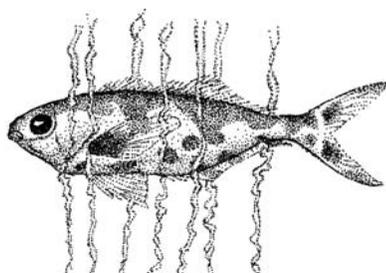


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Deadly Darts

*Brainless, boneless, bloodless . . . blobs . . .
successfully oceangoing for 650 million years.*

—LILY WHITEMAN*

IRIDESCENT PURPLISH BALLOONS skittered across the sea in a fresh breeze, destined to wash up in windrows on a sandy beach like the remnants of a child's birthday party. A little boy wandered along. Curious, he bent over to pick up a stranded "balloon." The "string" touched his leg. An excruciating pain emanated from the point of contact. The child staggered back and fell among the balloons. He writhed in agony, the stings causing a spiderweb of red welts like whiplashes on his skin. A stranger happened along and carried the now semiconscious child to the nearest first aid station, where his body was slathered with meat tenderizer. The protein-destroying enzyme in the tenderizer destroyed the toxin. The child survived after hospitalization.

Shaken after the horrific scene played out in front of me, I walked over to the shore. Among the footprints of the saved and the savior were a few of the balloons. Recognizing them for what they were, I looked around for

* Lily Whiteman, "The Blobs of Summer," *On Earth* (National Resources Defense Council), Summer, 2002.

something to put one in. I needed a photo of the creature and recalled the dictum, “the best way to take an underwater photo is not to take it underwater.” Back at my motel room was a water-filled lunch box-sized aquarium. A camera with macro lens stood poised on a tripod, pointed at a potential aquatic subject.

The beach was pristine—no washed-up plastic cups, no Coke bottles. How could I carry the specimen back to the “photography studio” I had set up in my room? Then I thought of the dive mask on my forehead. I scooped up a little water in the mask, slid it under a balloon, rushed back to the room, and plopped the specimen into the tiny tank. Its tentacles moved up and down. The balloon even writhed around, so that a sequence of photos would prove that this purple sphere was capable of movement.

About two hours later, after the photo session and lunch, I returned to the shore for more photo ops. I put on my mask. Suddenly my face was on fire! The pain was so intense that I gasped and ripped off the mask. My eyes were swollen nearly shut as I rushed back to the room. We had no meat tenderizer, but my wife applied a topical anesthetic.

After half an hour the haze of pain lifted and I was able to think. “What happened?” I asked myself. I realized that there were some tentacles left in the mask, and despite drying for hours in the sun, they still retained their toxicity.



The innocent-looking balloons were in reality biological bladders filled with air secreted by dangling colonies of tiny elongate animals. The villain of the piece is the Portuguese man o’ war, *Physalia physalia*, among the most fearsome of jellyfishes. Few biologists know the origin of the name “Portuguese man o’ war.” It was derived from a powerful four-masted battleship, bristling with at least thirty-eight cannons and characterized by two large, voluptuous lateen sails and a substantial stern (like Miss Nubile). This warship made it possible for the Portuguese to dominate the seas during the sixteenth century.

The ship's biological namesake is also formidable. This bizarre jellyfish is an animal of such simplicity that its functions are divided among three body types called polyps: one for defense, one for feeding, and one for reproduction. These quarter-inch-long, interconnected, semi-independent polyps dangle from the bottom of the balloon and combine their functions for the greater good. In other words, the phylum has not yet evolved a body that can perform all of the life functions. Like the Borg, each function is performed by a specific part of the collective body that is connected with the others. Food is eaten by a gastrozoid, reproduction is performed by a gonozoid, and protection is provided by a dactylozoid. In the case of the Portuguese man o' war, the defensive dactylozoids evolved to become the aggressive members of the triumvirate. They extend filamentous fishing tentacles twenty feet behind the floating colony, ensnaring passing fishes and zooplankton in an almost invisible web of toxic threads.

