of two eyes of the larvae of the sunburst diving beetle (*Thermonectus marmoratus*). The two eyes have the bifocal lens, which the researchers have found in four of the larvae's 12 eyes, says researcher Elke K. Buschbeck, a UC associate professor of biology.

The article explains that using two retinas and two distinct focal planes that are substantially separated, the larvae can more efficiently use these bifocals, compared with the glasses that humans wear, to switch their vision from up-close to distance - the better to see and catch their prey, with their favorite food being [mosquito larvae](#).

"In addition, we think that within the principle eyes, separate images of the same object could be focused on each of the two retinas, allowing each [eye](#) to function as 'two eyes in one,'" the researchers reveal in the article. The tubular-shaped eyes with the bifocals allow them to efficiently focus onto their two retinas, says Annette Stowasser, a UC biology doctoral student and first author on the paper.

The discovery was made in Buschbeck's lab and was supported by her National Science Foundation CAREER award to recognize the research and teaching talent of young faculty. "We're hoping this discovery could hold implications for humans, pending possible future research in biomedical engineering," Buschbeck says.

"The discovery could also have uses for any imaging technology," adds Stowasser.



Photo of head of third instar larva by Elke Buschbeck

Bugs with Bifocals

The sunburst diving beetle larvae that was studied typically live in creeks and streams around Arizona and the western United States. It's classified as a holometabolous insect - the group of insects that morph into something completely different from how they originated - like the caterpillar/moth or the maggot/fly. The larvae of these beetles have the bifocal lens. They lose these intricate lenses when they become a beetle.

Researchers Couldn't Believe Their Eyes

As the researchers zeroed in on how the multiple eyes of this insect worked, they did even more research to try to disprove what they saw. They first used a microscope to look through the lenses of the two eyes detailed in the research article. They saw how the lens could make a second image grow sharper - something that could only happen with a bifocal. "It was my first research project, and I seriously thought I made a mistake, and then we did additional research to try to kill the hypothesis," says Stowasser.



Photo of adult beetle by Annette Stowasser

However, their findings were confirmed with more research in addition to observing the operation of the lens and the two focal planes via a microscope. They saw the bifocal again when they used a method to project a narrow light beam through the lens. "Our findings can only be explained by a truly bifocal lens," write the researchers.

Provided by University of Cincinnati

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