

# Hungry eyes: Spiders lose vision when they're starving

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A bold jumping spider. Researchers found that undernourished spiders begin to lose light-sensitive photoreceptors. Credit: Joseph Fuqua II/UC

Biologists at the University of Cincinnati discovered that underfed jumping spiders lose light-sensitive cells that are key to their vision.

UC College of Arts and Sciences Professor Elke Buschbeck and her co-authors studied photoreceptors in the eyes of bold [jumping spiders](#), tiny eight-legged predators found across North America. The little hunters rely on their keen vision to stalk prey.

But researchers found that underfed spiders begin to lose photoreceptors that give them such good eyesight. Their findings could improve our understanding of the role that nutrition plays in common age-related vision problems such as [macular degeneration](#).

The study was published in the journal *Vision Research*.

Their discovery occurred by serendipity while examining the eyes of wild-caught bold jumping spiders using her lab's custom-made ophthalmoscope, which can take photos of the retinas of insects and spiders. They found [dark spots](#) on some of the spiders' photoreceptors, suggesting they had degenerated during its life or development.

"You could tell just by looking at them that some of the photoreceptors had died," Buschbeck said.

"But are the photoreceptors really degenerating?" UC doctoral student Shubham Rathore asked. "Or are they just getting bleached by the way we do the experiment?"

Rathore turned to electron microscopy to confirm that the cells indeed were dying.

The study suggests jumping spiders are a compelling model to study retinal and neuronal health.



University of Cincinnati Professor Elke Buschbeck created a custom ophthalmoscope in her lab to study the vision of spiders and insects. Credit: Andrew Higley/UC

### **Did poor nutrition cause it?**

To test their hypothesis, Miranda Brafford and John Goté, both UC graduates, studied two groups of captive spiders, one fed a normal unrestricted diet and another that was given half portions. In the underfed group, spiders lost more photoreceptors, particularly in the part of the retina that has the highest density of them.

