

MULTICELLULAR AND TISSUE LEVELS OF ORGANIZATION

➤ Origins of Multicellularity

➤ Phylum Porifera

- Cell Types, Body Wall, and Skeletons
- Water Currents and Body Forms
- Maintenance Functions
- Reproduction

➤ Phylum Cnidaria (Coelenterata)

- The Body Wall and Nematocysts
- Alternation of Generations
- Maintenance Functions
- Reproduction
- Class Hydrozoa
- Class Scyphozoa
- Class Cubozoa
- Class Anthozoa

➤ Phylum Ctenophora

Mastigias quinquecirrha

- The so-called **stinging nettle**, is a common Atlantic scyphozoan.
- long tentacles and fleshy lobes hanging from the oral surface.
- Populations increase in late summer and become hazardous to swimmers.
- A **rule of thumb** for swimmers is to avoid helmet-shaped jellyfish.

Aurelia

- ✓ The margin of its medusa has a fringe of short tentacles and is divided by notches.
- ✓ Gastric pouches, which contain cnidocyte-laden gastric filaments.
- ✓ Canal system is extensively branched and leads to a ring canal around the margin of the medusa.
- ✓ plankton feeder
- ✓ eight specialized sensory structures, called **rhopalia**

- **rhopalium**

- ✓ Located in the notches at the margin of the medusa.
- ✓ Each rhopalium consists of sensory structures surrounded by rhopalial lappets.
- ✓ Two sensory pits (presumed to be olfactory) are associated with sensory lappets.
- ✓ A statocyst and photoreceptors, called ocelli, are associated with rhopalia.
- ✓ Aurelia displays a distinct negative phototaxis.

