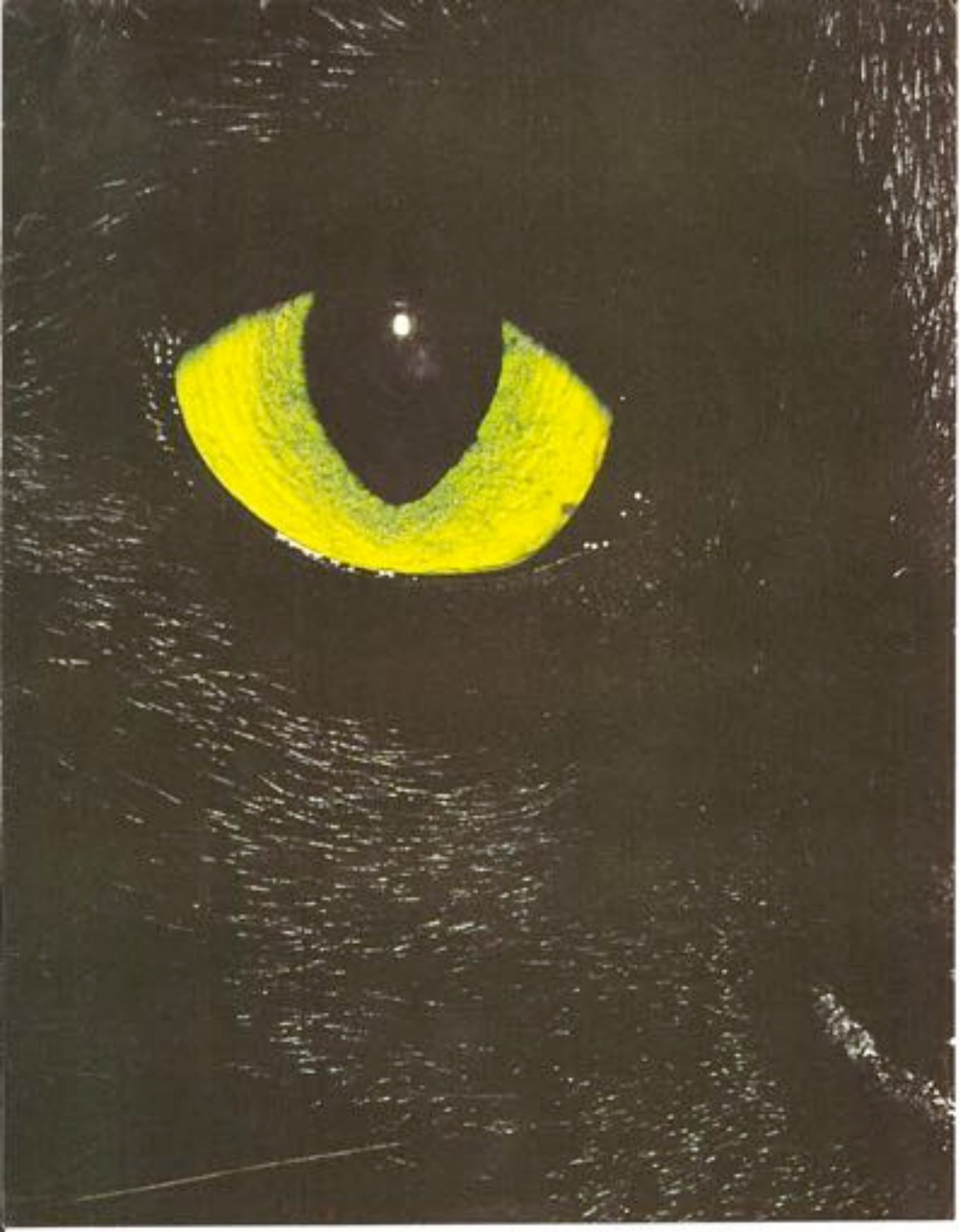


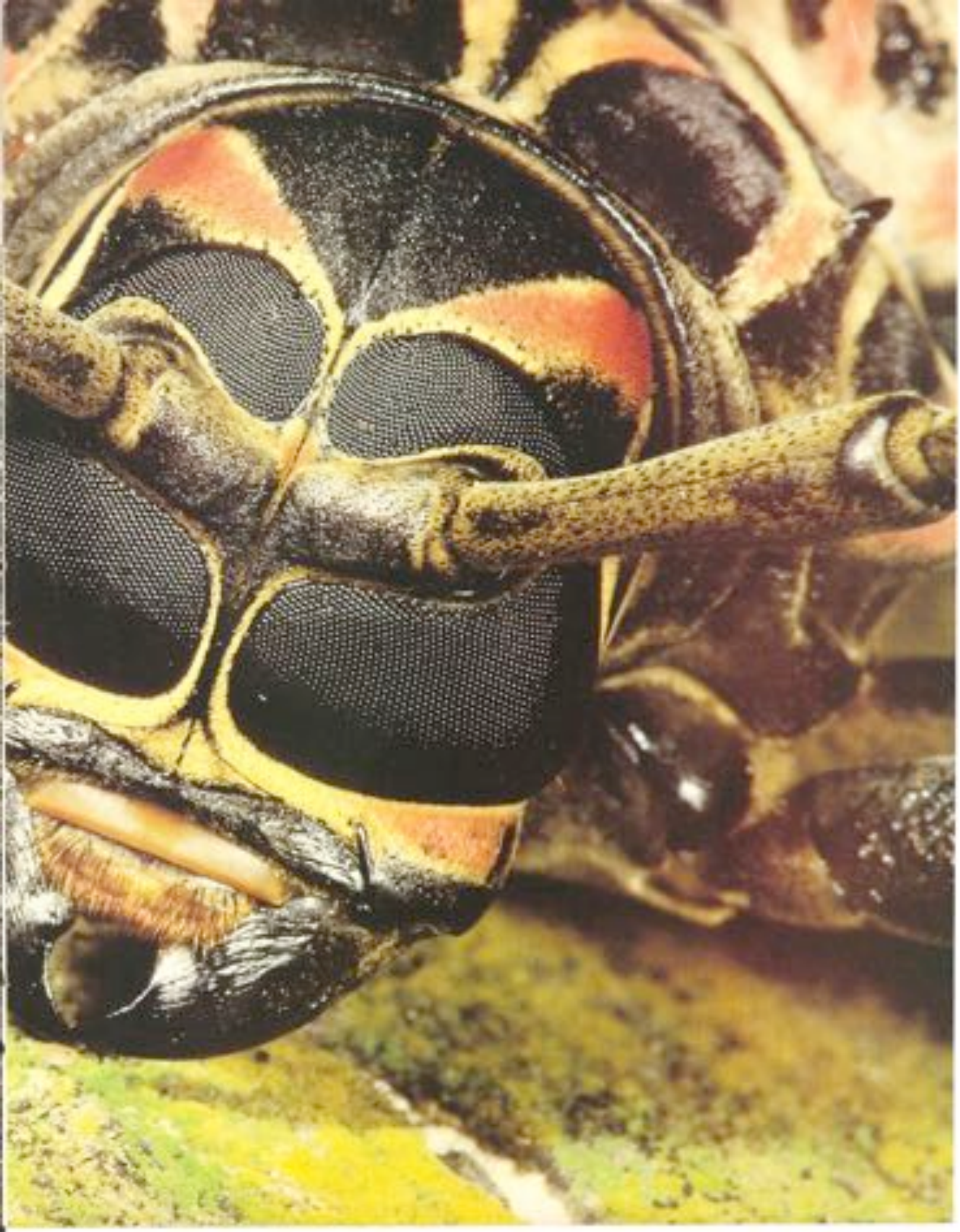
July 1985 OMNI

A MULTIFACETED WORLD

From the Svengali-like gaze of the common house cat to the furtive glance of the timid gerbil (pages 50 and 51), animals' eyes are distinctive; they also see the world differently from the way we do.