How has this phylum, the Cnidaria* so primitive as to lack organs and virtually just a jelly-filled sack, existed for 650 million years? No brain, no blood, no heart, no anus. Yet the phylum has survived fundamentally unchanged over the millenia, so it must have something going for it. That something is a poison arrow, the nematocyst. Each tentacle is covered with thousands of cells that are capable of discharging poisonous nematocysts in an explosion of toxicity. So tiny are these ancient weapons that in their coiled state they are scarcely larger than the nucleus of the cell. In typically huge numbers, the microscopic darts are capable of introducing considerable amounts of toxin into the superficial layer of the victim's skin. The toxin must be very powerful indeed if the small amount that penetrates the epidermis can cause humans to experience such intense pain and small fish such instantaneous paralysis. Visualize the hairs on your arm as poisonous weapons and you will have an idea of what an aquatic organism faces when it rubs against a tentacle.

The basic cnidarian life cycle consists of two independent reproductive forms, one sexual (the medusa) and the other asexual (the polyp). In one large group, including corals and sea anemones, the polyp incorporates the

* The phylum is called Cnidaria (kneeè-daria) after the Greek word *cnidus*, meaning thread. The thread referred to is the tiny, painful, hair-like spine of a plant called the nettle, *Urtica*. To sit on a nettle plant is to be stung with tiny, needle-like "threads."

PLATE I

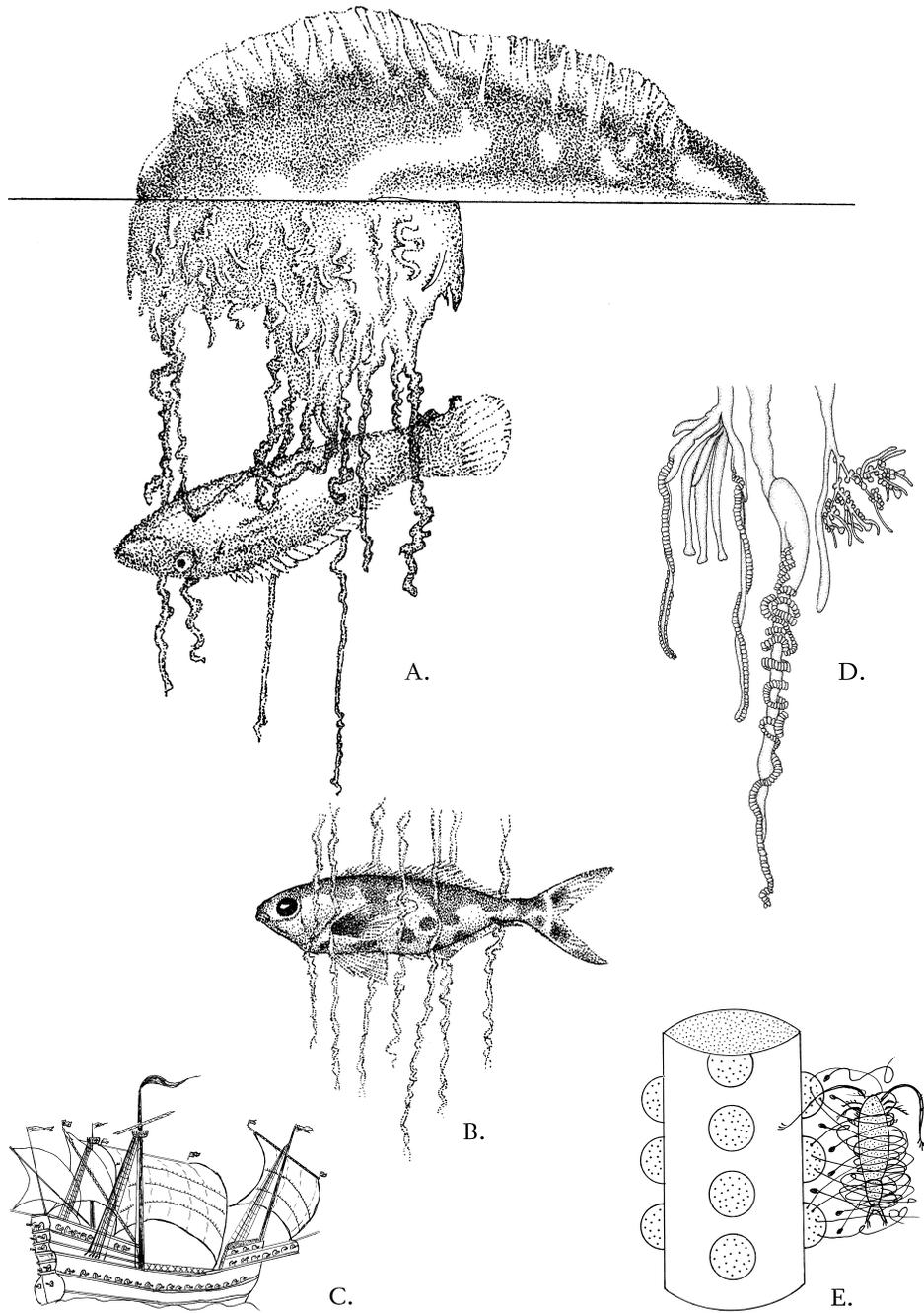
A. THE PORTUGUESE MAN O' WAR, *Physalia physalia*, is a 12-inch purple translucent bladder filled with nitrogen-rich air secreted by polyps dangling below. The colony has many 20-foot fishing tentacles. Some of these have retracted, pulling a paralyzed fish toward the rest of the colony suspended from the bladder, where hundreds of feeding polyps will digest the fish.

