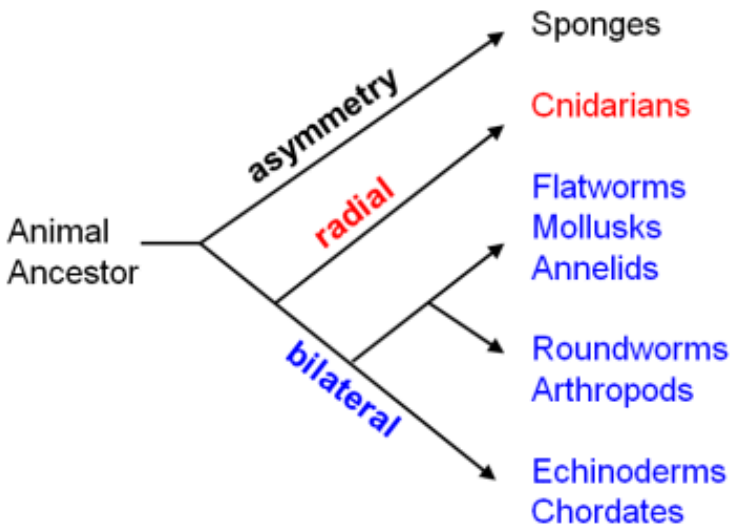
Phyla Cnidaria and Ctenophora

- Domain Eukarya
- Kingdom Animalia

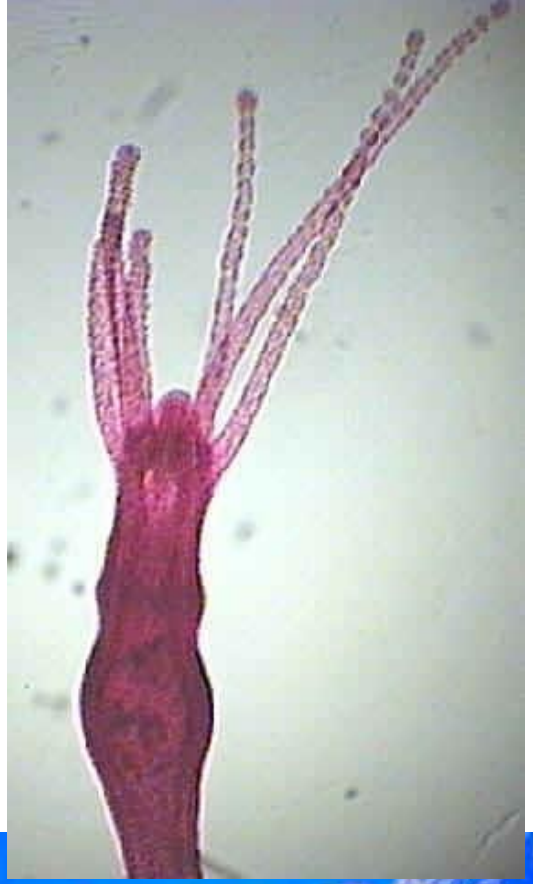


Phyla Cnidaria

- Marine members include jellyfishes, sea anemones, corals, and hydroids.