"Nature has displayed enormous creativity in the design of the eye," says Sandra Sinclair, author of the newly published book *How Animals See: Other Visions of Our World*. So to understand how creatures view their surroundings, Sinclair enlisted the aid of leading wildlife photographers, whose specialized craft enabled them to record the world as various animals perceive it. Using special effects, for example, her photographic collaborators were able to reveal what insects see through their compound eyes—the multifaceted structures that frame the antenna (right). Unlike our eye, with its solitary lens, a compound eye may contain up to 30,000 separate tiny lenses, enabling an insect to see objects close up in great detail and without distortion. Initially, scientists thought compound eyes fragmented objects into crude mosaiclike images similar to the butterfly photograph below (top left). But they now believe that the more highly evolved flying insects combine multiple images into a single picture. Some insects, such as butterflies, can also see ultraviolet rays. Flowers, to these insects, look like landing pads with lightened pollen centers and darkened petals (bottom left).

Facing page: the compound eye of the harlequin beetle. Right: the more spherical compound eye of the robber fly. Top right: flowers from the fly's point of view. Top left: a butterfly as seen by a primitive insect. Bottom left: what a daisy looks like to an insect with ultraviolet vision.



VIEW FROM DOWN UNDER

When scientists first descended into the ocean's depths, they were struck by the darkness. But they were even more amazed when, below 150 meters, that murky darkness was filled with stars. Because very little light can filter to such depths, many deep-sea inhabitants produce their own light, called bioluminescence. Such light, though faint, allows the enormous photoreceptors of most deep-sea creatures such as the hatchetfish (left) to perceive objects. But color is seen differently at these depths, even by human eyes. All wavelengths of light except for the blue part of the spectrum are filtered out. "A deep-sea diver who cut his hand would actually see his blood as green," says Sinclair.

Fish that live near the surface of the water can see much more color. They can also peer up into the airfilled world. Their vision above water, however, is limited to a 96° cone-shaped window. And because light rays bend where sea and sky meet, the sizes of objects above the surface are distorted. While a fisherman looking down through the water will see his quarry magnified in size, the fish in turn sees its hunter as smaller than he actually is (bottom left).

Other sea creatures, such as the chambered nautilus (bottom right), a cousin of the octopus and squid, have eyes that take a long time to focus on an object. In fact, they are often unable to see rapidly moving schools of fish that pass by.

Facing page: the hatchetfish sees by the light of bioluminescence. Left: how a fisherman looks to a fish underwater. Top left: coral seen through human eyes. Top right: the same coral seen through the lensless eyes of the chambered nautilus. Above: the nautilus.