B. THE MAN O' WAR FISH, *Nomeus gronovii*, flourishes among the tentacles although vulnerable to their fatal sting. The fish maneuvers among the toxic tentacles and darts out to capture its planktonic food.

C. THE PORTUGUESE MAN O' WAR SHIP, with up to seventy-two cannons, was instrumental in maintaining the Portuguese navy's dominance of the seas in the fifteenth and sixteenth centuries. It evolved from a merchant ship, the caravel (exemplified by Columbus's *Nina*), into the galleon depicted. Note the two voluptuous triangular lateen sails near the stern.

D. TYPES OF TENTACLES. Those on right are male and female reproductive polyps, gonozoids. They "ripen" at different times, preventing self-fertilization. The central polyp, the dactylozoid, is a coiled, retractable fishing tentacle armed with fierce nematocysts in batteries. Three feeding polyps, gastrozoids, are to the left between two dactylozoids. When the dactylozoids pull the prey close to the colony, gastrozoids will extend and secrete enzymes to digest the prey.

E. A COPEPOD paralyzed by venomous nematocysts from a tentacle (those with bulbs torn from the battery). Sticky, whip-like nematocysts stay attached to the tentacle to hold the prey until the coiled tentacle retracts and carries it to the colony. Nematocysts are in spherical batteries in this species. In other species they are distributed like hairs on your arm. Each nematocyst bursts from a single cell.



sexual phase and there is no medusa. When a medusa is present, this sexual floating stage is popularly known as the jellyfish. Scientists coined the term “medusa” because it reminded them of the snake-headed mythical monster who turned men into stone when they looked at her. The poisonous, snake-like tentacles of the medusa literally turn a small fish into stone—total paralysis, so that the death shudder is suppressed. A medusa produces either eggs or sperm and casts them into the sea. They fuse to become the asexual polyp. Many polyps clone to form fuzz-like colonies attached to hard objects on the bottom. These colonies then bud off juvenile jellyfish.

The Portuguese man o’ war differs from the typical cnidarian, being neither medusa nor polyp. It is a floating colony of polyps suspended from a bladder of its own making. The downward-pointing polyps, en masse, manufacture the purple balloon, injecting special nitrogen-rich air into it. Although the balloon can contort itself, swimming is impossible and the colony goes where it is blown.

The illustration depicts a Portuguese man o’ war sailing majestically along, wafted by the wind, a beautiful purple air-filled sphere trailing its fierce weapons behind—twenty-foot-long, nematocyst-laden, transparent, string-like fishing tentacles. It has captured a small fish. But the fish might escape, tearing off thread-like tentacles with one convulsive movement, partly disarming the colony. To prevent this, the Portuguese man o’ war must paralyze the fish instantaneously. After the prey is captured, the tentacle shortens, carrying its paralyzed victim to the tiny gaping mouths of the feeding polyps.

Nature, ever experimental, has come up with a surprisingly benevolent aspect to the fierce Portuguese man o’ war. It provides a haven for the man o’ war fish *Nomeus*, which finds protection among the malevolent nematocyst-bearing tentacles. What physiological mechanism has the fish evolved to foster this intimate relationship? Apparently none, for if the jellyfish is removed from the water and its resident fish falls on the tentacles, the fish is immediately paralyzed. But its survival depends on its ability to swim among the tentacles. Only one explanation is possible. *Nomeus* must have evolved an exquisitely sensitive sensory mechanism that allows it to live in a virtual web of danger and avoid getting stung.