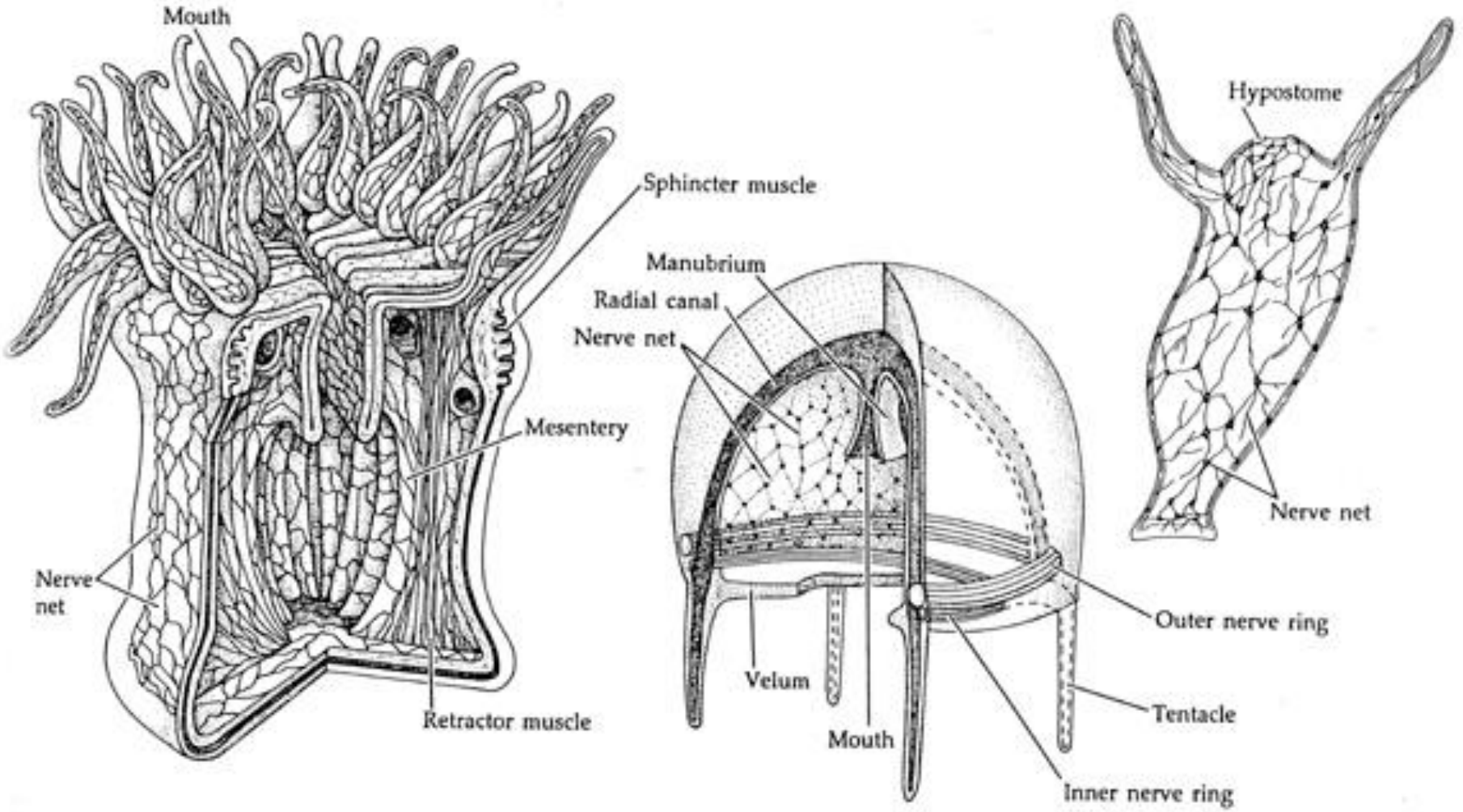
Body Plan

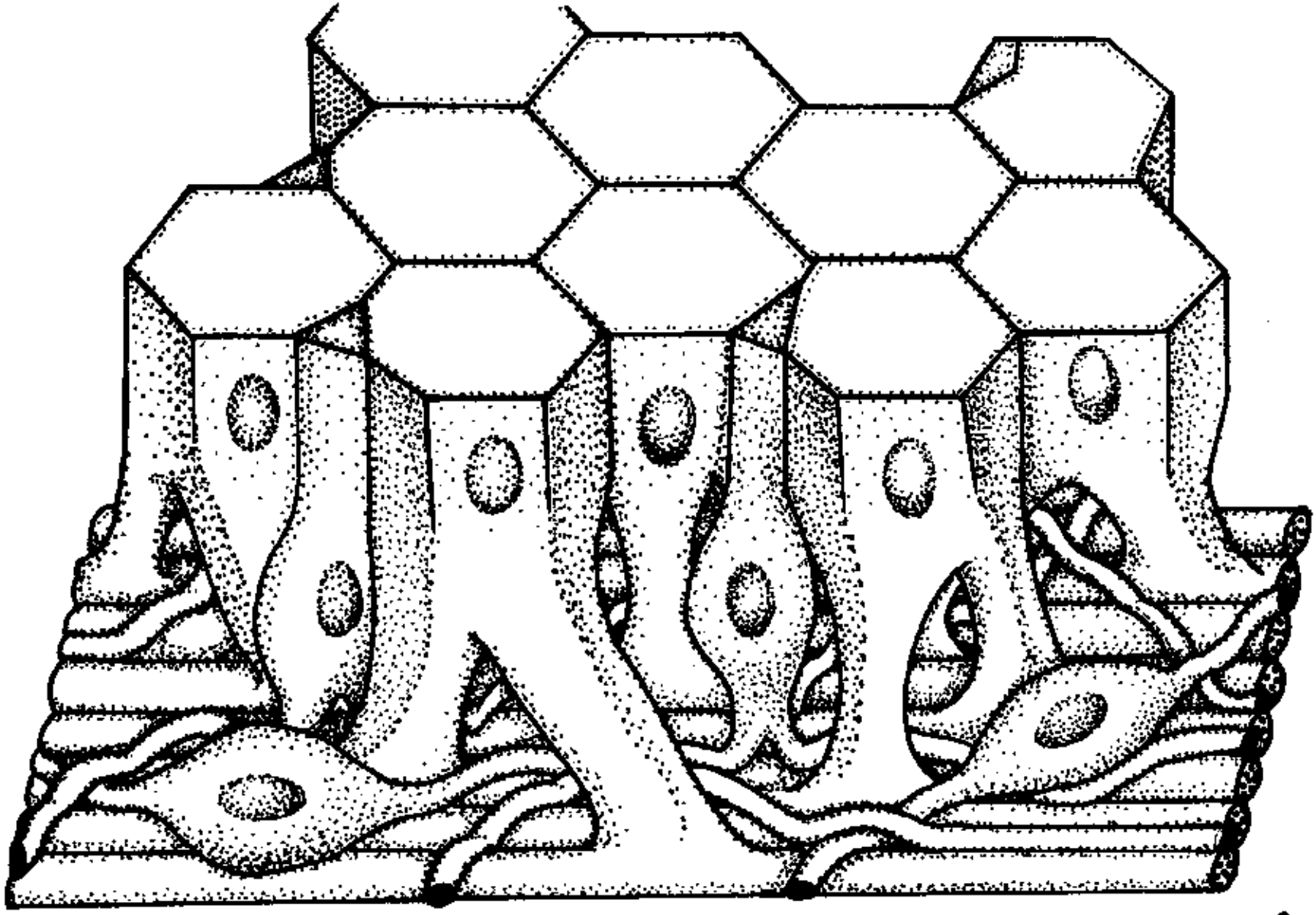
- Cnidaria and Ctenophora exhibit radial symmetry