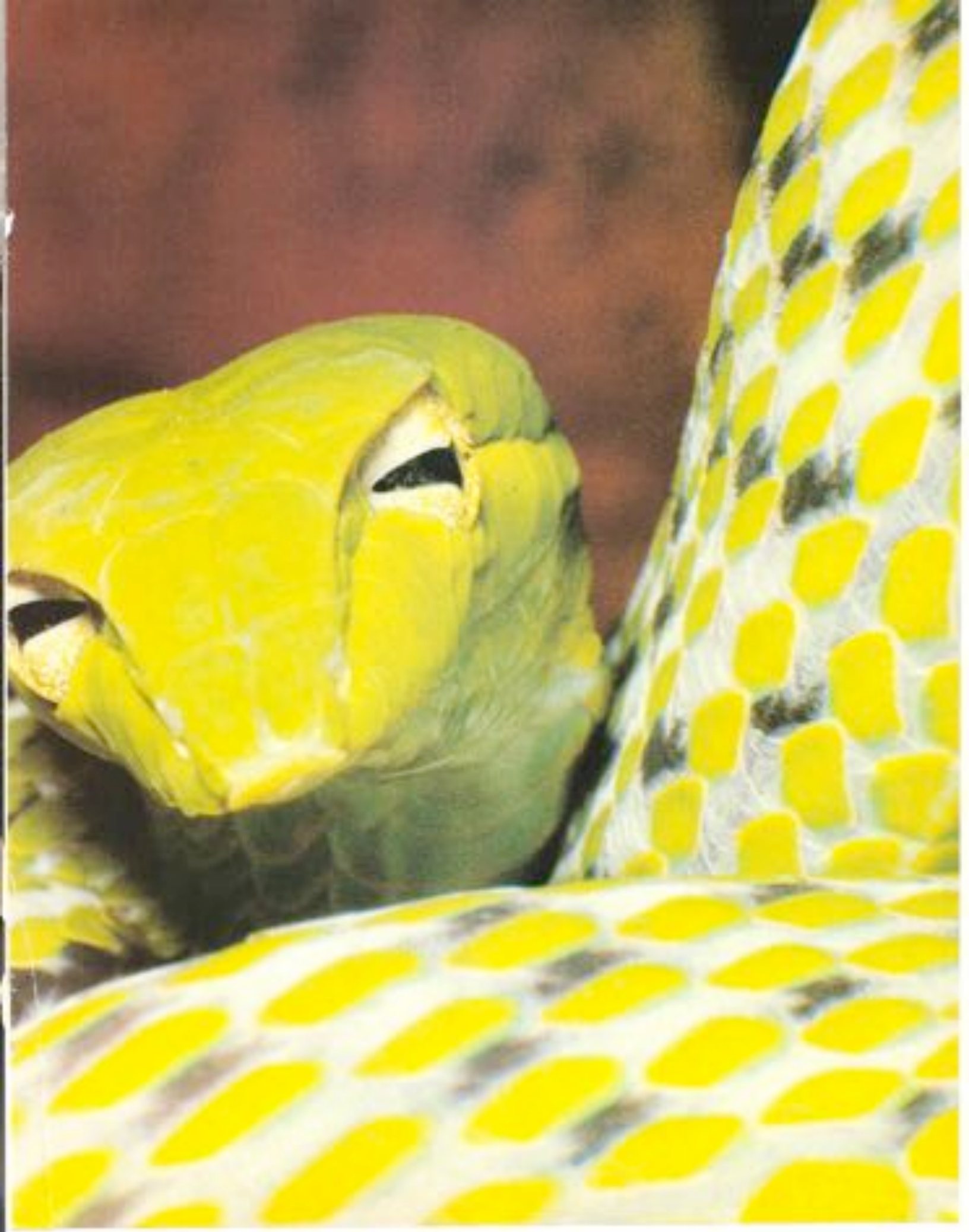
A SLIT-EYED PERSPECTIVE

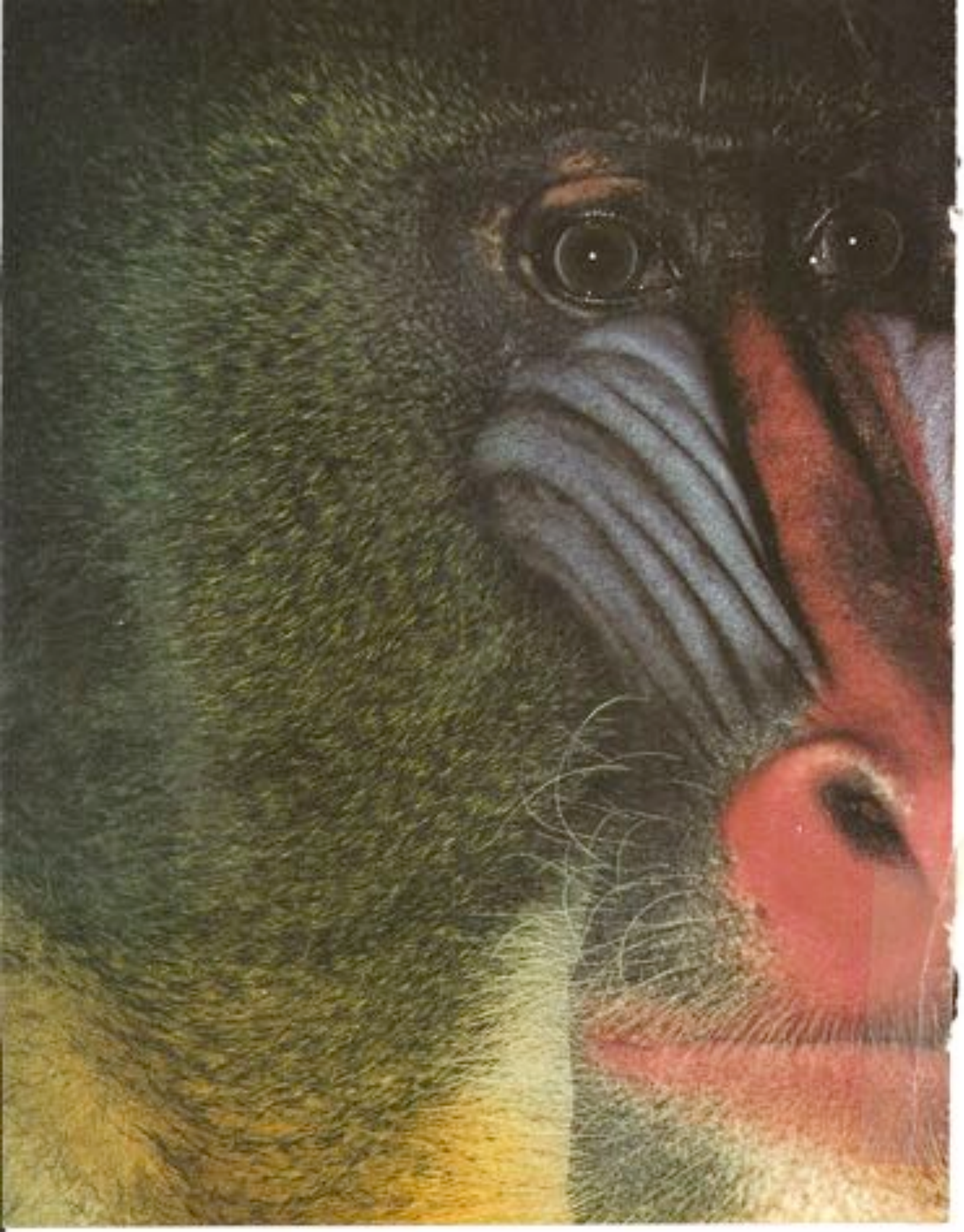
When snakes emerged from a long evolutionary period underground, some of them had gained the ability to see heat—a visual adaptation that knows no parallel in the animal kingdom. Pit vipers, such as the rattler, and boids, such as the python, combine both visual and thermal information into one image. (Their view of a gerbil appears below, at left.)

