Phylum CNIDARIA(colentrata)

Contains about 9000 living species(at 1977) . Individual colonial polyps may be microscopic, most species macroscopic.

Characteristics

1- Majority marine, but with a few fresh-water species.

2- Metazoan, with tissues.

3 -Phylum exhibits polymorphism. The two main structural types are the polyp and the medusa.

4-May be solitary or colonial.

5-Typical larval form is the planula.

6-Exhibit some form of radial symmetry.

7 -Generally possess a ring of tentacles around the oral end.

8-The single body cavity is the coelenteron.

9-The body wall is three-layered.

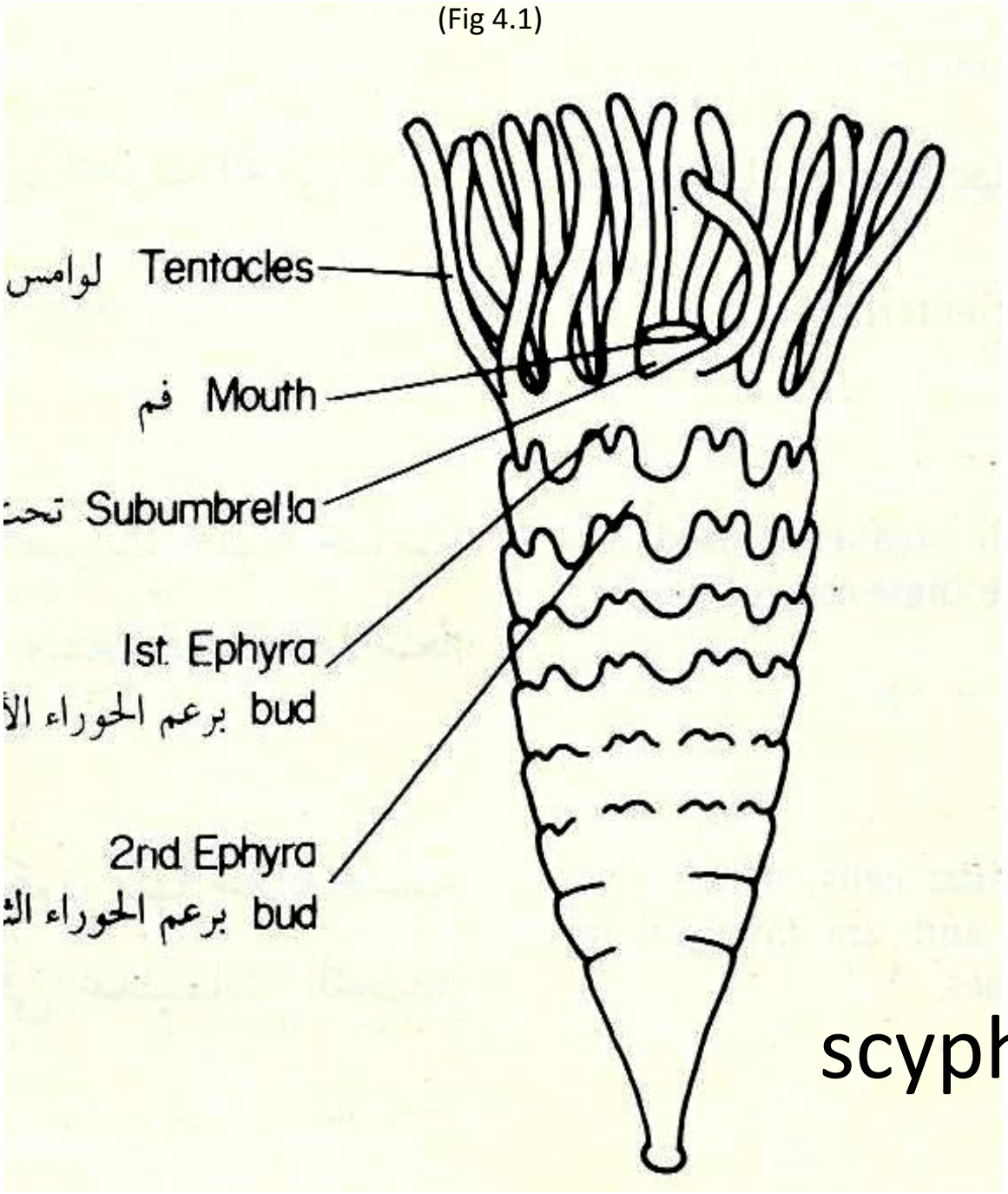
10-Possess nematocysts, special cell organelles used for offence and defence, located in cnidoblast cells of epidermis and gastrodermis.
11- Possess undifferentiated interstitial cells, which give rise to sex cells and cnidoblasts, and are involved in regenerative and reproductive processes.
12- Nervous system a network and not centralized
13 -Hermaphroditic or dioecious.

Larval form: The fertilized egg develops into a ciliated gastrula called the planula larva.

Metamorphosis: After swimming for a few hours to many days the planula attaches to substrat and develops into a polyp ,which in colonial species subsequently gives rise to the colony. In some hydroids the planula remains in the gonophore, developing into actinula larva which is liberated and creeps and develops into a polyp. In many hydrozoans with no polypoid phase the planula develops into an actinula and then a medusa.

In most scyphozoans, after attachment, the planula develops into a polypoid scyphistoma, with a stalked trumpet-shaped body (Fig. 4.1). At maturity, the scyphistoma produces a free-swimming medusa stage called ephyra larva, by transverse fission or strobilization. Ephyra may be produced singly or several at a time, and develop to adult medusa.

(Fig 4.1)



scyphistoma

Phylum Cnidaria-Class Scyphozoa:
Close-up of strobila stage, buds form from asexual reproduction
[fig 2.6-E]

Ephyra production

Adult body form: Polymorphism:

In many cnidarians the life-cycle contains two morphologically dissimilar individuals, the polyp and the medusa. In colonial species each of these types may occur in a number of different morphological forms, specialized to perform a particular function.

The types of modified polyp are:

1-found in hydrozoan colonies such as :

the gastrozooid — feeding polyp,

the gonozooid — reproductive polyp

the dactylozooid — protective polyp.

2- found in some anthozoan colonies such as:

The autozooid polyp -feeding reproductive polyp,

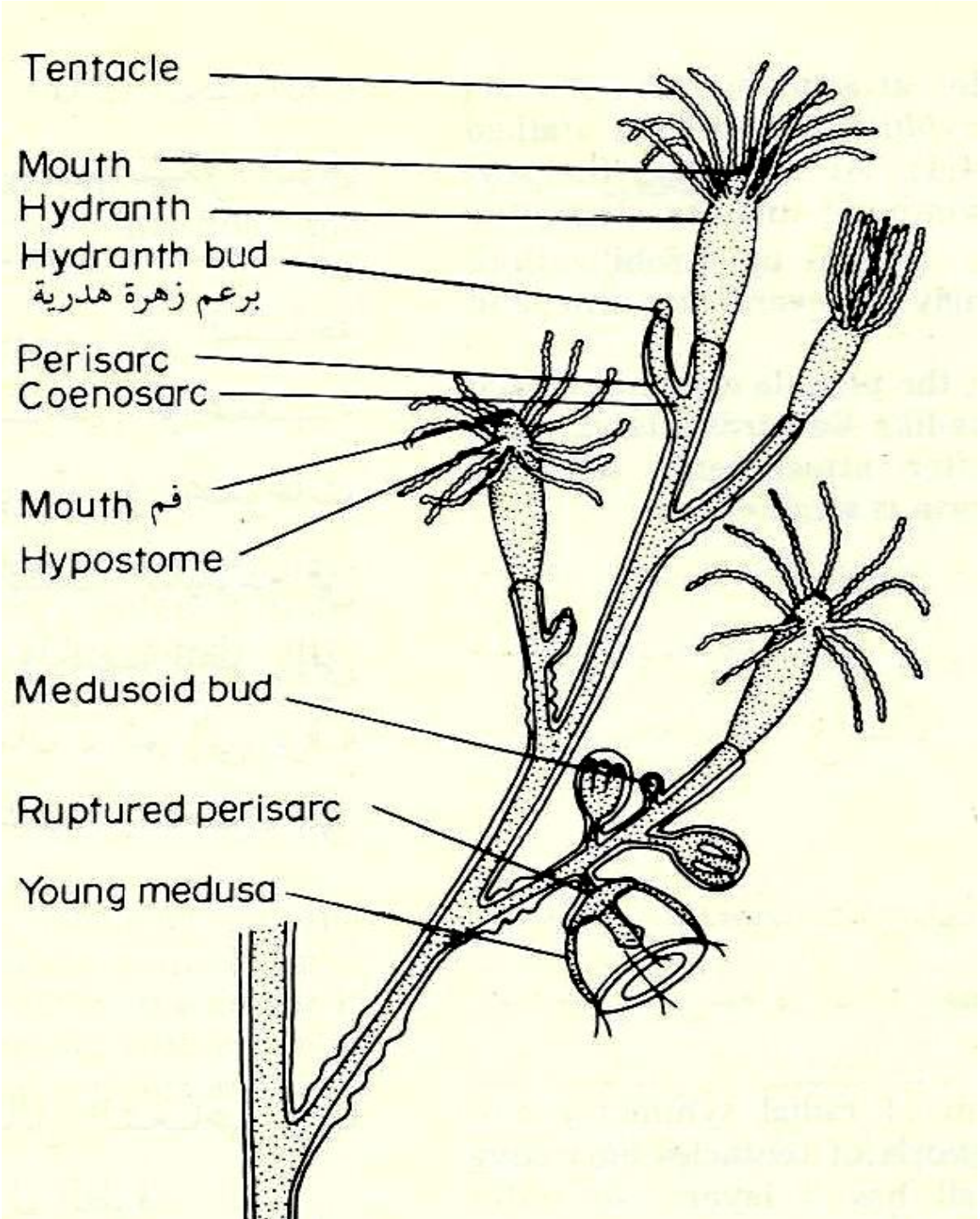
the siphonozooid polyp — current-producing polyp.

