Vision in Cubomedusan Jellyfish

The report by Wald and Rayport (1) on visual physiology in alciopids complements the recent ultrastructural study (2) of the remarkable eyes of these worms. However, adding annelids to molluscs, arthropods, and vertebrates does not complete the list of animals with elaborate eyes (3). One outstanding example is found in the cubomedusan jellyfishes (4) of tropical marine waters, the eyes of which were described by the end of the last century (5, 6).

Cubomedusas have as many as 24 eyes located near the bell margin, and the most complex of these eyes have an epidermal cornea, spheroidal cellular lens, and upright retina (Fig. 1). The retina is composed of layers, corresponding to those of alciopids: a presumably sensory layer, a pigmented layer, a nuclear layer, and a region of nerve fibers. The cells described by Berger (6) as sensory contain a zone of pigment granules at the level of the pigmented layer and, in the sensory layer, long “axial fibers” which he tentatively identified as cilia and clearly illustrated with basal bodies.

There are roughly 11,000 sensory cells in the eye (7), a number comparable to that estimated for alciopids (1). Elongate pigmented cells (supportive cells?) extend between the sensory cells in sections from animals fixed in the light, and are partially withdrawn in sections from animals fixed in the dark; Berger interpreted these observations as evidence for a kind of adaptation to light and dark, similar to that in arthropodan and other complex eyes. Between the lens and the retina is a “capsule” through which narrow processes extend from the tips of the long pigmented cells to the cells of the lens, features which Berger (6) speculated might be involved in accommodation for near and far vision.

Like alciopids, cubomedusas have been studied little (8, 9). They are agile and rapid swimmers; specimens only about 3 cm high have been clocked at up to 6 m per minute (10). They are active both by day and by night, and in the dark exhibit strong positive phototaxis (9, 10); they will orient accurately to the light of a match as much as 1.5 m away even if the match is extinguished before orientation is completed (9). Their combination of speed and fine directional sensitivity to light might enable them to orient to luminescent prey at night. Larson (10) observed that cubomedusas attracted to a night-light “neither swim toward prey nor avoided obstacles,” but the interesting possibility of image-forming vision under more normal conditions remains. Cubomedusas are unique among cnidarians in engaging in copulation (11); might the eyes be somehow involved in this behavior?

Cubomedusas are similar to the camera eyes of vertebrates and cephalopods that would be surprising if studies of them, on the level now begun for alciopids (1, 2), did not yield valuable perspective and reveal some more elaborate functions than ordinary directional sensitivity.

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References and Notes
4. Cubomedusas are usually placed in the class Scyphozoa, phylum Cnidaria. It has been argued that they constitute a separate cnidarian class, the Cuboza; see B. Werner, Helgol. Wiss. Meeresunters. 27, 461 (1975).
7. We arrived at this estimate by counting the sensory cells in figure 1 (cross section) of Berger (6); we then calculated the average density (3.3 × 10^6 cell/mm^2) and estimated the retinal area, assuming that the retina occupies half of a spherical eye 145 μm in diameter (measured inside pigment layer on figure 7 of Berger; see Fig. 1).
8. Cubomedusas are notorious, however, for their painful, sometimes deadly sting, and they are commonly known as “sea wasps”; studies have centered on their effects on bathers [for example, see Barnes (9)].
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Vision of cubomedusan jellyfishes
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