Insects See the Light

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Insects See the Light

By
Tom Turpin

Professor of Entomology
Purdue University

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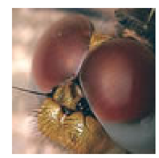
Insects, like almost all other animals, can see. The sense of sight, called photoreception, depends on light energy being reflected off objects. Specialized animal organs called eyes capture the reflected light, and vision results.



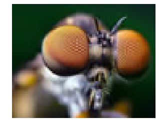
Fly eyes

Animals use vision for many purposes, including recognizing form, detecting movement and discerning color. Insects also use photoreception to determine day length, sometimes called the photoperiod. These six-leggedcreatures can even monitor the position of the sun – high in the sky vs. near the horizon - by the polarization of light.

Insect vision plays an important role in attracting mates, finding food plants and avoiding enemies. Insects also use their vision to navigate around stuff as they crawl or fly. In addition, photoreception is the reason insects can predict the approach of winter. Prediction is based on the declining minutes of sunlight. This information is important for a cold-blooded animal to anticipate, and survive, the cold of winter.

The ability to detect the polarization of light from the sky allows insects to determine direction. This is important for insects such as honey bees that need to find their way back to a nest site. Sort of the insect equivalent to a GPS system for humans!

While insects and humans have a lot of similarities in sight, major differences exist as well. The most obvious is in the structure of the eye. Human eyes and the eyes of most other non-insect animals are single-lens structures. The insect eye is made up of multiple lenses and is called a compound eye.



Insect eyes

The number of lenses in the compound eyes of insects varies according to species and ranges from as few as 10 to 28,000 or more per eye. The presence of multiple lenses means that the vision of insects is different than the vision of animals that possess eyes with a single lens.

Exactly what an insect sees through all of those lenses is a matter of speculation. One early theory, proposed by *Johannes Müller* in 1826, is still accepted today. According to this theory, an individual lens records a very small portion of the field that each eye views. Together, the eye sees a mosaic of the total view. One would guess that such an image would be very similar to viewing the world through a woven-wire fence, a food strainer or a bundle of soda straws.

Another major difference in photoreception of insects compared to other animals is in color vision. In general, humans can see wavelengths of the electromagnetic spectrum from 400 to 800 nanometers - from violet to red. Insects, on the other hand, perceive wavelengths of from 650 to 300 nanometers, including the ultraviolet range of the spectrum.

What this means is that most insects don't see well in the yellow, orange and red portion of the spectrum but see ultraviolet very well. Humans are just the opposite. We can see the yellow, orange and red but don't do so well with the ultraviolet.

The way that insects perceive color has led to the use of yellow light bulbs as a method to discourage insect attraction to lights. A red bulb would be less attractive to insects but provides a minimum amount of light for humans. However, some insect behavioral researchers do use red lights to observe insects that are active at night, because the light is not seen at all by the insect.

UV light

On the other hand, ultraviolet lights are used to attract night-flying insects to traps. Entomologists use such traps to assess numbers of insects that are pests. Black lights are also used to lure insects to electric grids where they are killed. Such "bug zappers" are used to eliminate undesirable insects. Unfortunately, most of the insects killed in such devices are not problem insects.

So why are night-flying insects attracted to lights? This is an age-old question, and one for which science does not have an answer. One theory is based on the fact that insects use ultraviolet light to navigate during dark hours. A point source of light, such as a flame or a light bulb, interferes with the insect's ability to navigate. As a result, the insect loses direction and ends up flying around in the vicinity of the light. In this case, when an insect sees the light, it is not a good thing!

Writer: Tom Turpin
turpin@purdue.edu

Editor: Olivia Maddox
maddoxol@purdue.edu