Types of polype	Its Function
gastrozooid	feeding
gonozooid	reproductive
dactylozooid	protective
autozooid	feeding reproductive polyp,
siphonozooid	current-producing polyp.

The body wall has 3 layers, an outer epidermis, the mesogloea and an inner gastrodermis. The gastrodermis lines the single body cavity, the gastro-vascular cavity or coelenteron.

The polyp is generally sessile, and the medusa is generally free-swimming and the sexually-reproducing form.

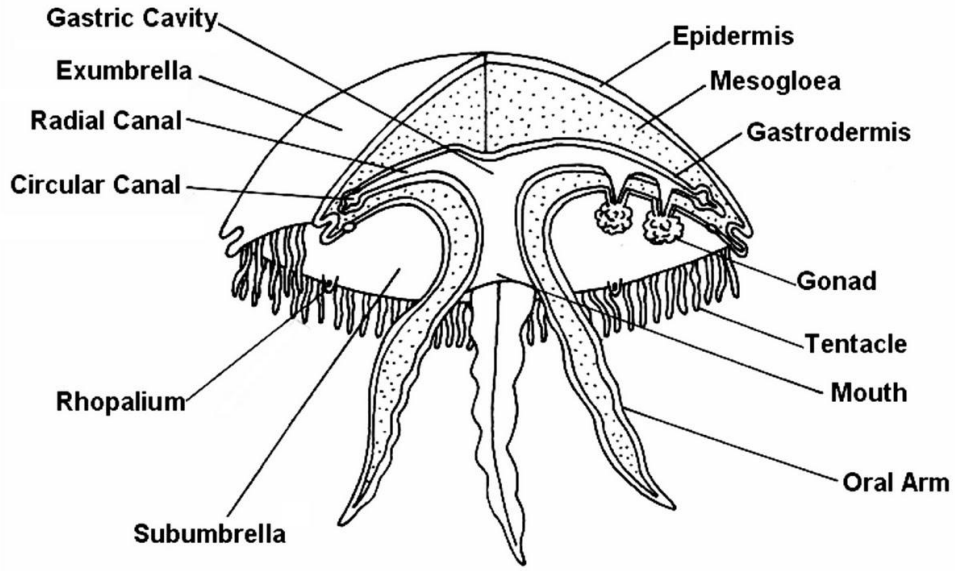
The polyp has a cylindrical form and is attached basally by a pedal disc or root-like stolons. In the Hydrozoa bears an oral cone (or hypostome) with a terminal mouth and a ring of tentacles encircling the base of the oral cone (Fig. 4.2), and in the Anthozoa an oral cone with elongated mouth, and tentacles encircling the mouth.

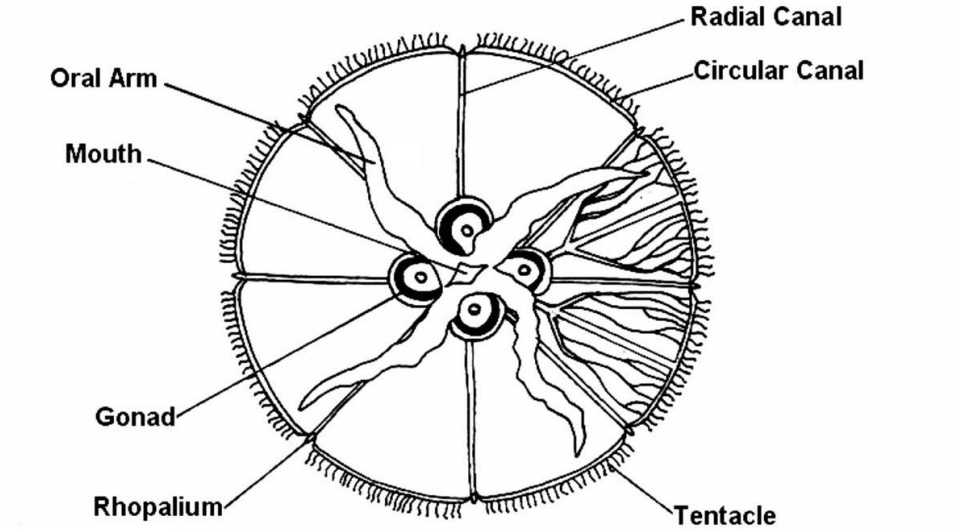

Tentacle
Mouth
Hydranth
Hydranth bud
برعم زهرة هدرية
Perisarc
Coenosarc
Mouth فم
Hypostome
Medusoid bud
Ruptured perisarc
Young medusa

polype

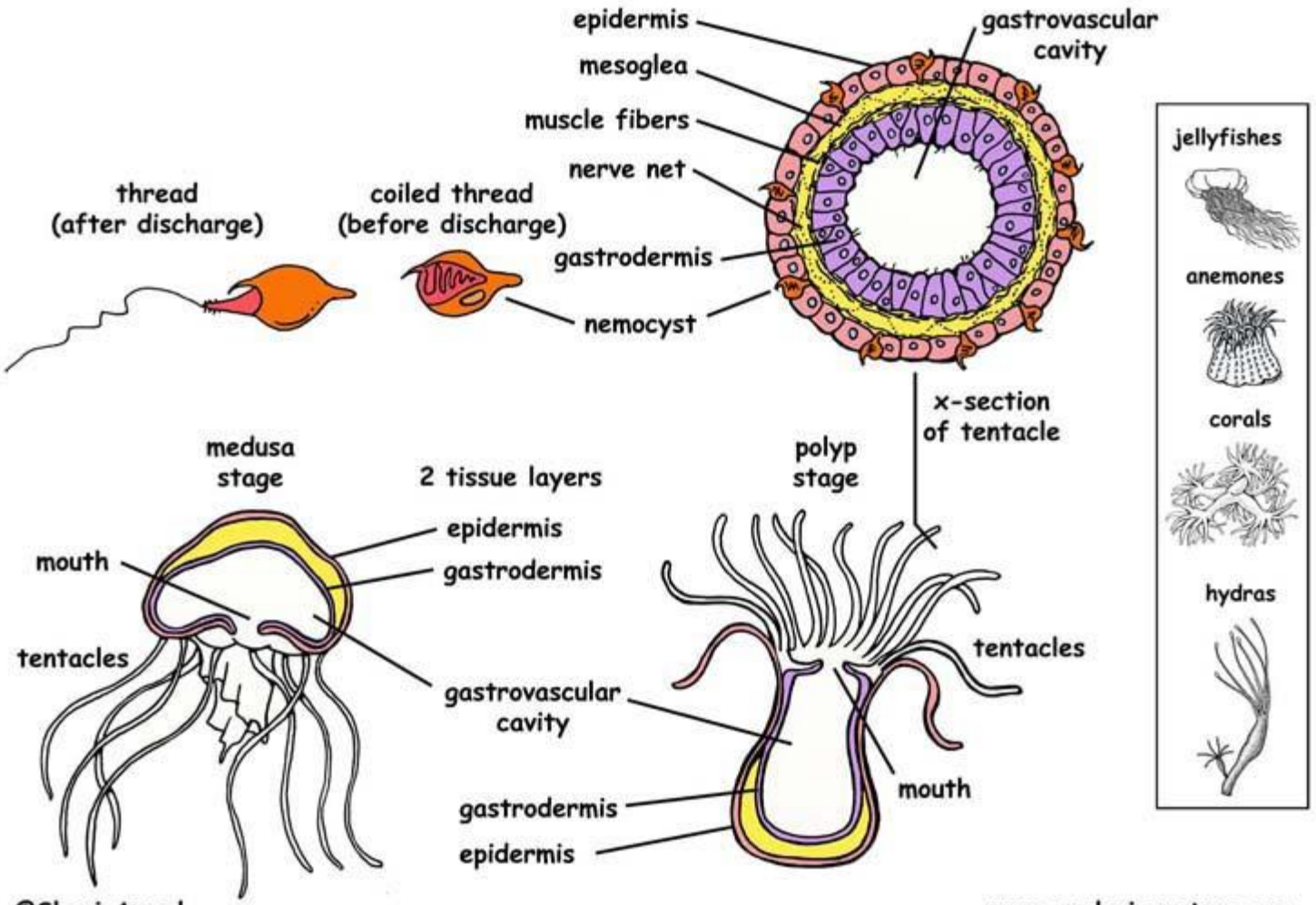
The medusa is shaped like a dome or umbrella with a convex aboral (subumbrella) surface and concave oral surface. They bears tentacles around its margin. From the centre of the subumbrella projects the manubrium, a tube lined with endoderm. Its free end bears the mouth and its other end leads into the stomach, occupying the central region of the bell.

