BIOLOGY

Hatchlings with Vision

Jumping spider babies are the size of a grain of sand but see surprisingly well

Adult jumping spiders are littler than a fingernail, but their vision is as clear as a small dog's. And the babies, with heads a hundredth the size of their parents', may see in almost as much clarity. Researchers have now discovered a mechanical secret behind this remarkable hatchling ability.

"Even arachnophobic people find these little jumping spiders to be compelling—they dance, they sing vibratory songs to each other," says Nathan Morehouse, a co-author of the study published in July in *Vision Research*. (Morehouse started the research at the University of Pittsburgh and finished it at the University of Cincinnati.) And the spiders' extraordinary visual ability captivates many scientists.

"Everyone I know who works on vision just loves jumping spiders," says Jamie Theobald, who studies insect vision at Florida International University and was not involved in the new study. "How they accommodate such amazing visual behaviors is a pretty important question."

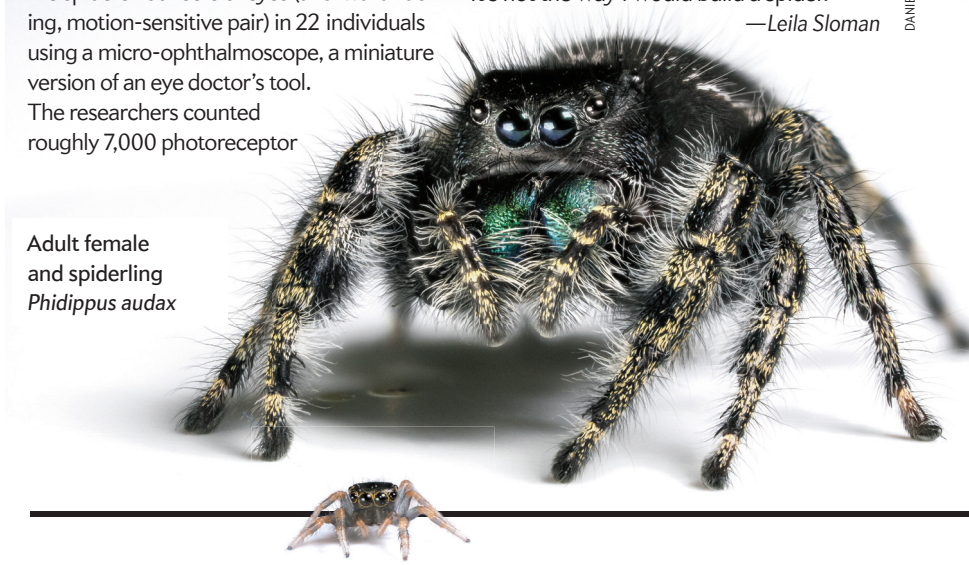
Researchers have observed that young jumping spiders can use complex visual cues while hunting. To find out how youngsters' vision is so close to adults', Morehouse and his colleagues peered into one of the spiders' four sets of eyes (a forward-facing, motion-sensitive pair) in 22 individuals using a micro-ophthalmoscope, a miniature version of an eye doctor's tool. The researchers counted roughly 7,000 photoreceptor cells per eye in early juvenile, late juvenile and adult spiders. They also examined seven of the spiders twice, four months apart, and found that none of them produced new photoreceptors.

That measurement indicates the spiders do not add receptors as they grow but cram in all these cells by the time they hatch—"Which is a crazy thing to do!" Morehouse says. According to the team's earlier genetic research, the tiny spiders most likely share an "ancient genetic tool kit" with insects: their bodies first construct the photoreceptors, then top them off with lenses. That mechanism makes sense for certain insects that add new photoreceptors, capped with separate lenses, to their eyes as they grow larger. But it is developmentally cumbersome for spiders, whose eyes each accommodate only one lens and so need all their photoreceptors in place early in life.

These results suggest spiderlings see as much detail as adults, with a comparable field of vision—although there are drawbacks. For instance, baby spiders' tiny photoreceptors provide poor light sensitivity. Morehouse has seen evidence of this himself: "They're a little bit stumbly," he says.

The eyes' biological structure cannot tell scientists everything about how the spiders see. "They may be making trade-offs at the neural level," Theobald says, such as restoring some sensitivity at the expense of spatial or temporal detail. For that reason, behavioral studies are necessary to fully understand spiders' vision. But the biological results alone are surprising, Theobald says: "To have to have all your photoreceptors right from the beginning? It's not the way I would build a spider."

—*Leila Sloman*



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Adult female and spiderling *Phidippus audax*