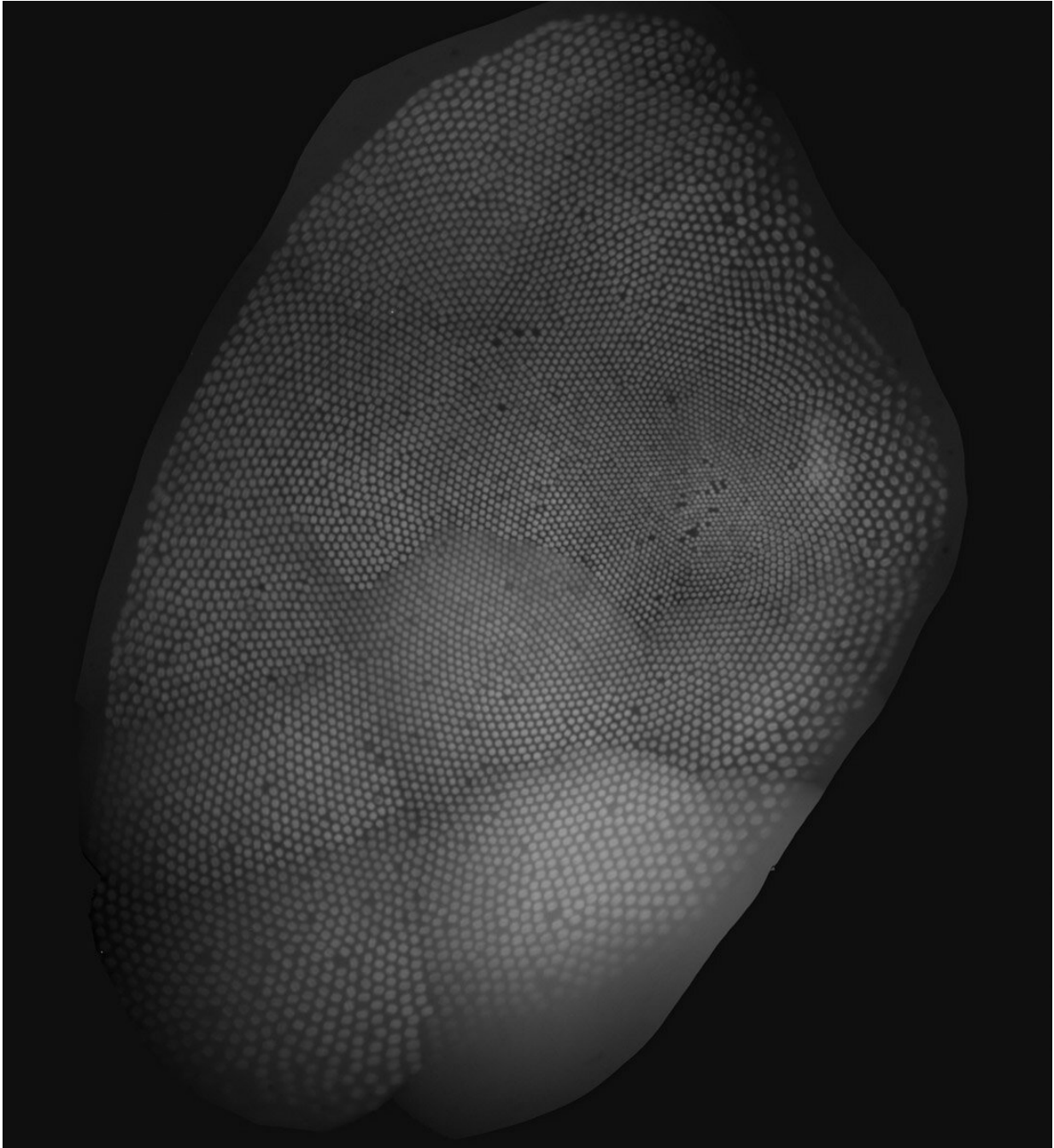
"It's the functional equivalent of the macula in our eyes," Buschbeck said.

That is the part of the eye that processes visual information directly in front of you.

"Photoreceptors are energetically costly. It's hard to keep up with their energy needs," Buschbeck said. "If you deprive them of nutrition, the system fails."

Macular degeneration affects an estimated 20 million people in the United States. It's the most common cause of age-related vision loss and has no cure.

"What's interesting is macular degeneration in humans also has evidence of being linked to [metabolic processes](#) and difficulty with energy being delivered," Buschbeck said.



An image of a jumping spider's retina shows damaged photoreceptors like dead pixels in a digital camera. Credit: Buschbeck Lab

Rathore and Buschbeck said they would like to see if the degeneration

begins in the support tissues around the photoreceptors and what nutrients in particular support good visual health.

Study senior author Annette Stowasser, an assistant professor in UC's College of Arts and Sciences, said it's premature to draw direct comparisons between vision deficits in spiders and people.

"To be able to say anything about how this may inform treatments in people, first carefully designed studies would need to tease out which exact nutrients are involved, which may depend on [environmental conditions](#) and other factors," Stowasser said.

"However, that nutrient deprivation can have the shown effect indicates the importance of paying close attention to the effects of nutrients," she said.

Co-author Nathan Morehouse is director of UC's Institute for Research in Sensing and has studied the vision of jumping spiders around the world.

"Wouldn't it be wild if a breakthrough in macular degeneration treatments for humans was inspired by work on jumping [spiders](#) common to back yards across the United States?" said Nathan Morehouse, an associate professor in biological sciences.

"Sometimes answers to challenging problems can come from unexpected places," he said.

**More information:** Shubham Rathore et al, Nutrition-induced macular-degeneration-like photoreceptor damage in jumping spider eyes, *Vision Research* (2023). [DOI: 10.1016/j.visres.2023.108185](https://doi.org/10.1016/j.visres.2023.108185)

Provided by University of Cincinnati

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