Phylum: Cnidaria
Aurelia (Moon Jellyfish)



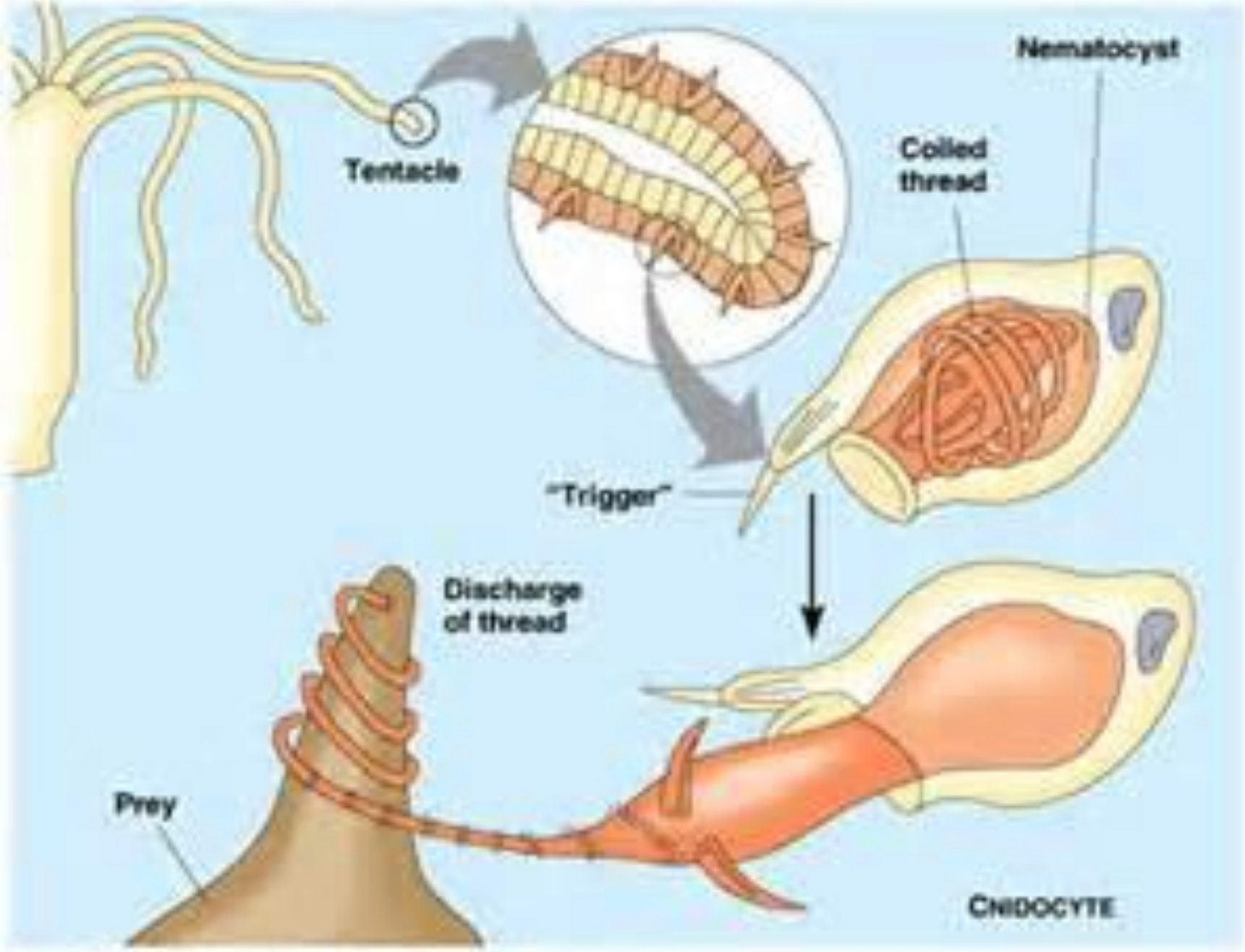


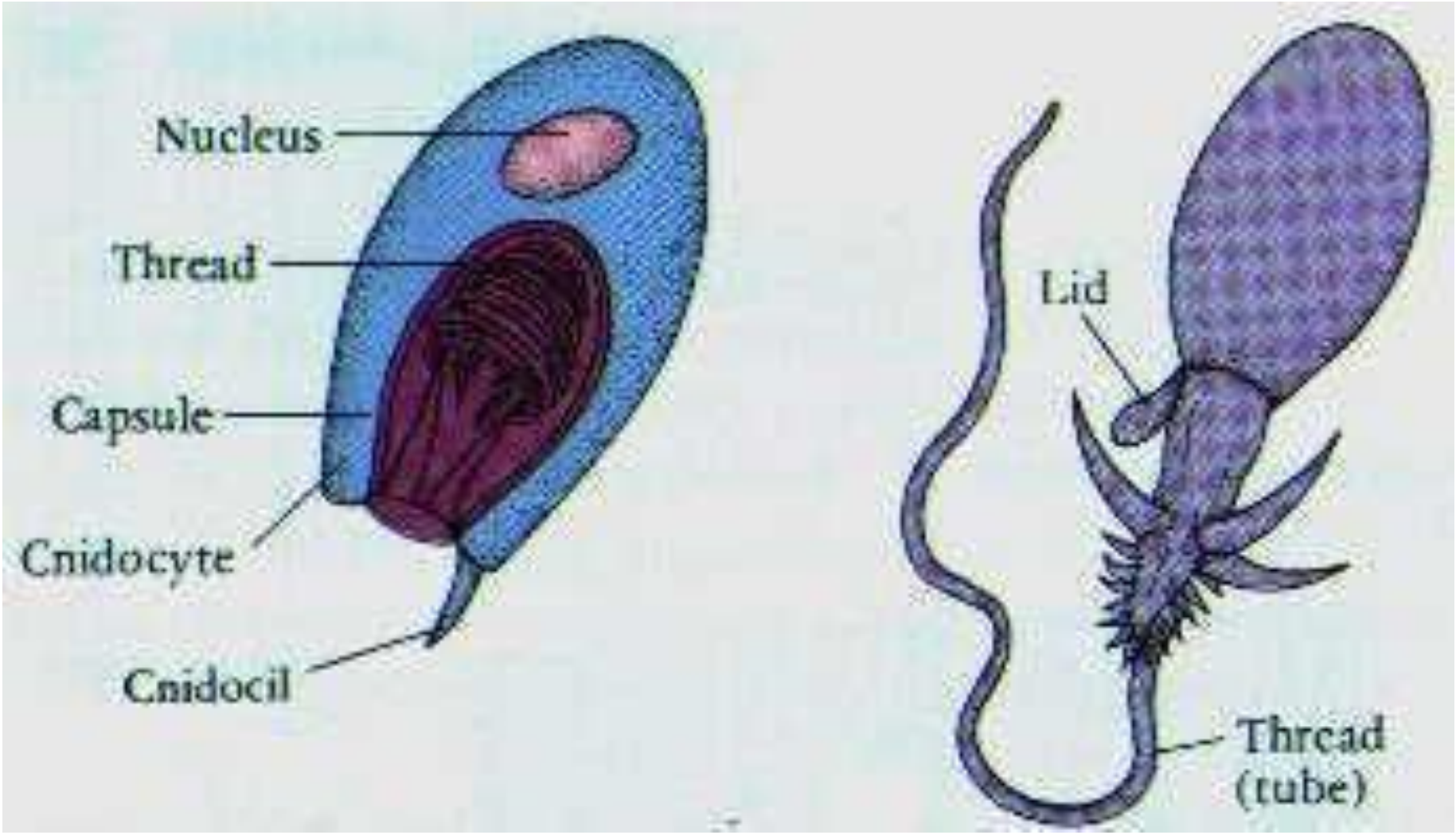
Anatomy of Cnidaria: Jellyfishes, Sea Anemones, Corals and Hydras

