Section 12 Cnidaria

(photo courtesy of T. Kato)

CHARACTERISTICS OF CNIDARIA

1) Cnidae
2) Radial or biradial symmetry
3) Single body opening
4) Diploblastic structure

INTRODUCTION

Members of the primarily marine phylum Cnidaria are diverse in morphology and life cycles. One of the two basic cnidarian body forms is a medusa (plural medusae), a deep or shallow circular dome with a central mouth beneath the dome, and tentacles fringing the edge of the dome. Typically living free in the sea (pelagic), its common name is jelly or jellyfish. The other cnidarian body form is a polyp, a cylinder with a mouth in the center of the disc at one end, and few to many tentacles surrounding the mouth. In a polyp that is part of a colony, the end opposite the mouth is attached to other members of the colony or to tissue connecting members of the colony; an example of colonial polyps are soft corals. In a polyp not part of a colony, the end opposite the mouth may be flat and attached to firm substrata, or rounded or pointed and burrowed into soft sediments; an example of a solitary polyp is a sea anemone.

Cnidarians are considered morphologically simple because of their radial symmetry (biradial in polyps such as sea anemones and corals), single body

opening, and body made of two tissue layers (thus they are diploblastic; most animals, including humans, are triploblastic, having three tissue layers). Yet cnidarians secrete the most complex intracellular structures known — cnidae, for which the phylum is named. All cnidarians possess the type of cnida (singular of cnidae) called nematocysts, microscopic stinging capsules with which cnidarians defend themselves and gather food. Nematocysts are a diagnostic feature of Cnidaria: if they are absent, the animal is not a cnidarian. However, their presence is not proof an organism is a cnidaria: nematocysts may be found in some predators of cnidarians. The cnidarian life cycle can also be complex: many species alternate between polyp and medusa forms, the polyps forming medusae through an asexual process, and the medusae forming eggs and sperm that ultimately develop into polyps. In species having only a medusa or only a polyp, that stage reproduces sexually, and may reproduce asexually as well. If asexually generated individuals remain attached to one another, the resulting group is considered a colony; if they separate physically, whether they remain beside one another or disperse, they are collectively termed a clone (i.e. each individual is not a clone but a clone-mate).

Medusae may be in the water over hard bottom shores or among seagrass blades, but most cnidarians in these habitats are polyps. Attached to stones or seagrass blades are commonly hydroids (class Hydrozoa) (some solitary, but most colonial) and sea anemones (class Anthozoa, order Actiniaria). Tube anemones (class Anthozoa, order Ceriantharia) may be burrowed into the sediment in which seagrass is rooted. Rare cnidarians on seagrass blades or algal thalli are stauromedusae (class Staurozoa) and medusae that crawl using their tentacles (class Hydrozoa, order Limnomedusae).

GENERAL MORPHOLOGY

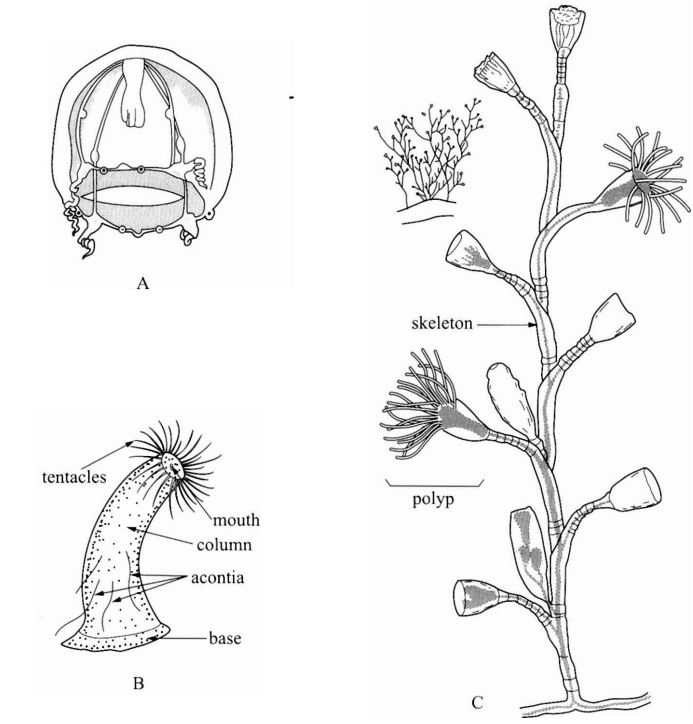

Fig. 12.1 **A.** *A medusa of a hydrozoan* (from Rufford, 1902). **B.** *A sea anemone*. Not all have acontia (nematocyst-studded threads emitted when the animal is disturbed) (From Verrill, 1928). **C.** *Hydroid colonies*. The larger, a close-up of part of the one at upper left, shows two polyps with tentacles expanded, four with tentacles retracted into the skeletal cup surrounding them, two empty cups, and two reproductive structures (from Rufford, 1902).