Nervous System

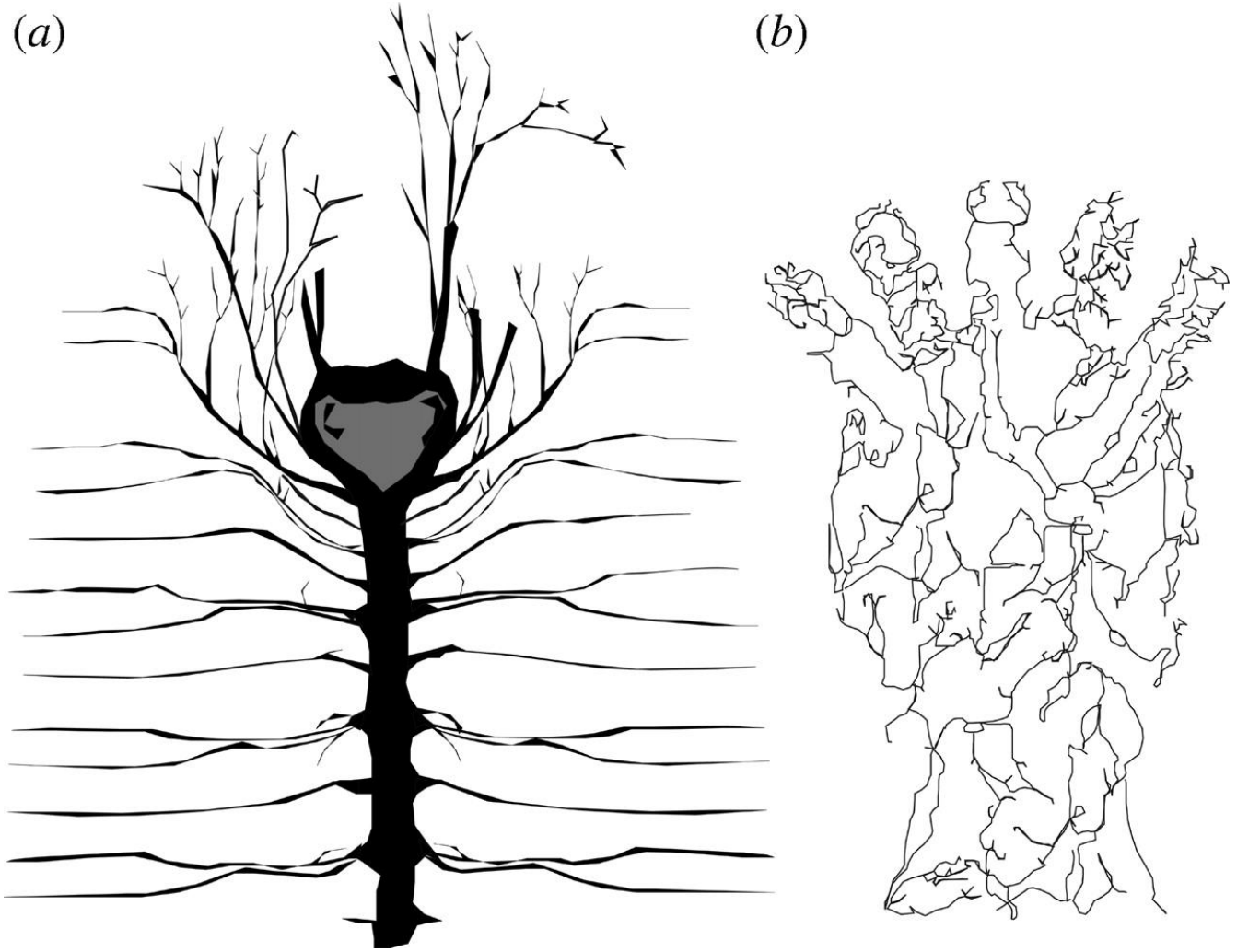
- Relatively simple, diffuse nerve net
- lacks a central brain to process sensory info. or to organize complex responses


Mouth
Sphincter muscle
Mesentery
Nerve net
Retractor muscle
Manubrium
Radial canal
Nerve net
Velum
Mouth
Outer nerve ring
Tentacle
Inner nerve ring
Hypostome
Nerve net



Livingstone, © BIODIDAC.