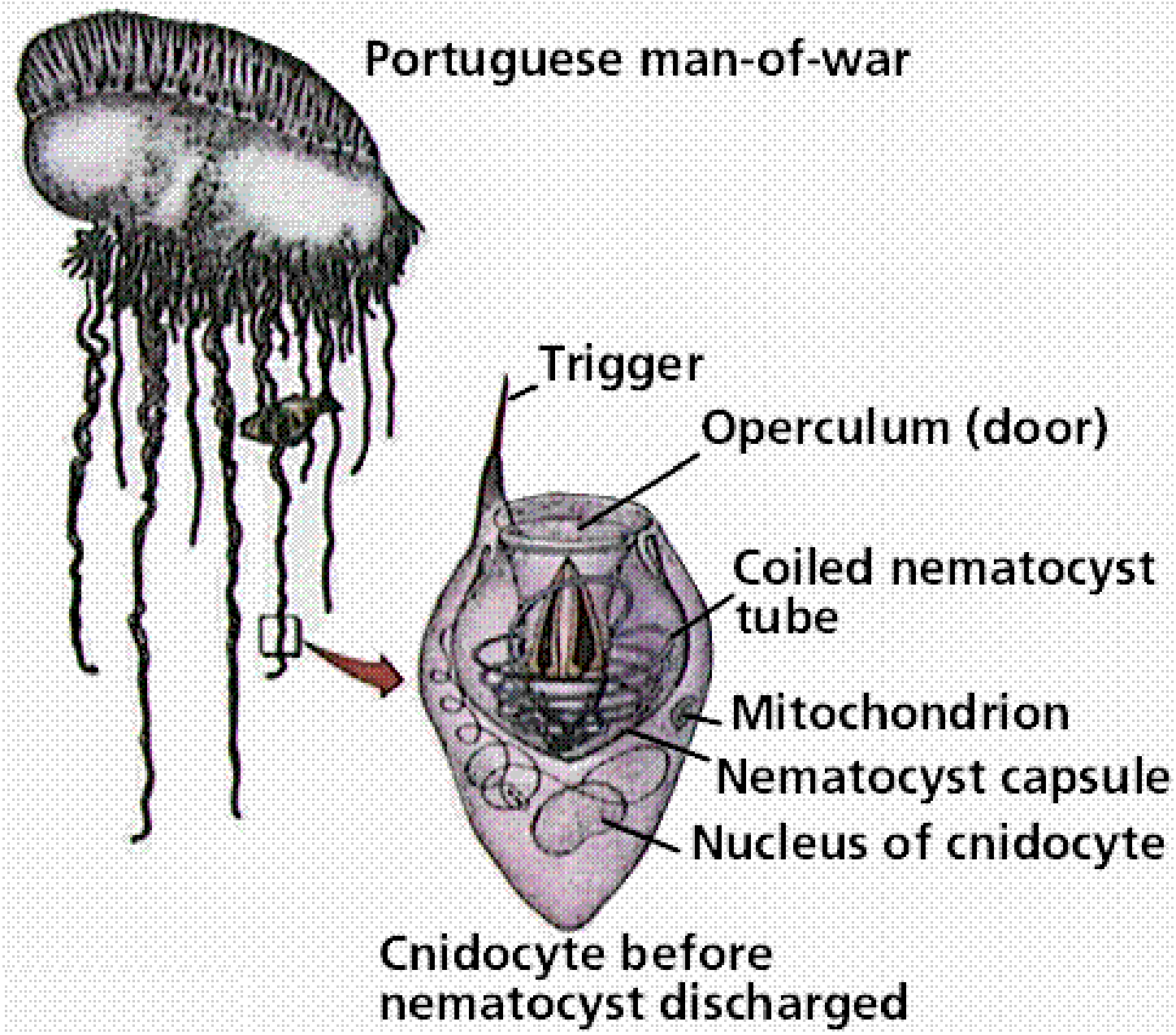


Nematocysts:

A nematocyst is a cell organelle formed within a cnidoblast cell (Fig. 4.8). It consists of a sac drawn out into a thread whose tip may be open or closed. The thread normally lies coiled within the sac and at the point of inversion there is usually a lid or operculum. A stimulus to the cnidocil, where present, and/or to the surface of the cnidoblast, causes the nematocyst thread to be everted. According to type, it may adhere to, coil round, or penetrate and paralyse prey. Normal discharge is dependent upon a combined chemical and mechanical Stimulus.

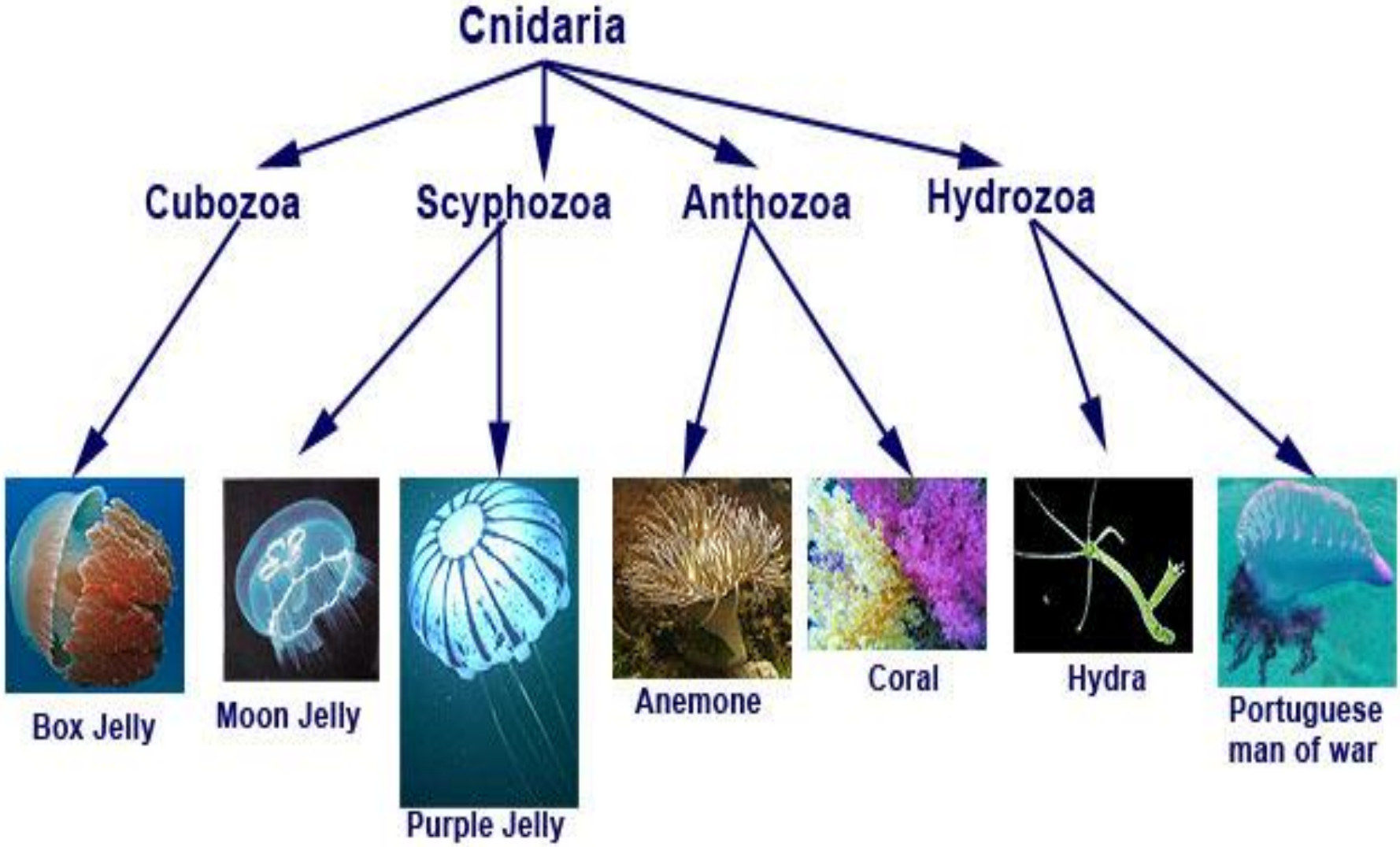



Nucleus
Thread
Capsule
Cnidocyte
Cnidocil
Lid
Thread
(tube)