PREPARING SPECIMENS FOR IDENTIFICATION

Cnidarians should be relaxed before preservation. Common relaxants are magnesium salts, chloral hydrate, menthol, and nicotine (see glossary of methods). When the animal no longer responds to touch, pour off the water and add the preservative of choice. Preservation method depends on whether the organism is a medusa or polyp, whether it has a calcareous or chitinous skeleton, and the sorts of analyses planned. For example, if histology is used to identify a sea anemone, the polyp must be fixed (i.e. put into a liquid such as 10% formalin or Bonin's solution; after some days, it should be moved to a preservative such as alcohol). Tissue destined for molecular analysis should not be fixed but should be preserved in 95% ethanol; because molecular analysis requires little tissue, a piece of an individual or a colony may be removed for preservation in ethanol and the rest fixed or preserved in some other way. Because most taxonomy of scleractinian corals is based on the calcareous skeleton, all tissue may have to be removed to make an identification; typically this is done by placing the coral in a solution of household bleach. For cnidarians such as tube anemones and sea anemones, features of internal anatomy must be examined. For hydroids, form of the colony or type of medusa it produces may be essential, so identification of a single polyp may be impossible.

Nematocysts are useful or even necessary, in identifying sea anemone and some other cnidarian species. Nematocysts will not fire once the animal is preserved; keys are based on unfired ones. Nematocysts may be visualized by placing a very small pinch of tissue on a microscope slide in a drop of water, squashing it under a cover slip, and viewing with a compound microscope at a magnification of at least 400× and ideally 1000×.

DIVERSITY

Phylum Cnidaria is divided into five classes (two having been identified only rather recently), four with members that alternate between medusa and polyp stages. In these four classes, collectively termed Medusozoa, the duration of polyp and medusa stages may be unequal and the polyp and medusa stages may not be equally conspicuous; in some cases, one or the other stage is absent. The fifth class, Anthozoa, has only polyps.

Scyphozoa. "True" jellyfishes. Medusae larger and more conspicuous than polyps.

Cubozoa. "Box jellies." Medusae larger and more conspicuous than polyps; some members can injure or even kill humans.

Staurozoa. Medusa shaped like an eight-pointed star attaches to a firm substratum; no polyp stage.

Hydrozoa. Medusae typically small, delicate, and short-lived. Polyps of many species colonial, form a skeleton, and have specialized types of polyps (i.e. some only feed, some only reproduce, some only protect the colony). Polyps with a chitinous skeleton are termed hydroids, those with a calcareous skeleton are termed hydrocorals. The Portuguese Man-o'-War, which is not a medusa but a pelagic colony mostly of specialized polyps, belongs to order Siphonophora. Members of order Chondrophora, also pelagic colonies, include the By-the-Wind Sailor.

Anthozoa. A polyp of subclass Octocorallia (= Alcyonaria) has eight tentacles, each with small side branches; almost all are colonial. Sea fans and sea whips (Order Gorgonacea) have stiff, flexible skeletons; a sea pen colony (Order Pennatulacea) has an internal strengthening rod throughout its entire length; blue corals (Order Helioporacea) have a calcareous skeleton. Some octocorals have polyps specialized for particular functions, such as pumping water through the colony. Polyps of subclass Hexacorallia (= Zoantharia), which are more variable morphologically than octocoral polyps, commonly have a multiple of six tentacles. Sea anemones (order Actiniaria), tube anemones (order Ceriantharia), and mushroom anemones (order Corallimorpharia) are exclusively solitary, black corals (order Antipatharia) exclusively colonial, and "true" corals (order Scleractinia) and zoanthids (order Zoanthidea) solitary or colonial.

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