

BOX JELLYFISH MORE THAN MEETS THE EYE

Continued from cover

The 50+ species belong to Cnidaria, the phylum that includes sea anemones, corals, Portuguese man of war and “true” jellyfish. At the top of their class — Cubozoa — these animals have two dozen, seemingly specialized eyes and a deadly delivery system of highly toxic venom.

Also called sea wasps, marine stingers and fire jellies, box jellyfish are partial to the warm coastal waters of Australia and Southeast Asia, but they are also found off the shores of Hawaii, the Gulf Coast and the east coast of the United States.

These sea creatures can outmaneuver and out-swim their closest relatives. Able to propel themselves backwards by squeezing their bodies in a pump-like motion, the jellyfish jet across the sea at speeds of up to four knots.

This speed enables them to keep up with their voracious appetites. Box jellyfish are carnivores; their diet consists of small fish and crustaceans. To protect their extremely delicate hydrostatic skeletons, the jellyfish must instantly disable or kill their prey, or risk damage to their tentacles. These appendages number up to 15 on each side of the bell and grow up to 10 feet in length. Each tentacle has approximately 5000 stinging cells (nematocysts), which fire spring-driven darts of venom within three milliseconds once activated — 10 times faster than an airbag inflates. The poison is triggered by skin chemicals rather than by contact alone. Once dinner has been acquired, the tentacles contract and the food is absorbed directly into the stomach. It is

quickly digested and waste is excreted through the ends of the tentacles.

Although toxicity varies among species, jellyfish toxins attack the heart, nervous system and skin cells. Only the flatback sea turtle seems immune to the venom. For humans, a box jellyfish sting is so unbearably painful that the victim usually goes into shock and drowns, if heart failure doesn't occur first. Survivors must battle weeks of searing residual pain and significant scarring. One proven remedy: vinegar! This common household solution of acetic acid can actually deactivate the nematocysts and alleviate pain.

Scientists from the U.S. and Australia, concerned about the threat to humans of a burgeoning jellyfish population, are examining the evolutionary connections among the various species.

“By determining the relationships among the different box jellyfish...[our] study can help in the future development of antivenoms and treatments for their stings,” said researcher Allen Collins. “[We] will now be able to... make predictions on which species are likely to be of public health concern in addition to the known culprits.”

Eyes to the skies

The jellyfish are not only a box-like eye-fish, but also a box full of eyes. On each side of their bell-shaped body is a sensory “club” supporting six eyes: two lens eyes (small and large) and two pairs of pit eyes. The former has human-like structures including a retina, vitreous, cornea, iris and a lens.

Recently, scientists in Sweden observed that four of these lens-eyes are always looking skyward, regardless of how the animal is oriented. These eyes contain a heavy gypsum crystal which keeps them trained on the world above. In experiments conducted in the mangrove swamps in Puerto Rico, the box jellyfish were lowered into the water in a clear, open-top tank and videotaped. Varying the distance of the tank from the tree canopy above, the researchers observed that when the canopy was obscured, the jellyfish swam about aimlessly. However, when the trees were within view (within 8 meters), the jellyfish swam towards the canopy and the shallow-water feeding grounds beneath. These specially adapted eyes enable the jellyfish to survive; in the open ocean, away from the trees, the jellyfish will starve. Says biologist Dan-Eric Nilsson, “This is the first time terrestrial cues have been demonstrated to be used for navigation by jellyfish or any other invertebrate.”

Trees aside, one group of jellyfish, *Carybdea sivickisi*, has an eye for the ladies (or gentlemen) of the species. Unlike most jellyfish that spawn en masse — with no physical contact — these sea dwellers engage in a courtship ritual, as a prelude to internal fertilization.

The courtship begins with the male and female swimming together, with tentacles fully extended. The male asserts control, initiating tentacle-to-tentacle contact that allows him to restrain and maneuver the female so that their manubria (oral openings) align. Two to three days later, following the transfer of sperm, thousands of embryos can be

observed moving about the female's bell. The nascent jellyfish are pushed out in pulse-like thrusts, in gelatinous strands of 3000 embryos.

All of the recent research points in a single direction. Lacking a central nervous system, jellyfish have developed specialized sensory receptors - olfactory, optical, etc. — which minimize input data, but maximize processing efficiency. Whereas the eyes of most animals seek to gather as much information as possible, then parse that input to accomplish a multitude of tasks, the eyes of the jellyfish concentrate on a single task, enabling them to perform complex behaviors with only the simplest of nervous systems. Says marine biologist, Edward Buskey, “[Previously, we had] an under-appreciation for how sensory systems in simple organisms are used for fairly sophisticated adaptations.” In the study of box jellyfish, looks can definitely be deceiving.

Sources

- <http://animals.nationalgeographic.com/animals/invertebrates/box-jellyfish/>
- <http://www.newscientist.com/article/dn20428-brainless-box-jellyfish-know-which-way-is-up.html>
- <http://www.sciencedaily.com/releases/2009/11/091118151141.htm>
- <http://www.barrierreefaustralia.com/the-great-barrier-reef/jellyfish.htm>
- <http://io9.com/>
- <http://www.nytimes.com/2007/08/14/health/14real.html>