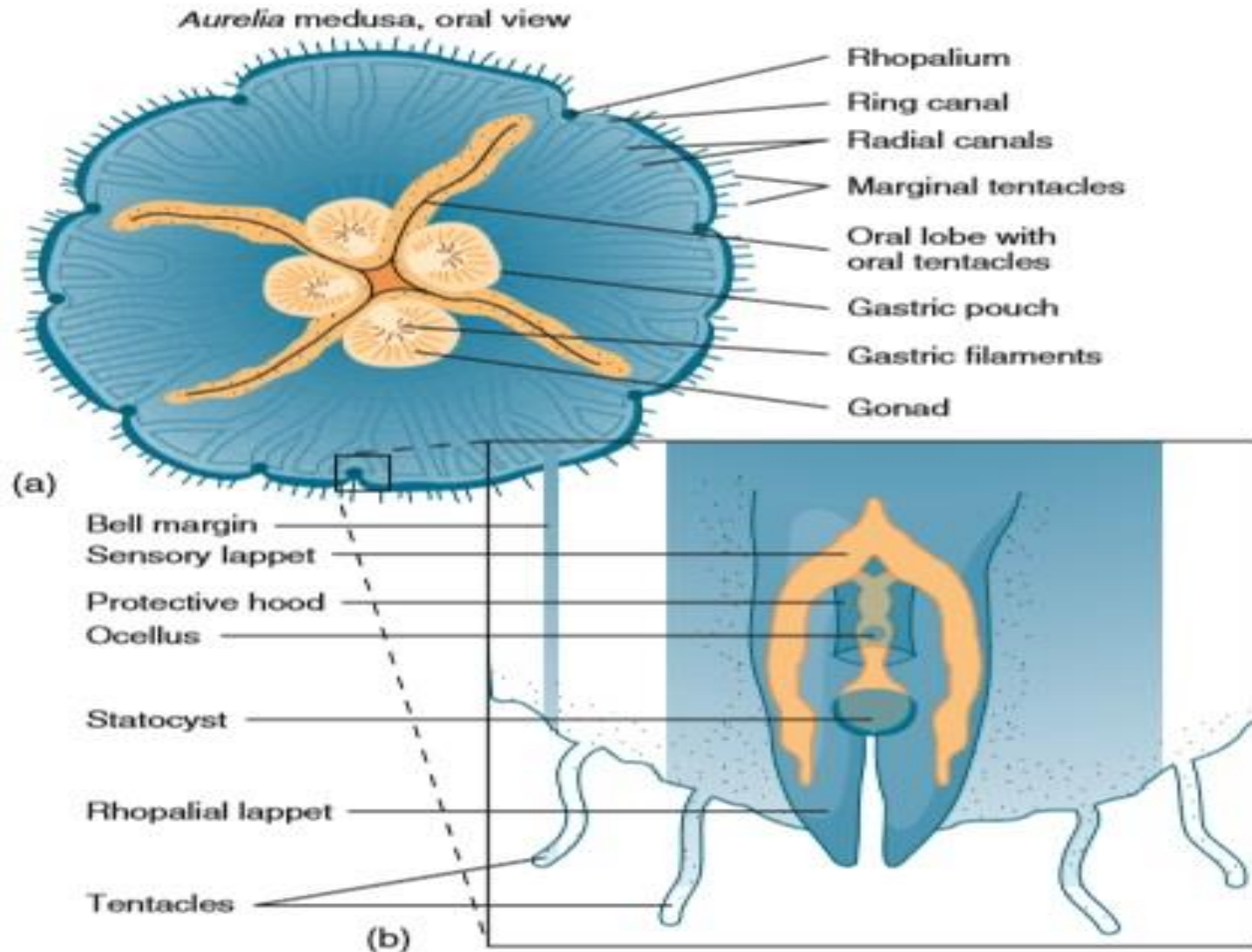


Fig: Structure of a Scyphozoan Medusa. (a) Internal structure of *Aurelia*. (b) A section through a rhopalium of *Aurelia*. Each rhopalium consists of two sensory (olfactory) lappets, a statocyst, and a photoreceptor called an ocellus.

Reproduction

- ✓ Scyphozoans are **dioecious**.
- ✓ Aurelia's **eight gonads** are in gastric pouches, two per pouch.
- ✓ Gametes are released into the **gastric pouches**.
- ✓ In *Aurelia*, eggs lodge in the oral lobes, where fertilization and development to the **planula** stage occur.
- ✓ The planula develops into a polyp called a **scyphistoma**.
- ✓ The scyphistoma lives a year or more, during which time budding produces miniature medusae, called **ephyrae**.
- ✓ Repeated **budding** of the scyphistoma results in ephyrae being stacked on the polyp.
- ✓ After ephyrae are released, they gradually attain the adult form.