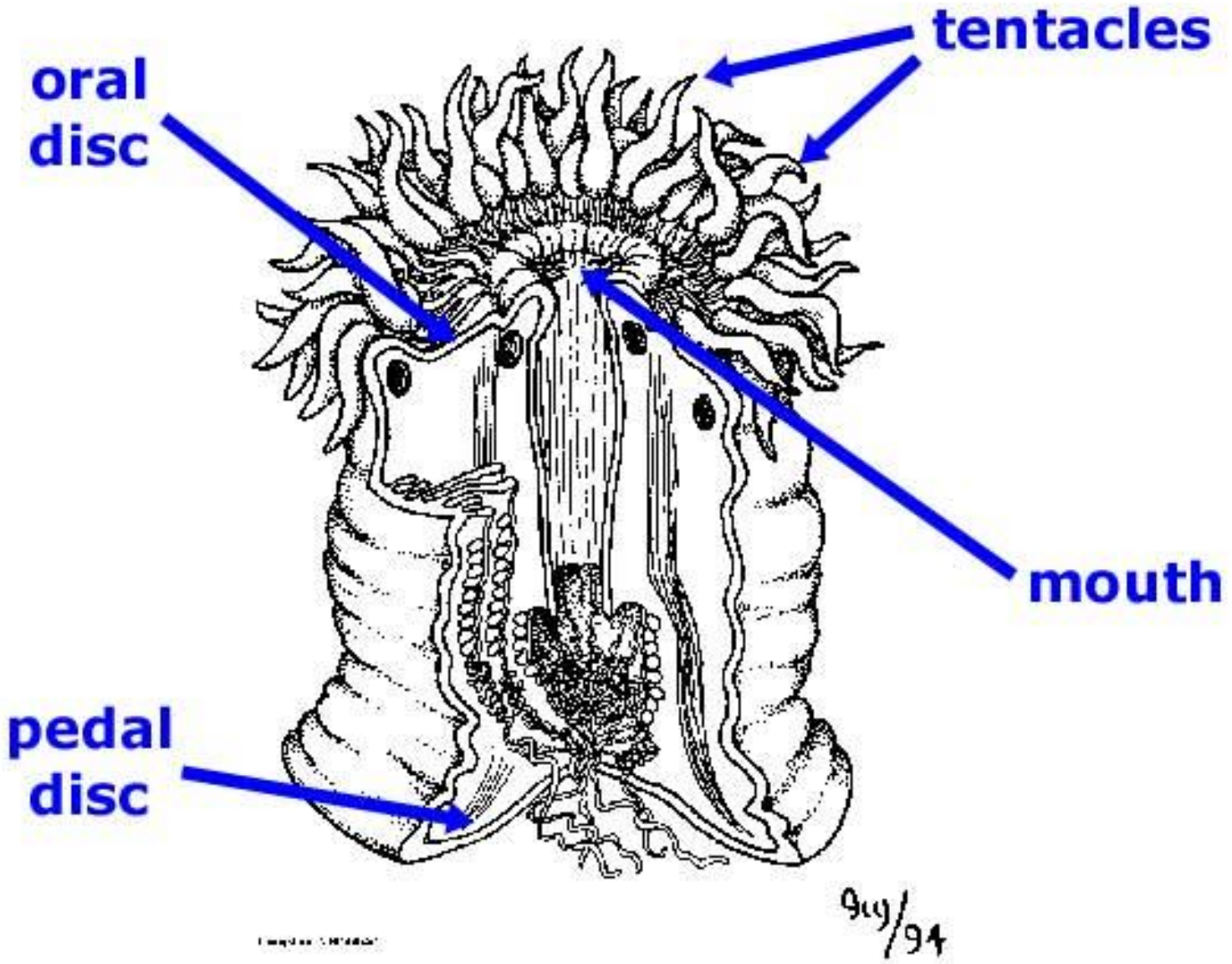
Different degrees of centralization in metazoan brains.