Portuguese man-of-war
Trigger
Operculum (door)
Coiled nematocyst tube
Mitochondrion
Nematocyst capsule
Nucleus of cnidocyte
Cnidocyte before nematocyst discharged

The stomach in turn leads into radial gastro-dermal canals which connect with a ring canal in the margin. The bulk of medusa is composed of mesogloea. The skeleton may be hydrostatic (e.g. anemones), or an exoskeleton secreted on the external surface, or an endoskeleton formed in the mesogloea as separate elements or a continuous mass.

Taxonomy


Cnidaria
Cubozoa
Scyphozoa
Anthozoa
Hydrozoa
Box Jelly
Moon Jelly
Purple Jelly
Anemone
Coral
Hydra
Portuguese man of war

1-Class HYDROZOA : It includes the hydroids - and medusa forms; chiefly marine but with some fresh-water forms. Radial symmetry; solitary or colonial; life-cycle may include both polypoid and medusoid forms or may lack either; no stomodaeum, gastric tentacles or septa in coelenteron are present ; non-cellular mesogloea; sex cells mature in the epidermis; oral end of polyp elongated into a hydranth; medusae generally have a fold or velum projecting horizontally inwards from the bell margin (Fig. 4.3A).

In colonial forms the polyps are in continuity through their body layers and their common gastrovascular cavity, that is through the coenosarc. Members of the colony may be differentiated to perform different functions. The epidermis commonly secretes a horny exoskeleton, the perisarc . This is calcareous and massive as the *Milleporina*.

There are more examples as:

species	charactrestics
Hydra	solitary polyp, no medusoid stage
Obelia	colonial, with polypoid and medusoid forms
Geryonia	medusa, no polypoid stage
Velella	colonial, pelagic, medusoid and polypoid forms

2-Class SCYPHOZOA :

the jellyfish, medusae lacking e.g. *Cassiopeia*; exclusively marine. Radial symmetry; not free-swiming then attached by an aboral stalk (Fig. 4.4A); coelenteron lacks a stomodaeum but has gastric filaments and may be divided by septa into four pockets; mesogloea cellular; gonads endodermal; life-cycle generally includes a polypoid stage only. A skeleton is lacking, but the mesogloea of the bell gives support.

There are more examples as:

Lucernaria —(Fig. 4.4A) stalked.

Aurelia (Fig. 4.4B)— free-swimming

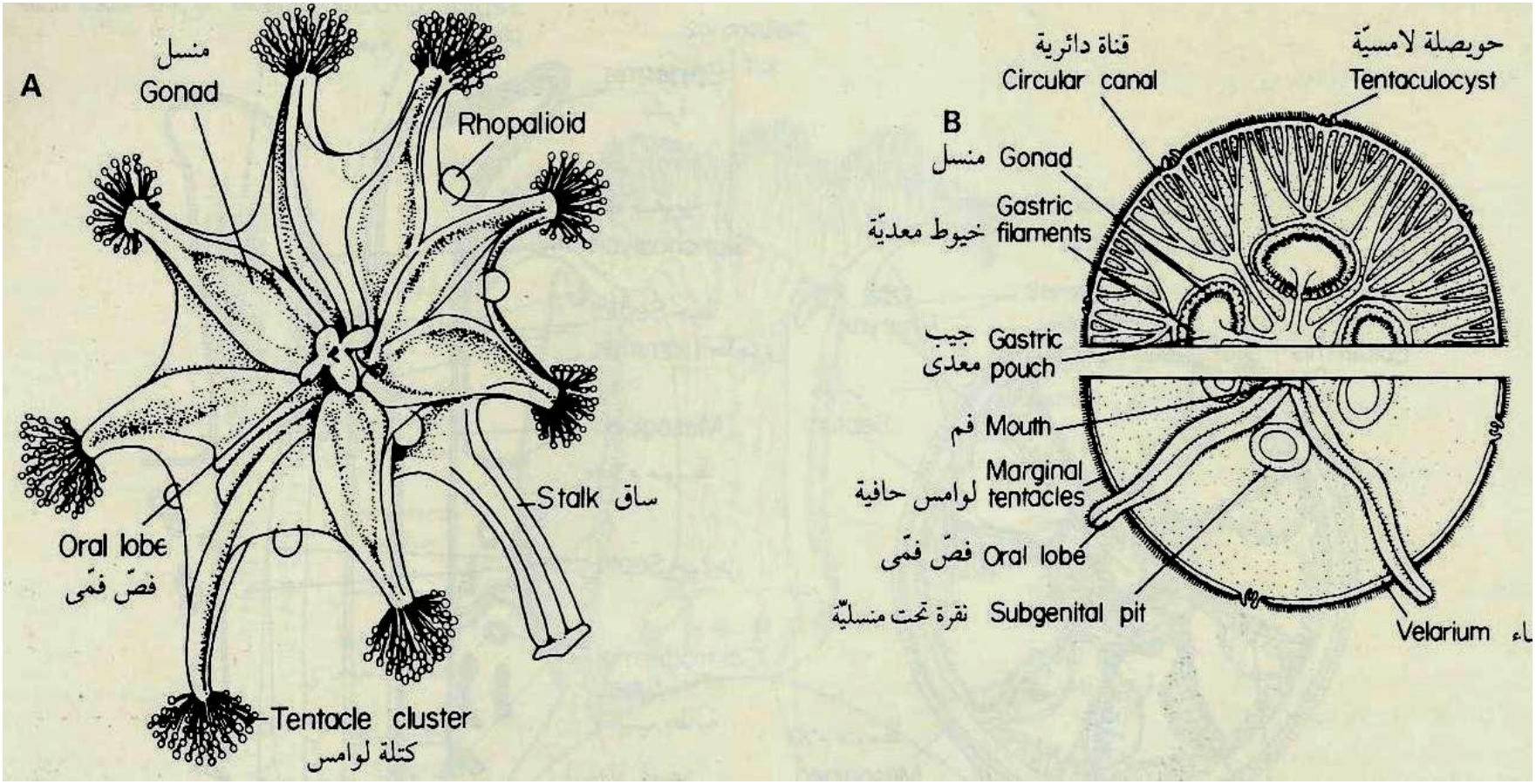

A
منسل
Gonad
Rhopalioid
Stalk ساق
Oral lobe
فصّ فمّى
Tentacle cluster
كتلة لوامس
B
قناة دائرية
Circular canal
حويصلة لامسيّة
Tentaculocyst
منسل Gonad
Gastric
خيوط معديّة filaments
جيب Gastric
معدى pouch
فم Mouth
Marginal
لوامس حافية tentacles
فصّ فمّى Oral lobe
نقرة تحت منسليّة Subgenital pit
Velarium

Fig. 4.4 A,B

3-Class ANTHOZOA -

the sea anemones and corals, e.g. *Eunicella, Actinia;* exclusively marine. No medusoid stage; symmetry biradial; richly-cellular mesogloea; oral end expanded to an oral disc; body wall at the mouth forms a stomodaeum (pharynx), which may have one or two ciliated grooves or siphonoglyphs , coelenteron divided by septa with filaments (bearing nematocysts) on their free edges; gonads endodermal; solitary or colonial — colony members communicate by gastrodermal tubes .

The exoskeleton, were present, may be of calcium carbonate, secreted by the epidermis as in stony corals or may be an endoskeleton formed by mesogloeal cells, or calcareous spicules. Where a secreted skeleton is lacking, the coelenteron and its fluid contents function as a hydrostatic skeleton.

Examples	Characters
Tubipora	colonial form, endoskeleton of fused spicules;
Alcyonium	***colonial***, endoskeleton of separate spicules;
Metridium	solitary, no secreted skeleton;
Porites	colonial, with exoskeleton;
Fungia	solitary, with exoskeleton.