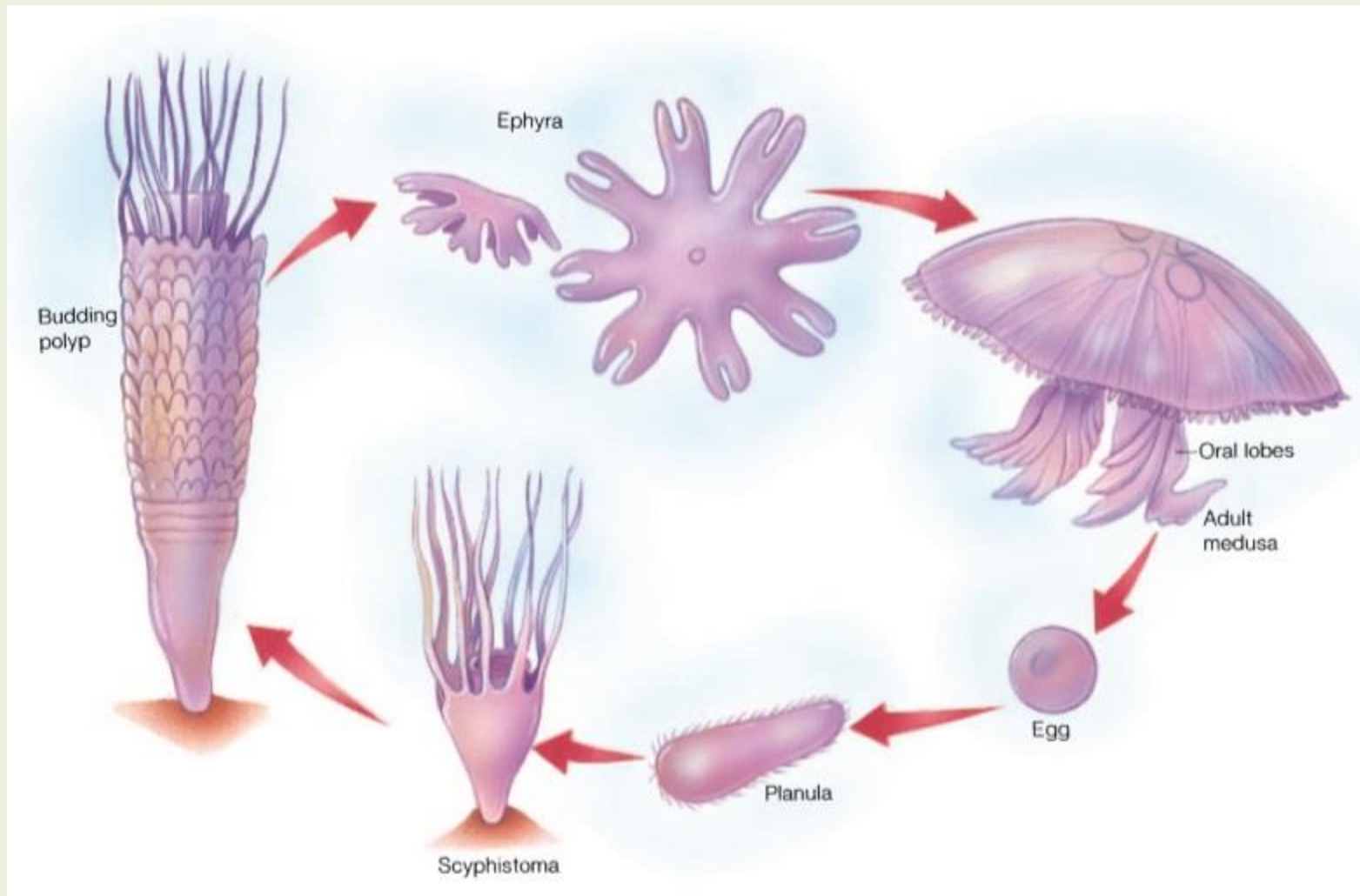


Fig: *Aurelia* Life History. *Aurelia* is dioecious, and like all scyphozoans, the medusa (10 cm) predominates in the organism's life history. The planula (0.3 mm) develops into a polyp called a scyphistoma (4 mm), which produces young medusae, or ephyrae, by budding.

❑ CLASS CUBOZOA

- ✓ The class Cubozoa was formerly classified as an order in the Scyphozoa.
- ✓ The medusa is cuboidal, and tentacles hang from each of its corners.
- ✓ Polyps are very small and, in some species, are unknown.
- ✓ Cubozoans are active swimmers and feeders in warm tropical waters.
- ✓ Some possess dangerous nematocysts



Fig: Class Cubozoa. The sea wasp, *Chironex fleckeri*. The medusa is cuboidal, and tentacles hang from the corners of the bell. *Chironex fleckeri* has caused more human suffering and death off Australian coasts than the Portuguese man-of-war has in any of its home waters. Death from heart failure and shock is not likely unless the victim is stung repeatedly

☐ CLASS ANTHOZOA

- ✓ colonial or solitary, and
- ✓ lack medusae.
- ✓ They include anemones and stony and soft corals.
- ✓ Anthozoans are all marine and are found at all depths.
- ✓ Externally, show perfect **radial symmetry**.
- ✓ Internally, the mesenteries and other structures convey **biradial symmetry**.

Anthozoan polyps differ from hydrozoan polyps in three respects:

- 1) the mouth leads to a pharynx, which is an invagination of the body wall that leads into the gastrovascular cavity.
- 2) Mesenteries that bear cnidocytes and gonads on their free edges divide the gastrovascular cavity into sections.
- 3) The mesoglea contains amoeboid mesenchyme cells

Sea anemones

- ✓ Solitary, frequently large, and colorful
- ✓ The polyp attaches to its substrate by a **pedal disk**.
- ✓ An **oral disk** contains the mouth and hollow, oral tentacles.
- ✓ At one or both ends of the slitlike mouth is a **siphonoglyph** to maintain the hydrostatic skeleton.
- ✓ **Mesenteries** are arranged in pairs.
- ✓ Mesenterial filaments bear cnidocytes, cilia that aid in water circulation.
- ✓ Threadlike **acontia** at the ends of mesenterial filaments bear cnidocytes.



(a)

Fig: Representative Sea Anemones.

(a) Giant sea anemone (*Anthopleura xanthogrammica*). Symbiotic algae give this anemone its green color.