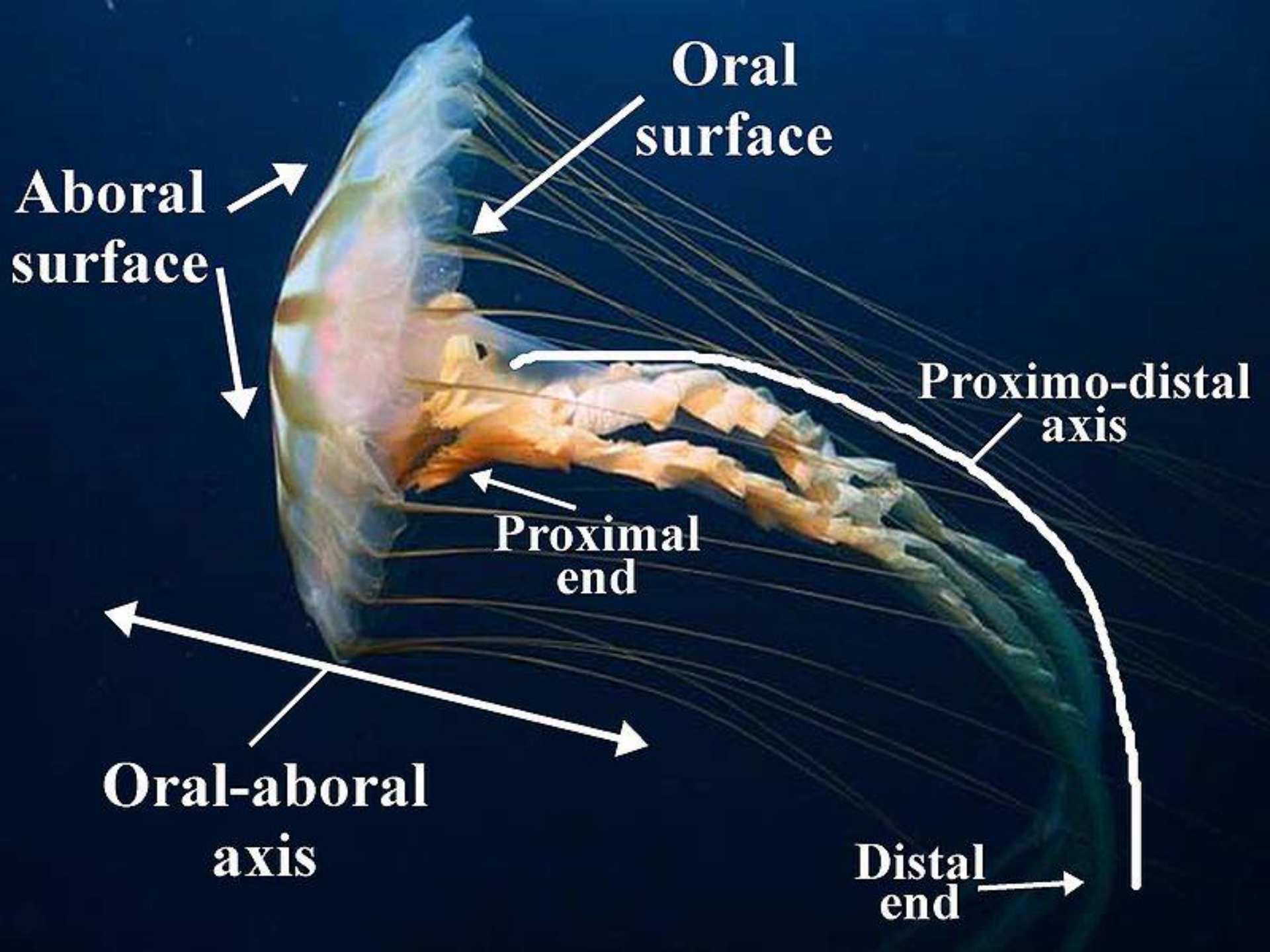


Arendt D et al. Phil. Trans. R. Soc. B 2008;363:1523-1528

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B

- Mouth is located at the center of the body on the oral side.
- The opposite side is the aboral side


tentacles
oral disc
mouth
pedal disc


Oral surface
Aboral surface
Proximo-distal axis
Proximal end
Oral-aboral axis
Distal end

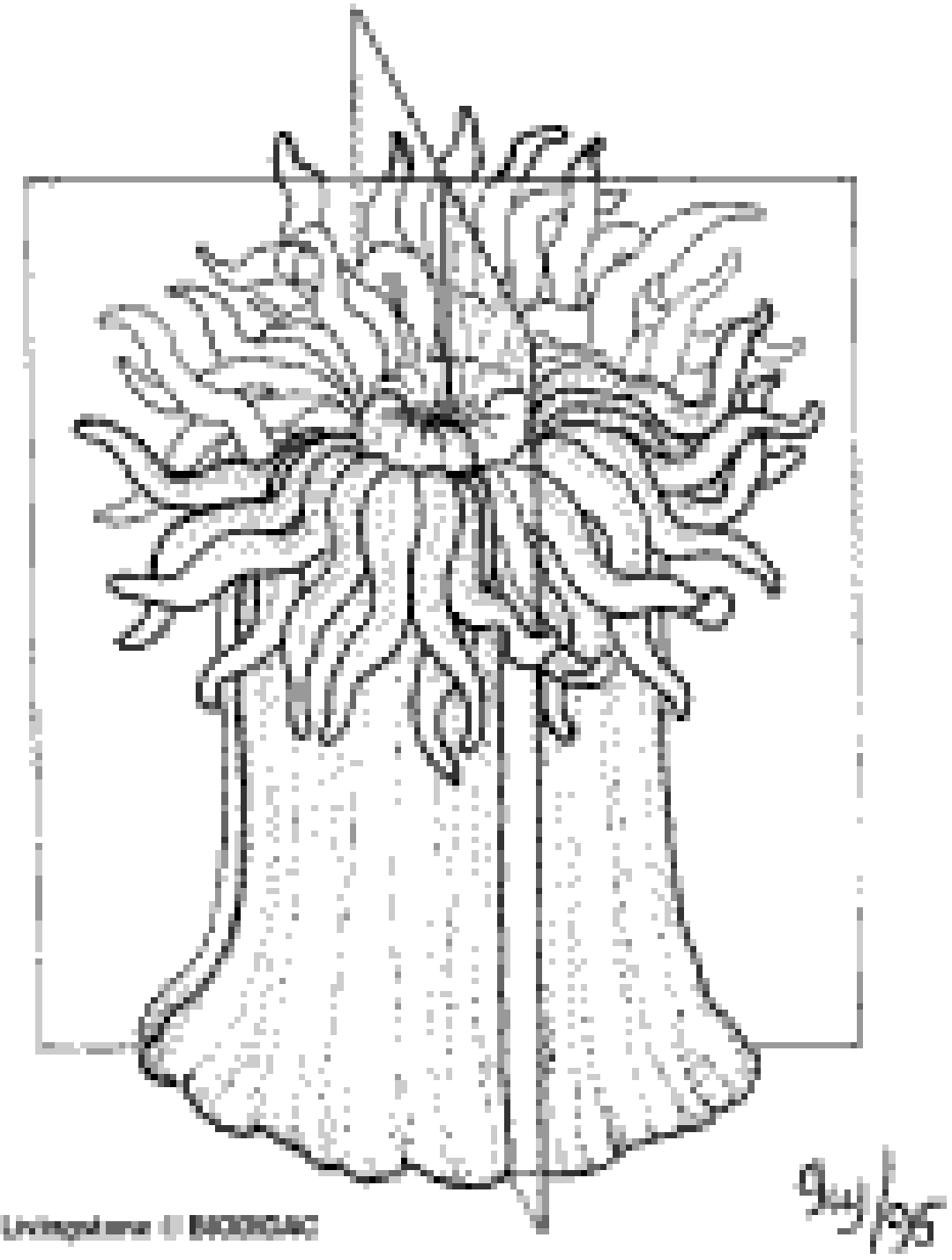
Box Jellyfish

- Uncharacteristically advanced Cnidarian. Primitive eyes (eyespots) are present. When they detect a dark spot, they go the other way.

