Abstractions

SENIOR AUTHOR

Colour vision is the result of a remarkably complicated process that requires a host of photoreceptor cells to be arrayed so that they can catch, and then process, light of different wavelengths. How these receptors are arranged, and what role each type plays in processing the small components of an image into a colourful whole, is a mystery.

On page 174 of this issue, a team of developmental biologists explores how the random — or stochastic — distribution of photoreceptors in fruitflies' eyes can give some insight into human sight. They found that, although photoreceptor distribution is random and complex, the expression of one gene plays a crucial role in how they are arranged. *Nature* spoke to team leader Claude Desplan, a biologist at New York University, to find out how flies — and humans — reconstruct colour.

Why look at flies to understand human vision?

Most mammal animal models don't have colour vision because they are nocturnal. It is not absolutely obvious that insects are good models for human vision, but insects have a pretty well-developed colour vision; they can compare the vector of light polarization for navigation as well as different-colour wavelengths. There are some differences, though. Flies have three eye units, each of which processes different kinds of visual information.

How hard was the experimental work?

We know the system extremely well. The eye is a system that can be manipulated. You let the body of the fly be wild type and you make the genetic mutation almost at the single-cell level. Now that we know that one gene — one transcription factor — plays a role in the random distribution of receptors we can change its timing, level or pattern of expression.

What is the role of randomness in colour vision?

In flies, the colour receptors are stochastically distributed. This is true in humans, too, but with a very fixed ratio of one kind of colour receptor to another. Interestingly, in zebrafish, receptors are amazingly well organized in an array — which seems to make more sense. I don't fully understand why zebrafish receptors are more organized than the more random fly or human retinas.

Announcement

The third issue of *Nurture*, *Nature*'s magazine for authors, is now available. If you are a *Nature* author and have not received your copy, please contact authors@nature.com with your mailing address details and publication reference.

MAKING THE PAPER

Catherine Darst

How impersonating a poisonous frog can stop you from becoming dinner.

For her thesis, Catherine Darst spent a lot of her time carting coolers of thumb-sized frogs and crates of chickens on crowded buses across the Ecuadorian Andes. The work wasn't some complex relocation project but a study of batesian mimicry, a process by which one species of animal adopts the appearance of an unrelated species to gain protection from predators.

Collecting and analysing the study subjects proved to be a challenge for the University of Texas graduate student. "When I first got to Ecuador I barely spoke Spanish. I went where colleagues said the frogs were, but I could not find any," she recalls. She eventually used tape-recorded frog sounds to convey what she was after to the locals, and they pointed out where the creatures could be found.

Darst focused on two species of frog living in different parts of the Amazonian rainforest: *Epipedobates bilinguis* in the north and *E. parvulus* in the south. Both flaunt red-spotted backs but have different-coloured markings on their legs to warn predators of their poisonous skin. A third species, *Allobates zaparo*, is not poisonous but looks very similar to *E. bilinguis* or *E. parvulus*. According to batesian theory, this innocuous frog adopted the markings of the local poisonous frog to trick predators into believing that it too is toxic.

In an area somewhere in the middle of the rainforest, where all three frogs coexist, Darst discovered that *A. zaparo* took on the markings of *E. bilinguis* alone. *E. bilinguis* turned out to be less toxic and less abundant than *E. parvulus*. So why would *A. zaparo* opt to mimic this species? The question drove Darst's project, and her findings are published on page 208 of this issue.

Initially, Darst wanted to examine the frogs' predators — but no one could identify what they are. Darst even spent evenings in the rainforest making 200 plasticine frog models hoping that she could identify potential predators from bite marks. But she got no identifiable marks, so she opted for another kind of model — the chicken.

Using a local professor's backyard as a lab, Darst introduced chickens to the various frogs. If a chicken encountered one of the poisonous frogs it would peck it and quickly let the foul morsel go. After about eight encounters the chicken learned not to bother.

If a chicken did this 'training' with the more toxic *E. parvulus*, it would also steer clear of the other two types of frog. But if it learned to avoid *E. bilinguis*, then it would avoid only those frogs with exactly the same markings, such as the *A. zaparo* found in the area where all three species of frog coexist. So by mimicking *E. bilinguis*, *A. zaparo* maximizes its chances of survival.

"It is like eating shellfish and getting really, really sick. You are likely to avoid all seafood after that. But if you only get a little bit sick, you might just stay away from the specific kind of shellfish that made you sick for a while," explains Darst.

QUANTIFIED **FIJI**

A numerical perspective on *Nature* authors.

There is no such thing as a typical day at work for David Olson, the field programme director at the Wildlife Conservation Society in Fiji. On any given day, he could be drinking kava in a village, surveying groupers on a reef, or discussing policy issues with government working groups. Field programmes demand a flexible approach, Olson says, where conservation and logistical decisions must be made on the fly to keep on top of changing conditions. But he believes that field conservationists need to have a solid understanding of longer-term conservation goals for an area to adapt effectively. This week, Olson and his colleagues present a new analysis to show that regions with a high number of endemic species also have unexpectedly high overall species numbers (see page 212).

19 staff work with Olson on the Wildlife Conservation Society's South Pacific programme in Fiji.

2 submissions of original research have been made to *Nature* from Fiji in the past 12 months.

4 is the number of institutions — spanning the United States and Fiji — from which Olson and his co-authors came together for their collaboration.

200 visitors to *Nature* online in the past month were from Fiji.