(b) This sea anemone (*Calliactis parasitica*) lives in a mutualistic relationship with a hermit crab (*Eupargurus*). Hermit crabs lack a heavily armored exoskeleton over much of their bodies and seek refuge in empty snail shells. When this crab outgrows its present home, it will take its anemone with it to a new snail (whelk) shell. This anemone, riding on the shell of the hermit crab, has an unusual degree of mobility. In turn, the anemone's nematocysts protect the crab from predators.



(b)

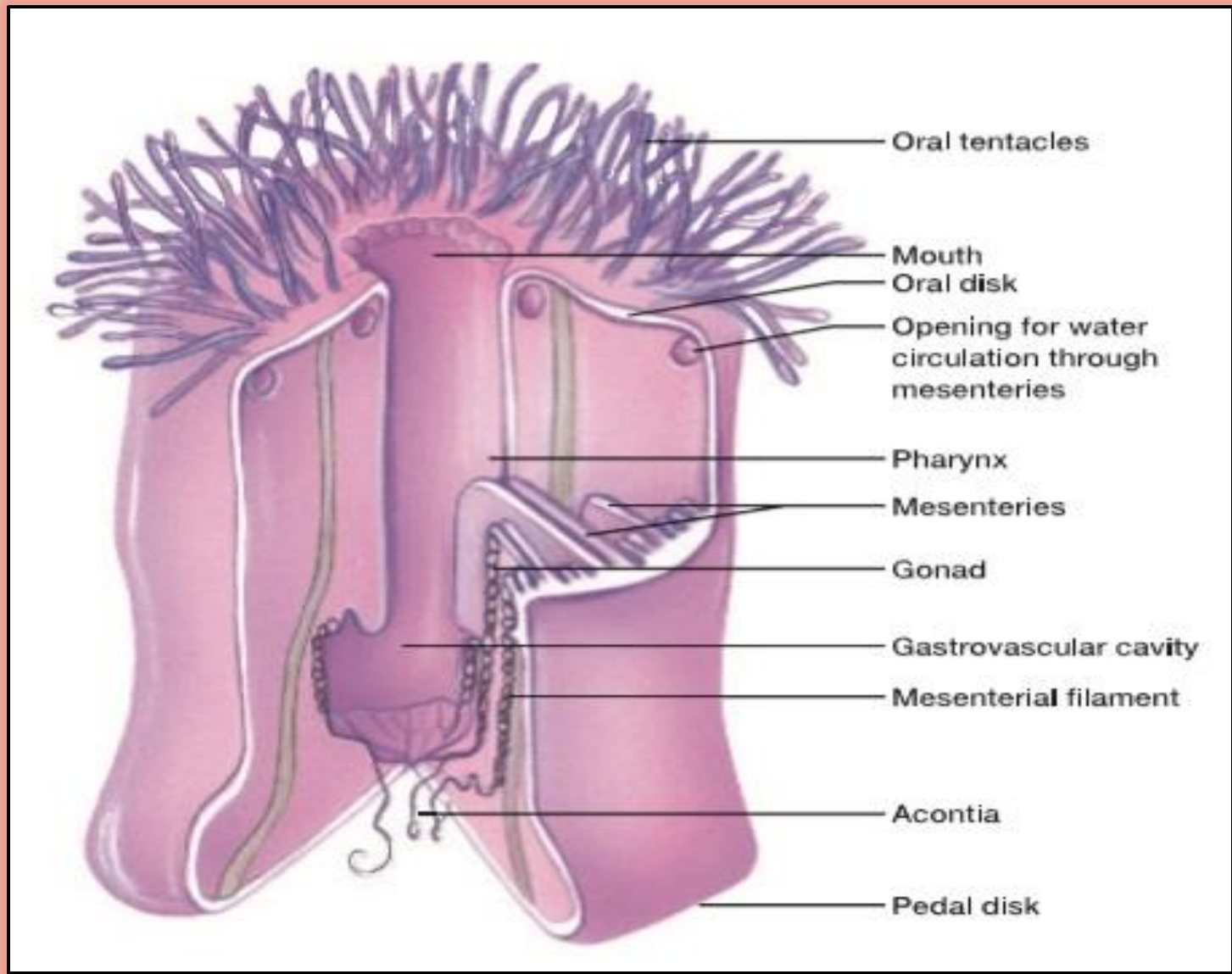


Fig: Class Anthozoa. Structure of the anemone, *Metridium sp.*

Longitudinal muscle bands are restricted to the mesenteries. Circular muscles are in the gastrodermis of the column.