Structure and Function

- The body may be either vase-shaped (polyp) or bell-shaped (medusa)

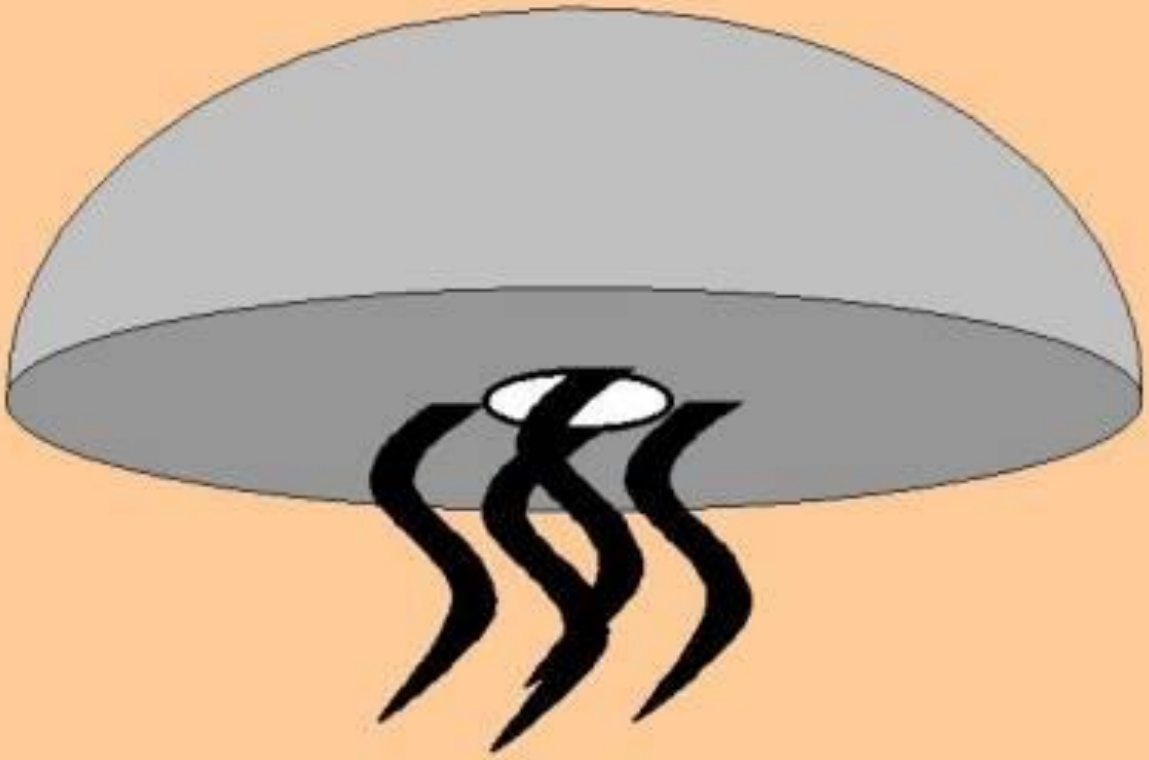
- Polyp is sessile and benthic.
  - Tentacles and mouth face upward