Not all snakes have that ability, however. The vine snake (far right) has grooves that sweep like brows across its head and function like a sight on a gun, focusing its slit eyes on targets within striking range. The barrellike protuberances that surround the eyes of the Senegalese chameleon (bottom right on this page) provide incredible optical mobility, enabling the animal to look in two directions at once. Its split-screen image of the world, however, merges when the chameleon gets ready to strike an insect. Then it brings both eyes into focus on the prey. The Tokay gecko, pictured directly above the chameleon, is equipped with another unusual visual feature. Like only a few other creatures, this nocturnal lizard has a stenopaic pupil: a slit that contracts to form two small apertures per eye, allowing sharper focus over great distance.

Like many animals, some reptiles may also have good color perception. The Australian skink (below) displays a dramatic coloration that may serve as a warning to other skinks, as well as predators.

Facing page: the vine snake. Above left: a gerbil as seen by a snake with infrared sensors. Above right: the nocturnal Tokay gecko, with its two-holed pupil. Top: the Australian skink flashes its tongue. Right: the mobile eyes of the Senegalese chameleon.





WIDE-EYED AND COLOR-BLIND

In the age of dinosaurs, mammals were nocturnal and inhabited the trees. With arboreal life came the development of the hand and the ability of the mammals' eyes to change focus for objects up close or far away. But because mammals were creatures of the night, color perception developed later. The slow loris (bottom left), for instance, can distinguish only between the brightness of different hues. Its eyes perceive green to be brighter than yellow.

Similarly, the New World monkeys of South America have only the rudimentary beginnings of color vision. They can see the blue coloring on parrots (below right) and can perceive yellow but have difficulty distinguishing reds and greens the way we do (below left). Surprisingly, the green foliage in which they frolic appears to them as shades of white and gray. Squirrels, prairie dogs, and many other simple mammals share the monkey's sensitivity to yellow and blue.

The more highly evolved African primates, however, have color vision similar to our own. The mandrill, a large baboon of western Africa (*opposite page*), for example, has no trouble distinguishing between green and red tones. It has the same three color receptors as the human eye and probably sees the world in the full spectrum of hues, a distinct advantage in the natural world. As Sinclair puts it, "A creature that can see in color has a better chance of survival."

Facing page: the mandrill. Left: the loris. Top left: parrots as seen by the human eye. Top right: parrots as a New World monkey sees them. Above: a human's-eye view of leaves. To most nocturnal mammals, the green leaf would seem brighter than the yellow one.