Locomotion

- ✓ Anemones have limited locomotion.
- ✓ They **glide** on their pedal disks, crawl on their sides, and walk on their tentacles.
- ✓ When disturbed, some “**swim**” by thrashing their bodies or tentacles.
- ✓ Some anemones **float** using a gas bubble held within folds of the pedal disk.

Reproduction

- ✓ Anemones show both sexual and asexual reproduction.
- ✓ A piece of pedal disk may break away from the polyp and grow into a new individual in a process called **pedal laceration**.
- ✓ **Longitudinal** or **transverse fission**.
- ✓ Anemones may be either monoecious or dioecious
- ✓ Male gametes mature earlier than female gametes. This is called **protandry**.
- ✓ Fertilization may be external or within the gastrovascular cavity.
- ✓ Cleavage results in the formation of a **planula**, which develops into a ciliated larva that settles to the substrate, attaches, and eventually forms the adult.

corals

- ✓ **Stony corals** form coral reefs and, except for lacking siphonoglyphs, are similar to the anemones.
- ✓ **Calcium carbonate exoskeleton** that epithelial cells secrete around the base and the lower portion of the column.
- ✓ Sexual reproduction is similar to that of anemones, and **asexual budding** produces other members of the colony.

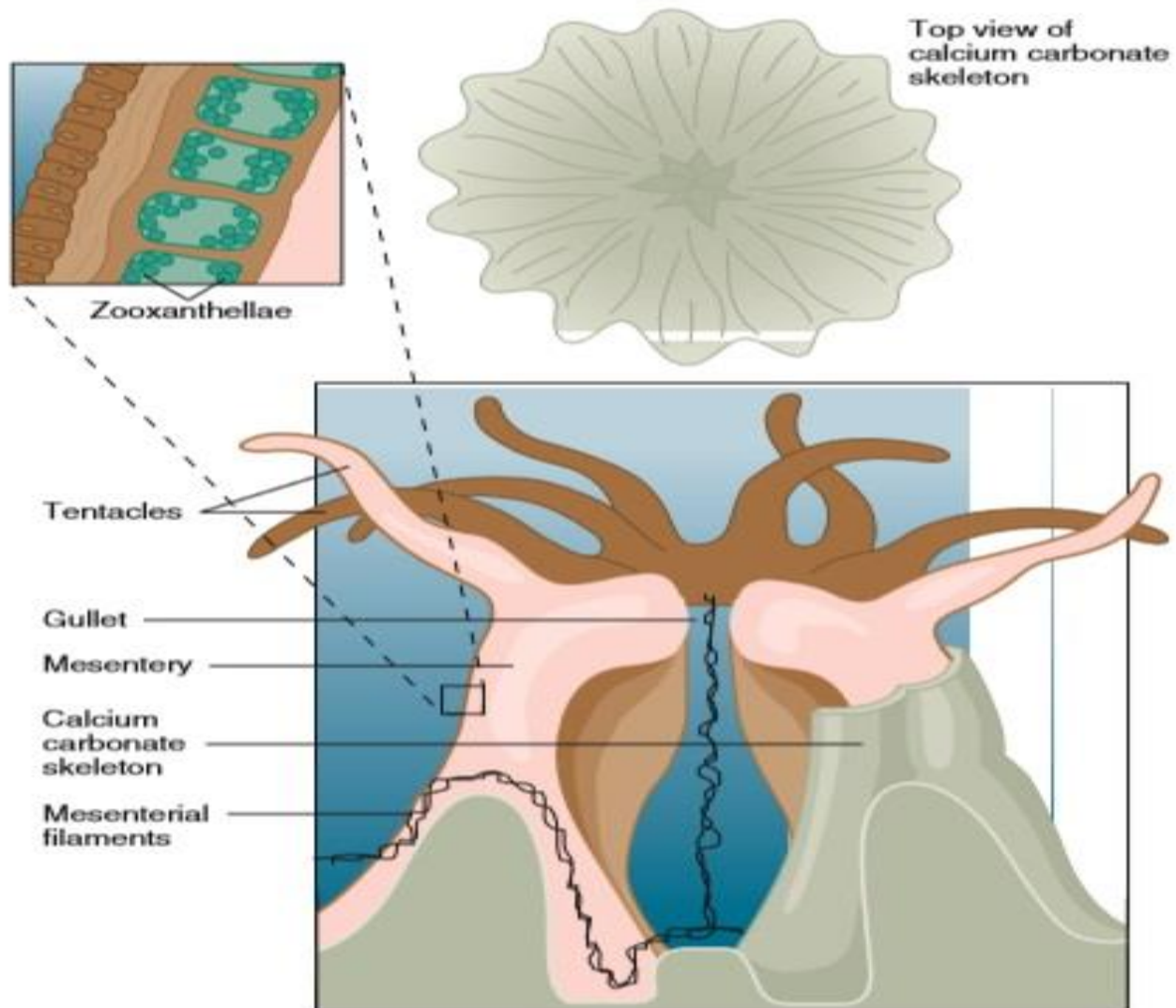


Fig: Class Anthozoa. A stony coral polyp in its calcium carbonate skeleton (longitudinal section).

Octacorallian corals

- ✓ The colorful octacorallian corals are common in warm waters.
- ✓ They have **eight pinnate (featherlike) tentacles, eight mesenteries,** and **one siphonoglyph.**