- Medusa is free-swimming
  - Tentacles and mouth face downward

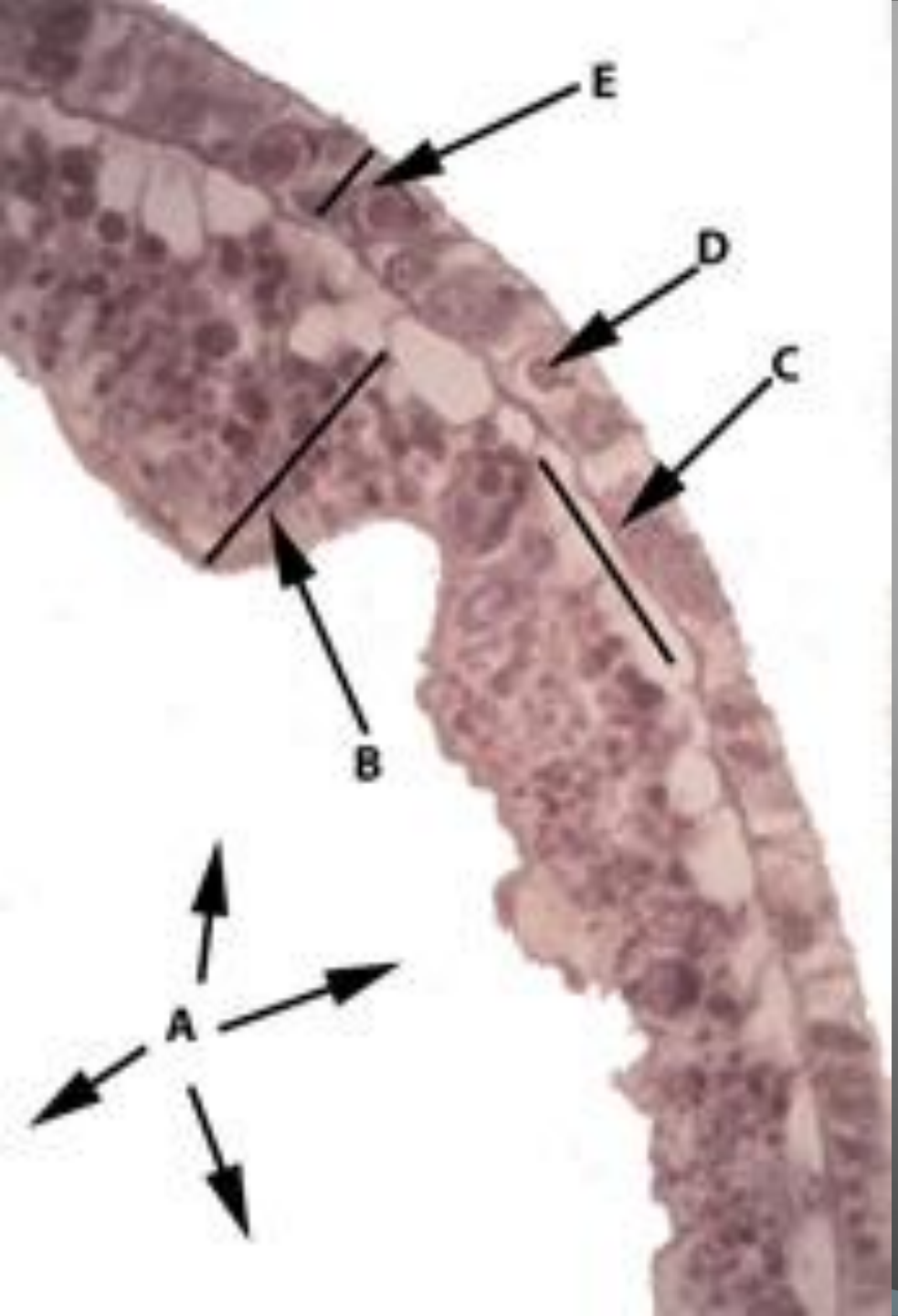
Medusa Orientation

aboral, or exumbrellar, surface



oral, or subumbrellar, surface

- All cnidarians have bodies constructed of two layers
  - Epidermis is outer layer
  - Gastrodermis is inner layer