Feeding:

a Cnidarians are generally carnivorous and either trap prey or are suspension feeders. Some hydroids, corals and Scyphozoa have symbiotic algae within their cells and obtain their food supplies with products of algal photosynthesis.

b The tentacles of cnidarians are used in prey capture. The tentacles and extensions of the manubrium such as oral arms, lobes and tentacles are well supplied with nematocysts which discharge when stimulated and aid in holding and subduing prey .

Hydra Eating Daphnia.flv

The digestive system is the coelenteron. In polypoid types it may be simple as in the Hydrozoa, or partitioned by septa as in the Anthozoa. In medusae it consists of the manubrium and a central stomach connected by radial canals to a ring canals within the bell margin. In the Scyphozoa the stomach is divided by septa which bear gastric filaments containing nematocysts and gland cells.

In the Anthozoa the free septal edges bear septal filaments with gland cells and nematocysts.
The tentacular nematocyst threads paralyse prey which is then introdused into the mouth.
In medusae prey is captured by extensible tentacles. Many scyphozoans and smaller anthozoans are ciliary suspension feeders and food particles are trapped in a mucous film in subumbrellar surface, and are transferred to the mouth by ciliary beat.

Digestion begins extracellular in the coelenteron with gastrodermal gland cells secreting a proteolytic enzyme into the coelenteron. The food is mixing by flagellar currents and body movements and then phagocytised into food vacuoles of gastrodermal cells then Intracellular digestion proceeds with acid and alkaline phases in the food vacuole, and is followed by absorption.

In colonial hydroids extracellular digestion occurs within the nutritive polyps and semi-digested food then passes into the common gastrovascular cavity for intracellular digestion.

Osmoregulation/excretion

a There are no special organs.

b Most cnidarians are osmotic adaptations .

Nitrogenous waste is mainly ammonia which diffuses out through the general body surface. Indigestible food materials are ejected through the mouth.

Movement

a Movement in polypoid forms is generally slow and restricted to tentacular movements, though they may change location, e.g. by floating, somersaulting {Hydra), slow gliding on the pedal disc (some anthozoans) or walking on the tentacles. A few anemones swim by means of tentacular movements. Some burrow in mud.

b In free-living medusoid forms which are float or swim there are no special organs for locomotion.

c The simplest cnidarian muscular system is found in hydroid polyps. The epidermal epithelio-muscular cells and the gastrodermal nutritive-muscle cells have basal contractile extensions. These extensions contain contractile fibres or myonemes. Tentacular movements are due to the actions of these contractile fibres on the hydrostatic skeleton.

Medusae possess a mainly epidermal musculature, The main musculature of medusae, responsible for swimming movements.

When these muscles contraction force water out from the subumbrellar space ,this resulting the medusa downwards.

In scyphozoan medusae the circular subumbrellar muscle is resembles vertebrate muscle in its properties.

In the Anthozoa the epidermal system of fibres is reduced, generally found only in the tentacles and oral disc, and the main muscles are gastrodermal. In addition to this muscle cylinder, longitudinal and transverse muscle bands are located in the coelenteric septa.

Co-ordination

a i The nervous system is of the nerve net type and composed of non-polarized, mulltipolar and bipolar neurones, situated at the bases of the epidermis and gastrodermis. There is some concentration of cells and fibres in certain groups. Various types of sensory cell are present, including chemo receptors and mechano-receptors scattered in the epidermis and gastrodermis. They may be concentrated on the tentacles and near the mouth. In some groups sensory cells may be concentrated in special organs.

However in hydrozoan polyps and anthozoans special sense organs are lacking.
Medusae generally have a more organized type of nervous system. There is a sub-epidermal plexus in the manubrium and tentacles .
The main sense organs are light-sensitive ocelli on the tentacle bases . The statocysts, borne on the bell margin. Scyphomedusae have a similar nervous system to hydromedusae but lack nerve rings.

ii Cnidarian nerve nets exhibit diffuse conduction and nervous excitation spreads in many directions from the point of stimulus. The muscle response is dependent upon the frequency of stimulation (fast and slow muscles) . The nervous system may be differentiated into two, fast, through-conducting net which mediates a specific response such as the swimming pulsation of medusae or polyp withdrawal, and a slow, which non-through-conducting net which concern with local movements e.g. in feeding

b Neurosecretory cells are reported in the sub-hypostomal region of Hydra. Active substances stimulate growth and inhibit reproduction. A pheromone inhibiting budding is also elaborated.

My Anemone Eat Meat.flv

Respiration

a There are no special organs.

b Gaseous exchange may be assisted by the circulation of coelenteric contents, due to body movement and cilliary or flagellar beating.

Circulation/coelom

a There is no coelom and no vascular system.

b The gastrovascular cavity have both digestive and circulatory functions.

Reproduction

a There are both dioecious and hermaphroditic species.

The gametes of cnidaria originate from epidermal or gastrodermal interstitial cells and are typical ova and spermatozoa. The gonads are located at a characteristic site, e.g. on the column in Hydra or on the radial canals or manubrium of medusoid forms.

b Sexual reproduction. Fertilization may occur in the parents tissues or in sea water. The fertilized egg may be shed into sea water or may develop in the parents to a late stage. The Cnidaria exhibit a wide range of cleavage patterns.

c Asexual reproduction is common. It may occur by**:**

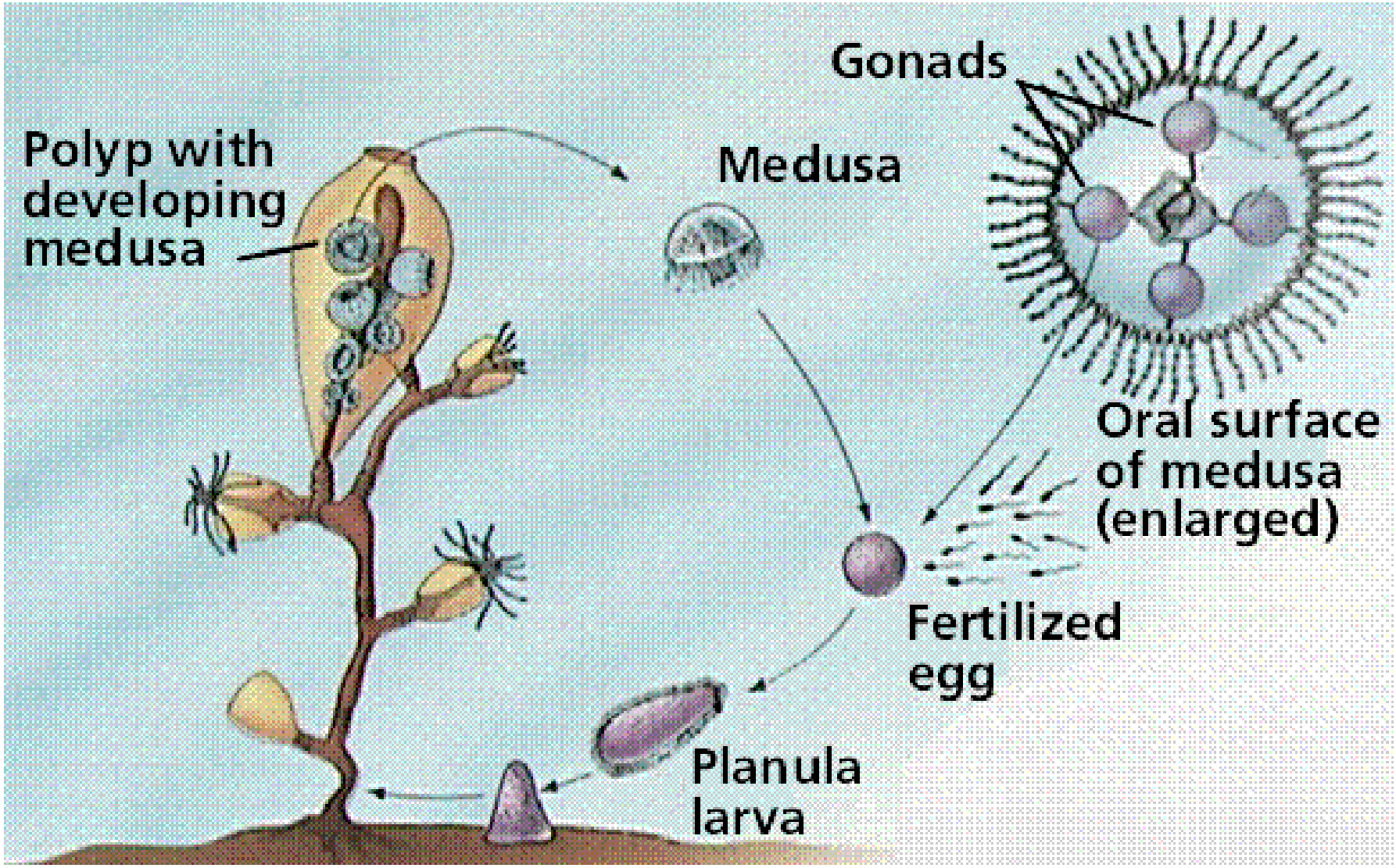
i budding, e.g. in in colonial forms of Hydrozoa, and scyphozoan.

ii production of gemmules e.g. in fresh water form.