- ✓ The body walls of members of a colony are connected, and mesenchyme cells secrete an internal skeleton of protein or calcium carbonate



Fig: Representative Octacorallian Corals.

(a) Fleshy sea pen (*Ptilosaurus gurneyi*). (b) Purple sea fan (*Gorgonia ventalina*).



PHYLUM CTENOPHORA

PHYLUM CTENOPHORA

- ✓ sea walnuts or comb jellies, *Pleurobranchia*
- ✓ The approximately 90 described species are all marine.

Characteristics of the phylum Ctenophora include:

1. Diploblastic, tissue-level organization
2. Biradial symmetry
3. Gelatinous mesoglea between the epidermal and gastrodermal tissue layers
4. Gastrovascular cavity
5. Nervous system in the form of a nerve net.
6. Adhesive structures called colloblasts
7. Eight rows of ciliary bands, called comb rows, for locomotion

CLASSIFICATION OF THE CTENOPHORA

Phylum Ctenophora (ti-nof' er-ah)

The animal phylum whose members are biradially symmetrical, diploblastic, usually ellipsoid or spherical in shape, possess colloblasts, and have meridionally arranged comb rows.

Class Tentaculata (ten-tak' u-lah-tah)

With tentacles that may or may not be associated with sheaths, into which the tentacles can be retracted. *Pleurobranchia*.

Class Nuda (nu' dah)

Without tentacles; flattened; a highly branched gastrovascular cavity. *Beroë*.

CLASSIFICATION OF CTENOPHORA

**Phylum
Ctenophora**



**Class
Tentaculata**



**Class
Nuda**



Fig: Phylum Ctenophora. The ctenophore *Mnemiopsis* sp. Ctenophorans are well known for their bioluminescence. Light-producing cells are in the walls of their digestive canals, which are beneath comb rows

