Rapid colour change is only one example of the dramatic rapid physiological changes the giant cuttlefish (Sepia apama) can perform. This remarkable cephalopod uses chromatophores, small vacuoles of pigment, to change colours quickly. These tiny organs are directly under neurological control, and each consists of an elastic sacculus with various coloured granules (black, brown, red, orange, or yellow) surrounded by between 10 and 25 radial muscles. With muscular contraction or relaxation the sacculus can be used to express or hide true pigmented colours, thus creating differences in both colour and pattern. These unique animals also use iridocytes (also called iridophores) around the eyes and elsewhere to create constructive interference, thereby creating other colours such as those of the shorter wavelengths, like blues or greens. Iridocytes consist of thin electron dense platelets alternating with chitin or cytoplasm of the appropriate thickness to create constructive and destructive interference. With this principle, these cells reflect selected wavelengths of light and create structural colours. Some squid, perhaps including the giant cuttlefish, can control the thickness of the plates in the iridocytes, and thus control the constructive interference pattern which would change the structural colour perceived by an observer.

This relative of the octopus, whose bizarre rectangular pupil is shown on the cover, has surprisingly good vision. Curiously, the pupil can close nearly completely, much like a window shutter, with only the smallest of openings remaining. Presumably, the remaining thin pupil, if not completely closed, can function as a pinhole or even a range finder, or can act like window shades if the animal wishes peace.

Cuttlefish, more than the octopus species, rely upon vision for prey detection and capture (not to mention predator detection). Accommodation has been measured in a closely related species, with several interesting observations. The resting refractive state of the cuttlefish is emmetropic in water, as might be expected. Accommodation (by movement of the lens) of approximately 5 dioptres occurs bilaterally, associated with convergence, a fraction of a second before a strike and occurs only in the frontal field with no change in the lateral field of view of vision (Schaeffel F, Murphy CJ, Howland HC. Accommodation in the cuttlefish (Sepia officinalis). J Exp Biol 1999;22:3127–34).

As with certain other species, cuttlefish can detect polarisation and probably see into the ultraviolet range. Recent work suggests that cuttlefish use their perception of polarisation to break the countershading camouflage of light reflecting silvery fish (Shashar N, Hagan R, Boal JG, et al. Cuttlefish use polarization sensitivity in predation on silvery fish. Vis Res 2000;40:71–5).

But, perhaps the most interesting feature of this animal is its ability to change shape, texture, colour, and pattern; it can even appear to change sex. Some breeding pairs of giant cuttlefish have been noted to have a third animal with them. This “chaperone” was a small male that had changed his body coloration and appearance to seem to be a female. Because of this appearance, the larger male would not drive away the would be interloper. When the larger, mating male leaves the female to defend his territory or his mate from a male in display coloration, the smaller “chaperone” male will change into full breeding coloration and often successfully mate with the unguarded female (Norman MD, Finn J, Tregenza T. Female impersonation as an alternative reproductive strategy in giant cuttlefish. Proc R Soc Lond 1999;266:1347–9). This is but one example of the extreme dynamic morphological and colour change this species can undergo.

With the exception of some breeding habits, little is known of the biology and distribution of this and related species. The animals congregate in great numbers off the coast of southern Australia in late April for breeding. By early May, they have dispersed again. The females lay eggs under rocks or in crevices in subtidal habitats although there is tremendous predation of the eggs by numerous aquatic species.

But, if a giant cuttlefish makes it to adulthood, you will enjoy its unrivalled capability of making magnificent colour changes and beautiful displays that would make an opera diva jealous. —IVAN R SCHWAB, MD, UC Davis Department of Ophthalmology, 4860 Y Street, Suite 2400, Sacramento, CA 95817, USA (irschwab@ucdavis.edu).