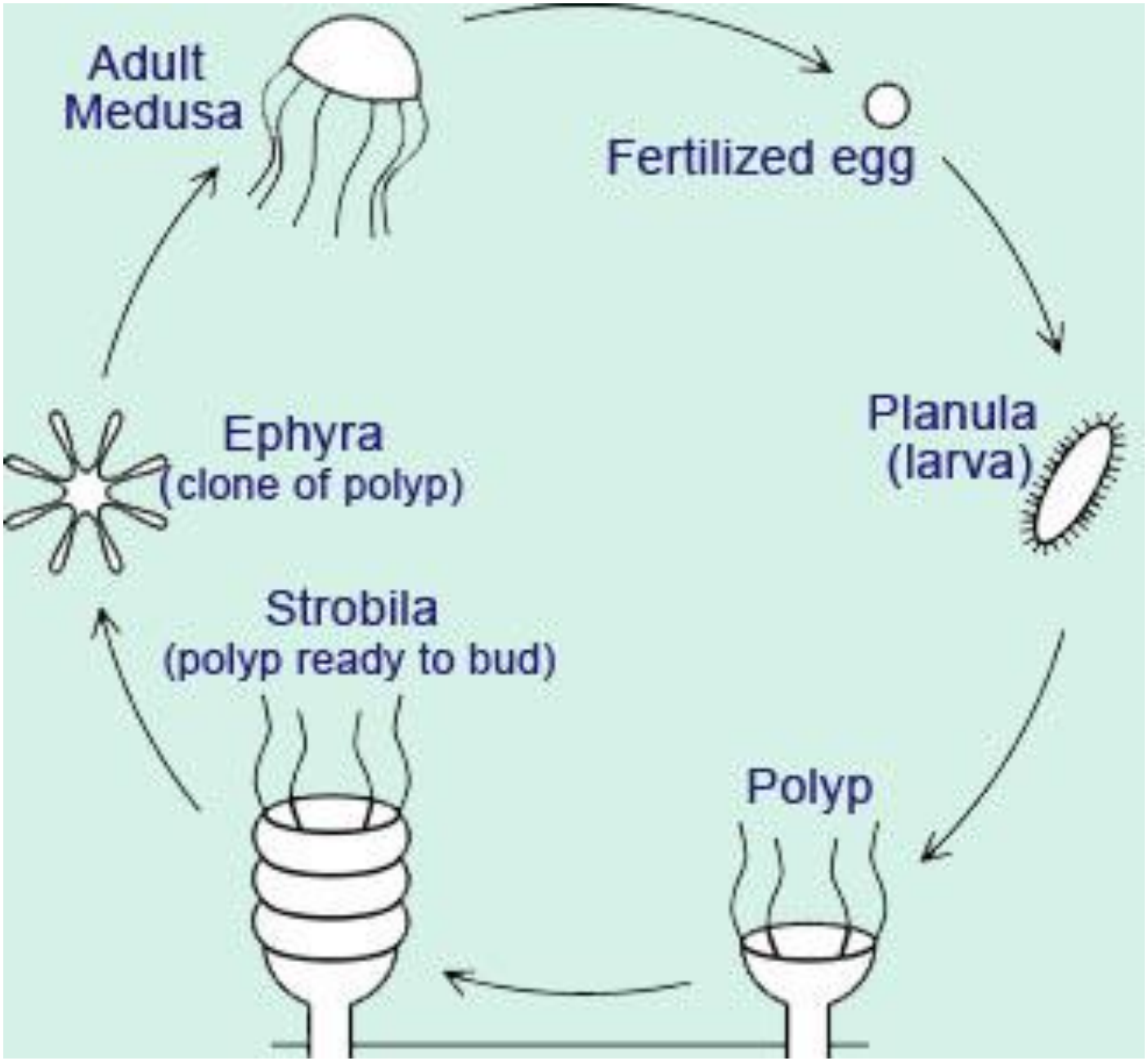
iii pedal laceration, e.g. in sea anemones;

iv transverse fission, e.g. in the production of ephyrae by scyphistomae;

v longitudinal fission, e.g. in many sea anemones.



Sexual reproduction



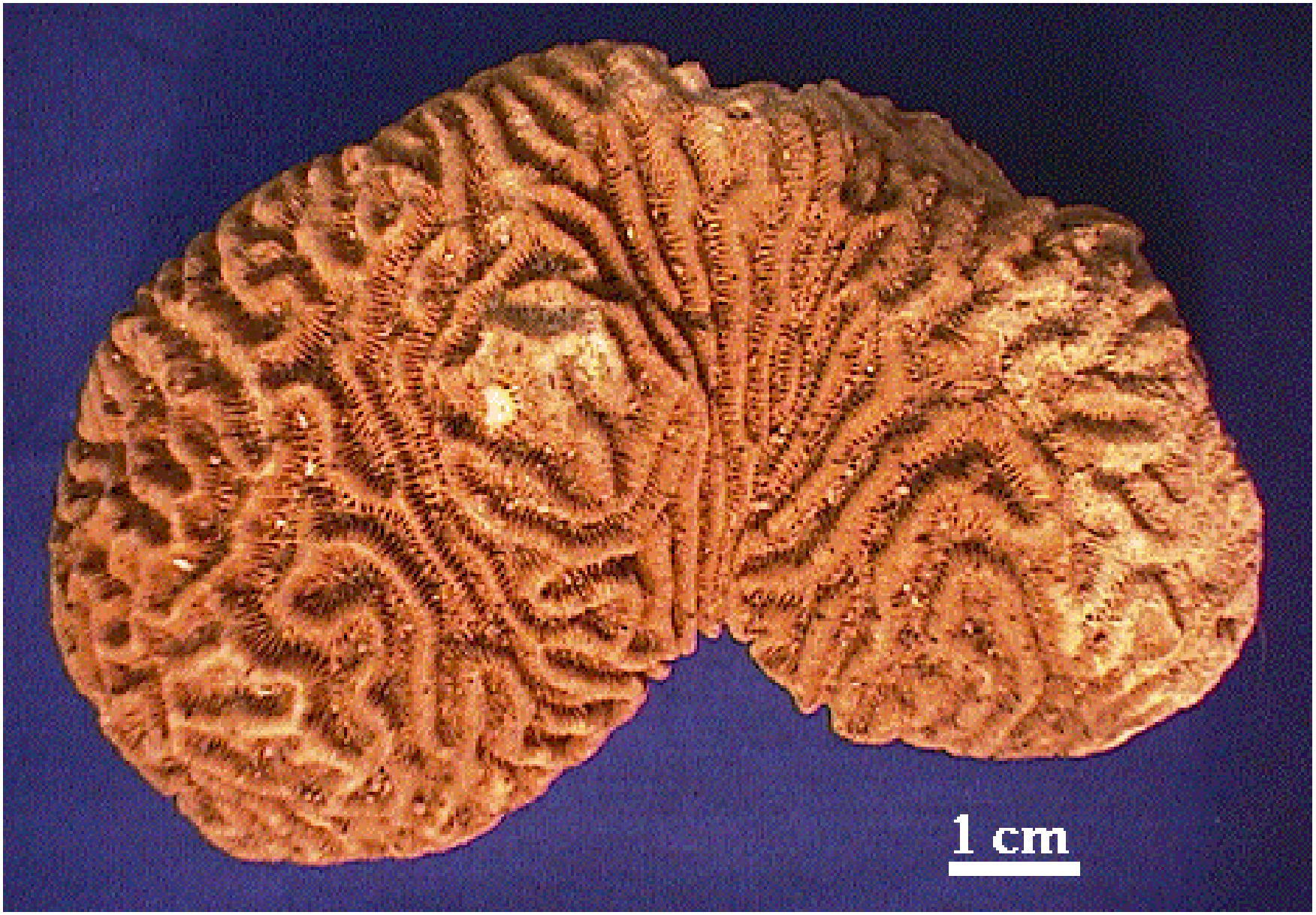
Asexual reproduction

Regeneration: Cnidarians possess high regenerative powers

Fossil record :The presence of hard skeletal materials has led to preservation of examples of all classes.