Structure of *Pleurobranchia*

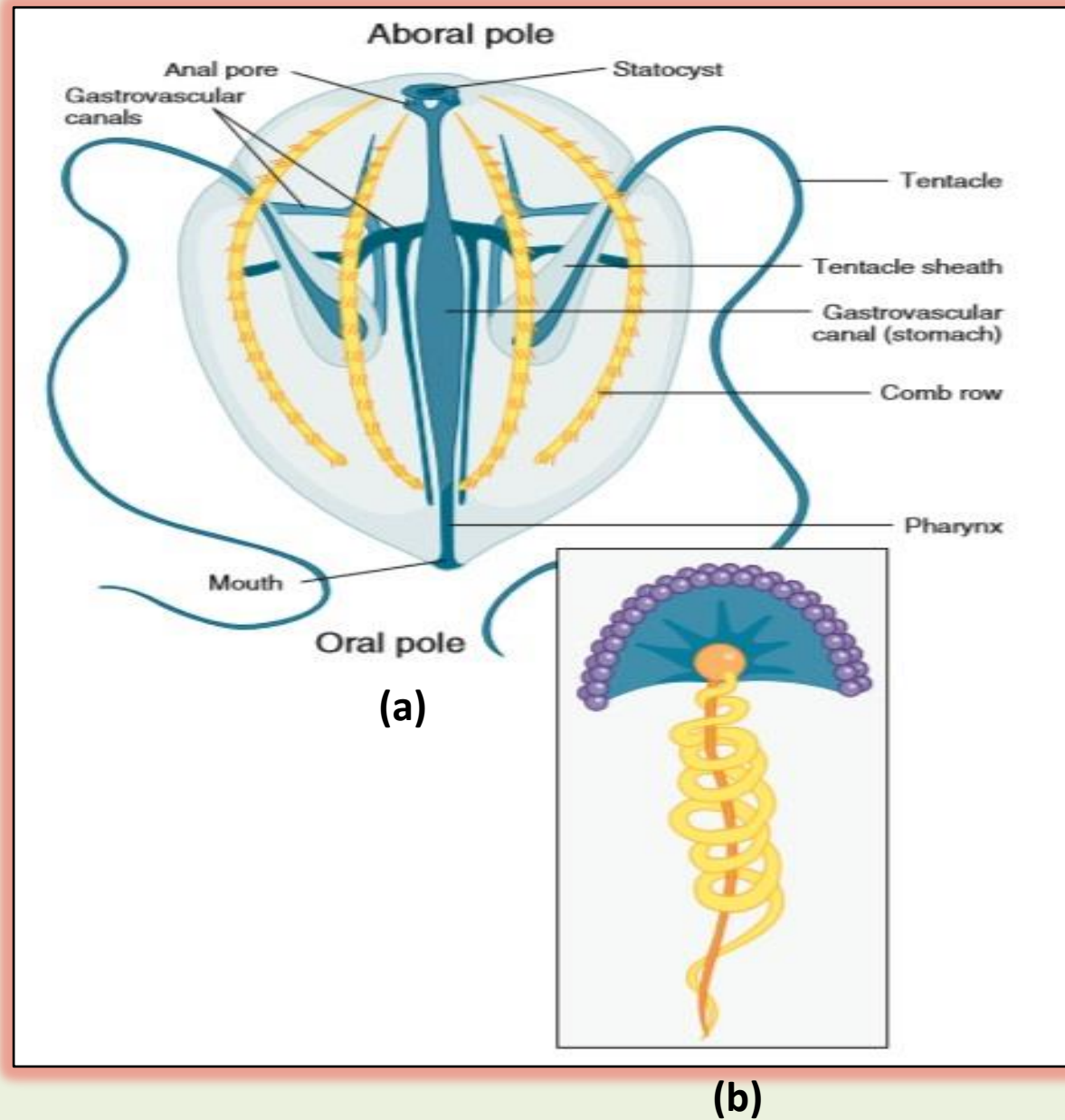
- ✓ Spherical or ovoid, transparent body about 2 cm in diameter.
- ✓ Eight meridional bands of cilia, called **comb rows**, between the oral and aboral poles.
- ✓ Comb rows are locomotor structures that are coordinated through a statocyst at the aboral pole.
- ✓ Tentacles possess contractile fibers that retract the tentacles, and adhesive cells, called **colloblasts**.

- ✓ The mouth leads to a branched gastrovascular canal system.
- ✓ Some canals are blind; however, two small anal canals open to the outside near the apical sense organ.
- ✓ Unlike the cnidarians, ctenophores have an anal opening.
- ✓ Some undigested wastes are eliminated through these canals, and some are probably also eliminated through the mouth

Fig: Phylum Ctenophora

(a) The structure of *Pleurobranchia sp.* The animal usually swims with the oral end forward or upward.

(b) Colloblasts consist of a hemispherical sticky head that connects to the core of the tentacle by a straight filament. A contractile spiral filament coils around the straight filament. Straight and spiral filaments prevent struggling prey from escaping.



Reproduction in *Pleurobranchia*

- ✓ Monoecious
- ✓ Two bandlike gonads are associated with the gastrodermis.
- ✓ One of these is an ovary, and the other is a testis.
- ✓ Gametes are shed through the mouth
- ✓ Fertilization is external, and a slightly flattened larva develops.