



### Now You See It (p. 241)

It only takes a split second for a hunter to decide to turn its attention to the tasty morsel that's just darted before it. But what is it that catches an amphibian's eye?

Ursula Dicke decided to

tempt salamanders to find out what they are looking for in a good meal. The best recipe seems to be the bigger and faster the prey, the stronger its allure.

Dicke and her colleague Niklas Schülert tempted salamanders by showing them a variety of movies, ranging from running crickets to mobile rectangles. Dicke showed each salamander two simultaneous images, with one moving left and the other right. She manipulated the size, speed and shapes of the moving objects, to assess which aspects of the images attracted the salamanders most.

Not surprisingly, the salamanders were most alert to large and fast running crickets. But, a cricket-sized rectangle seemed to interest the salamander almost as much as the insect movies. How the prey moved didn't seem to be a major factor in catching the salamander's attention, crickets that stayed in the middle of the screen and waved their legs and antennae were as attractive as a moving image of a stationary cricket.

So salamanders need more than just a cricket shape to catch their eye. They need a combination of different features, which include the object's shape, size and movement, which the salamander weighs up before it responds. Dicke interprets this as individual neurons responding with different strengths to specific aspects of the visual stimuli. The sum of these nerve signals encodes a stimulus. This information converges at a structure in the brain that directly controls the amphibian's motor response, turning the animal's head toward the next cricket portion.

Kathryn Phillips  
kathryn@biologists.com



### Sight Cycles (p. 201)

Sunset in South America signals the start of a busy night for blood-sucking insects, *Triatoma infestans*, called vinchuca. Crawling from their dark hiding places they look for their next meal. The vinchuca's prey includes

small mammals and even humans: Charles Darwin recorded being bitten during his voyage on the Beagle. The insects are most active at dusk and dawn and their eyes must respond quickly to significant changes in light intensity. Carolina Reisenman and her colleagues have revealed that intensity is not solely responsible for adjustments in their eyes. The structure of the eye also changes in a daily cycle, anticipating the changing light conditions the vinchuca will experience while hunting.

By assessing vinchuca behaviour in response to light, Reisenman had previously shown that their sensitivity was controlled by a circadian rhythm. While behaving normally in low light, as soon as the intensity increased they sought out darker refuges. "It is very important for their survival to escape from light," explains Reisenman. Curiously, considering their need for sensitivity, they have a type of compound eye that is less efficient than those found

in other nocturnal insects. So how do they compensate for the decreased sensitivity?

Compound eyes consist of many identical visual units. Below the lens in a vinchuca eye are two central photosensitive cells surrounded by a ring of six peripheral cells. During the day screening pigments in these outer cells form a 'pupil' that limits the amount of light falling onto the central cells. Pigment in these cells then prevents light from reaching the outer cells. At night the 'pupil' widens and the pigment in the central cells moves away so that light also reaches the photoreceptors in the outer ring. At the same time the whole photosensitive unit moves up towards the lens to catch more light. Reisenman has found that this rhythm of structural changes continues even if the bugs are kept in constant darkness. More interestingly, the pigment moves differently in the peripheral and central cells. While the peripheral pigment moves in the normal cycle, the pigment in the central cells only moves partially. Hence circadian rhythms control the movement of the photosensitive unit and the peripheral pigment, while the pigment movement in the central cells is also controlled by light input. By controlling the amount of light reaching the photoreceptors these mechanisms would make the bugs 'sensitive to slight changes in intensity'.

So is this the only reason why these bugs have such sensitive sight? Light varies in colour, as well as intensity. Each eye cell usually contains one photopigment that is sensitive to specific wavelengths. Reisenman hopes that further studies will show whether the wavelength spectrum of light varies at dawn and dusk. This becomes interesting when you remember that these bugs use only their central cells for sight during the day, but both groups at night. If these cells contain different pigments then it is possible that the bugs see in monochrome during the day but receive many more wavelengths at night. This would affect sensitivity, as Reisenman explains: 'they need to collect more photons' it doesn't matter what colour they are!

Sarah Tilley  
(London)



Reproduced by permission of Dr Bernd Minnich

### Making the Pulse Race (p. 225)

We all take our pulsing veins for granted, but what forces drive the development of the body's most widespread system? Blood circulation starts very early in development, but the nerves and hormones that control blood pressure in adults are not functional at this early stage. With the help of some tiny tadpoles, Thorsten Schwerte and colleagues from the University of Göteborg have solved this puzzle, and the answer lies in the blood vessel walls.

Blood pressure is a crucial force that drives development of the circulatory system. The tiny tadpoles control the pressure in their blood systems by regulating the blood vessel's diameter. Vasoactive substances narrow and widen the blood vessels modulating the blood pressure and driving development of the cardiovascular system.

Schwerte has developed a digital system that tracks the movement of blood cells, and uses their path width to measure the diameter of the developing vascular system. *Xenopus laevis* tadpoles are ideal for these studies because they are independent and transparent, so their developing cardiovascular system is easy to visualise. Schwerte wanted to find out which vasoactive factors were active in the tadpoles.

But before they could raise the tadpole's blood pressure, they had a few technical hitches of their own to overcome. They had to perform surgery on the tiny animals, isolating an artery with a

diameter of less than 0.1 mm from a creature that was only 2 cm long - no mean feat. When they dosed the artery with endothelin, a factor released from the blood vessel walls, they saw immediate constriction. But how could they stimulate the vessel to open and drop the blood pressure? They had a hunch that nitric oxide (NO), a powerful vasodilator, might relax the vessel walls. However, when they tested a NO releasing agent, sodium nitroprusside, on recently prepared blood vessels, they didn't respond. Even when they used an agent that blocked the synthesis of NO the blood vessels were unaffected. But when they constricted the blood vessels with endothelin before testing the effect of NO, the vessels relaxed and dilated.

'This gave us the idea that the vessels are completely dilated at the start of the experiment', said Schwerte. Blood vessels that have been constricted by endothelin are under great stress. This increased shear stress on the vessel walls causes the release of NO, which acts

as a break on the endothelin signalling pathway. However, Schwerte hasn't ruled out the involvement of other factors.

Schwerte has big plans for the tiny larvae in his imaging system, and the implications of this research go far beyond the amphibian world. The endothelin/NO double act is active in young mammals too, but mammalian embryos incubated in the womb are difficult to study. Schwerte comments 'Xenopus tadpoles and zebrafish larvae are ideal organisms to study the early development of the cardiovascular system'. In the near future, he hopes to use this approach to model human diseases and test emerging cardiovascular drugs.

**Alison George  
(Cambridge)**

The Journal of Experimental Biology 205, i-ii (2002)  
Printed in Great Britain © The Company of Biologists Limited 2002