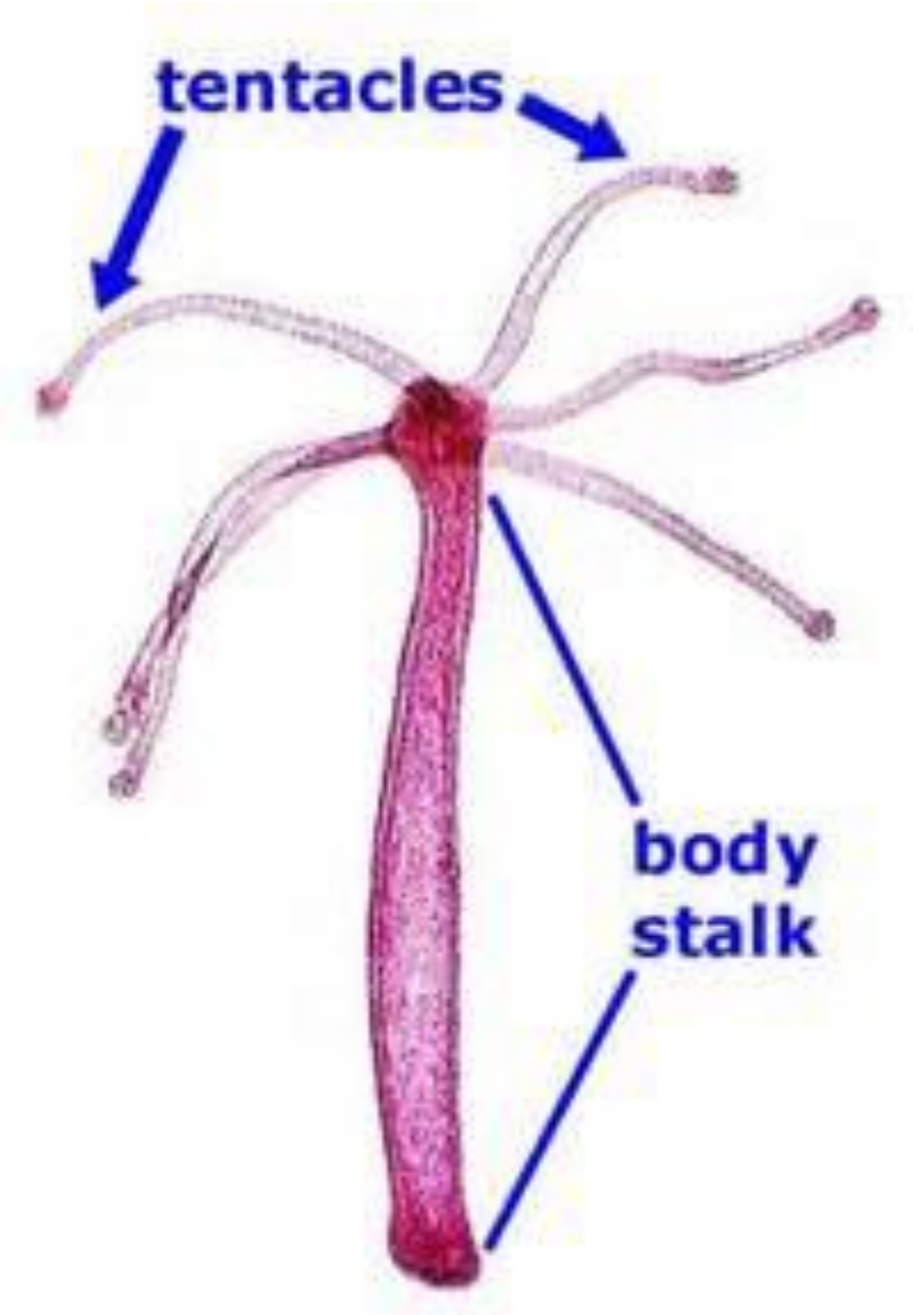
Economic importance: They important in wildlife and diving for showing coral reef formations with value to tourist industries.

Habitat :The majority of Cnidaria are marine, but some inhabit fresh-water lakes and streams.

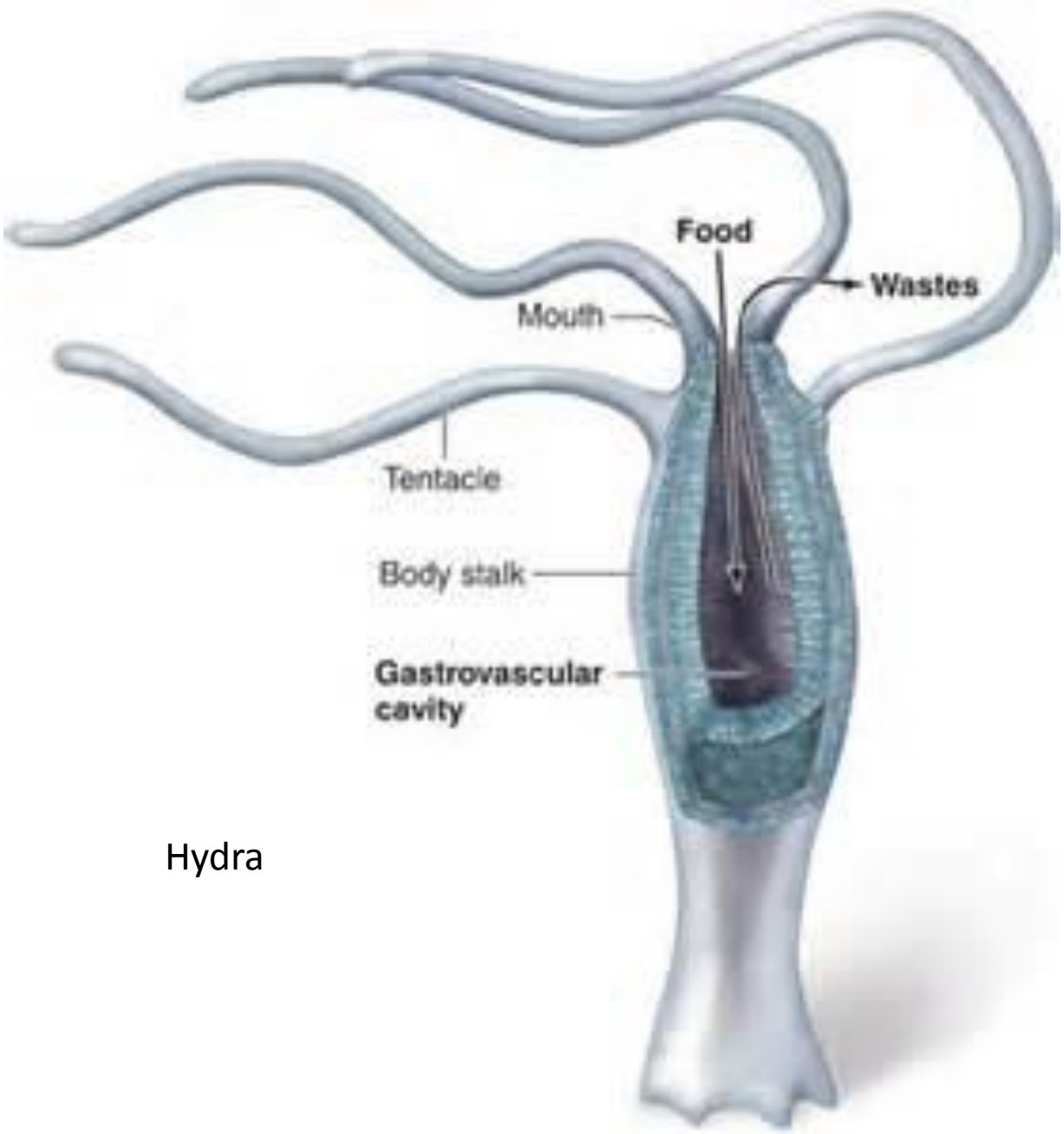


Celeria

Sea anemon



Hydra


Food
Wastes
Mouth
Tentacle
Body stalk
Gastrovascular cavity

Hydra

hydra .1.flv

Different corals

Fungia