A. gastrovascular cavity

B. gastrodermis

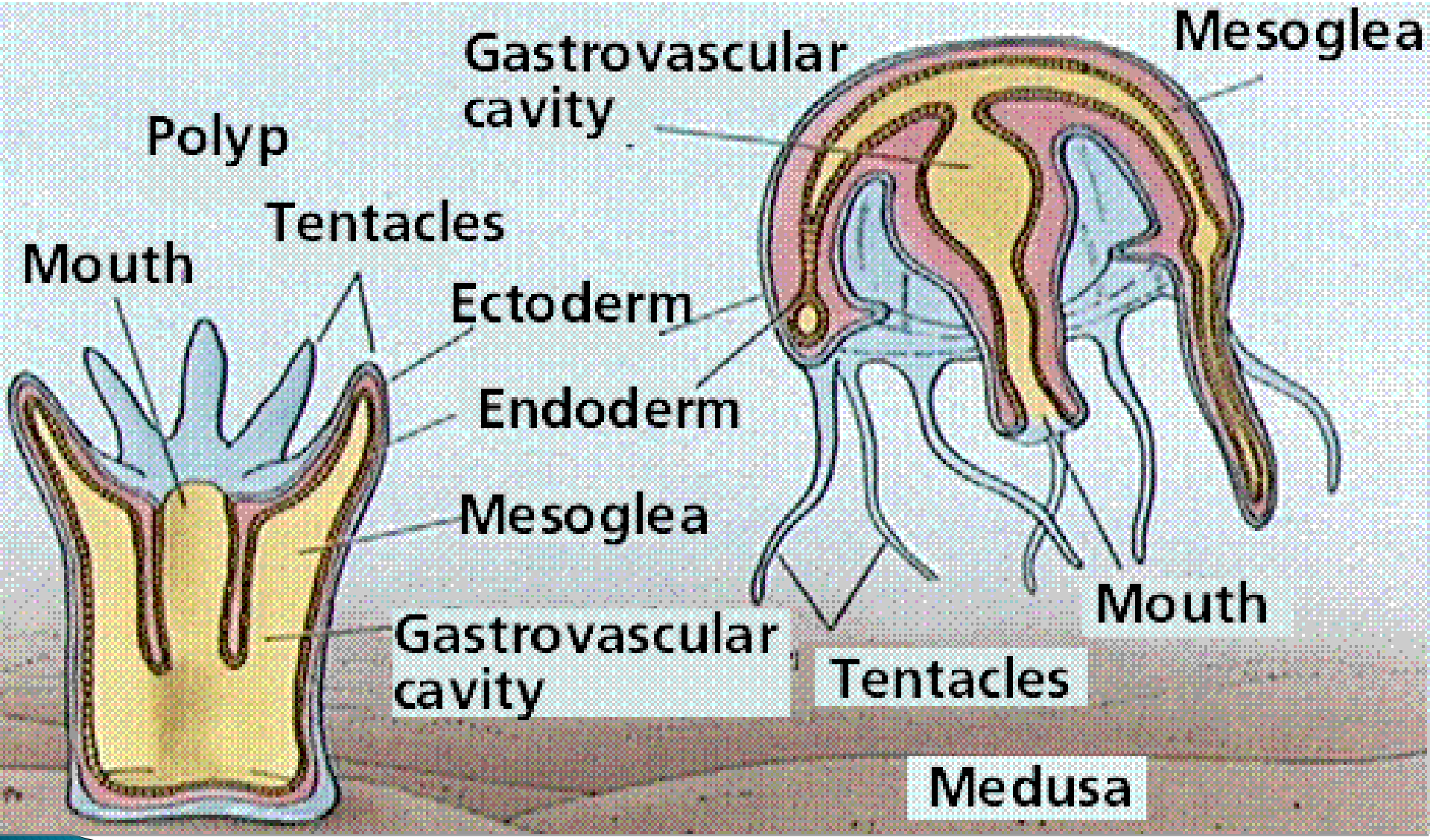
C. mesoglea

D. nematocysts

E. epidermis (integument)

- **Diploblasty** is a condition of the blastula in which there are two primary germ layers: the ectoderm and endoderm.

- Between the layers is a jellylike mesoglea
- A centrally located mouth leads to a baglike digestive tract- the gastrovascular cavity

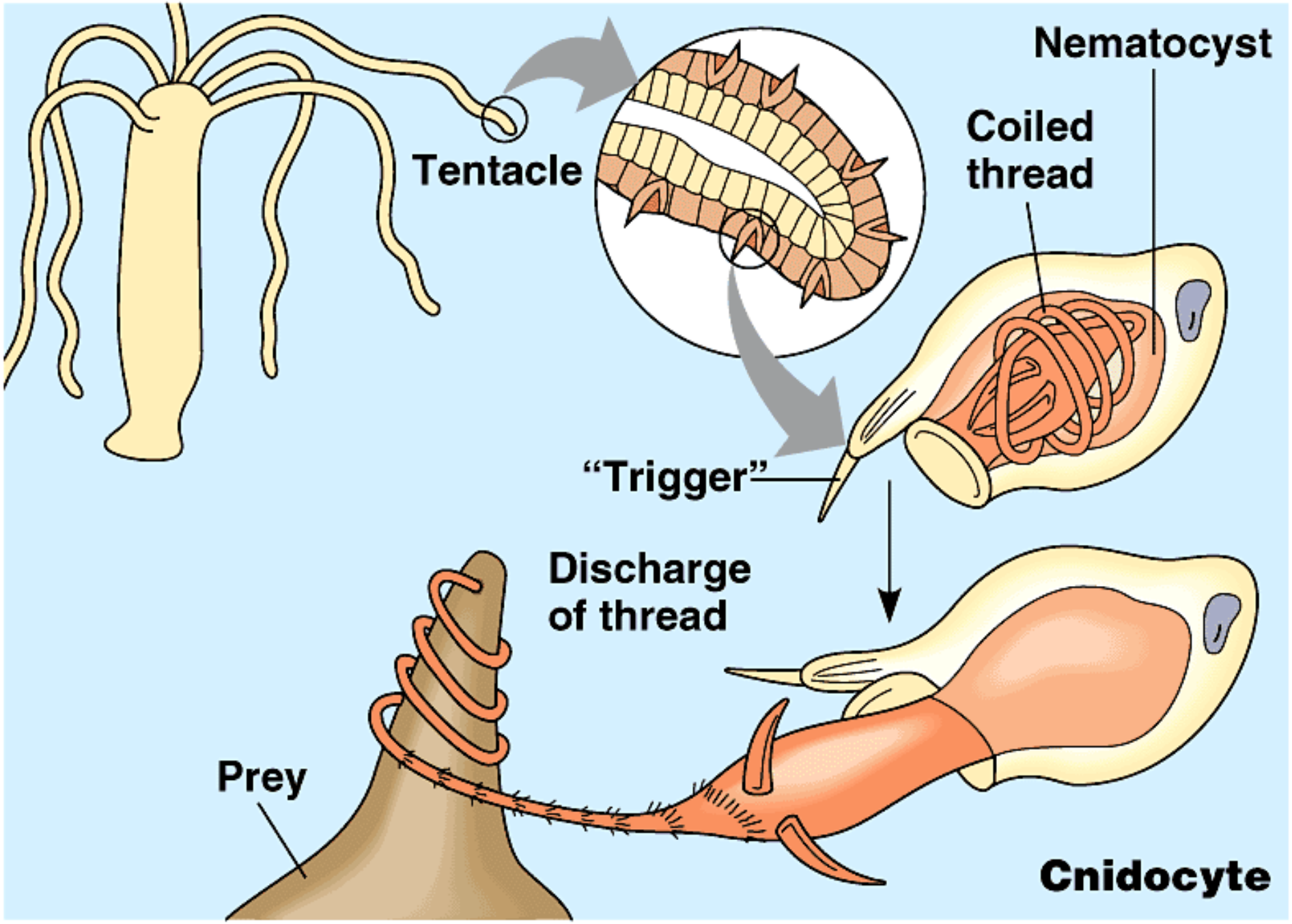

Gastrovascular cavity
Mesoglea
Polyp
Tentacles
Mouth
Ectoderm
Endoderm
Mesoglea
Gastrovascular cavity
Mouth
Tentacles
Medusa

Cnidarian feeding and Defense

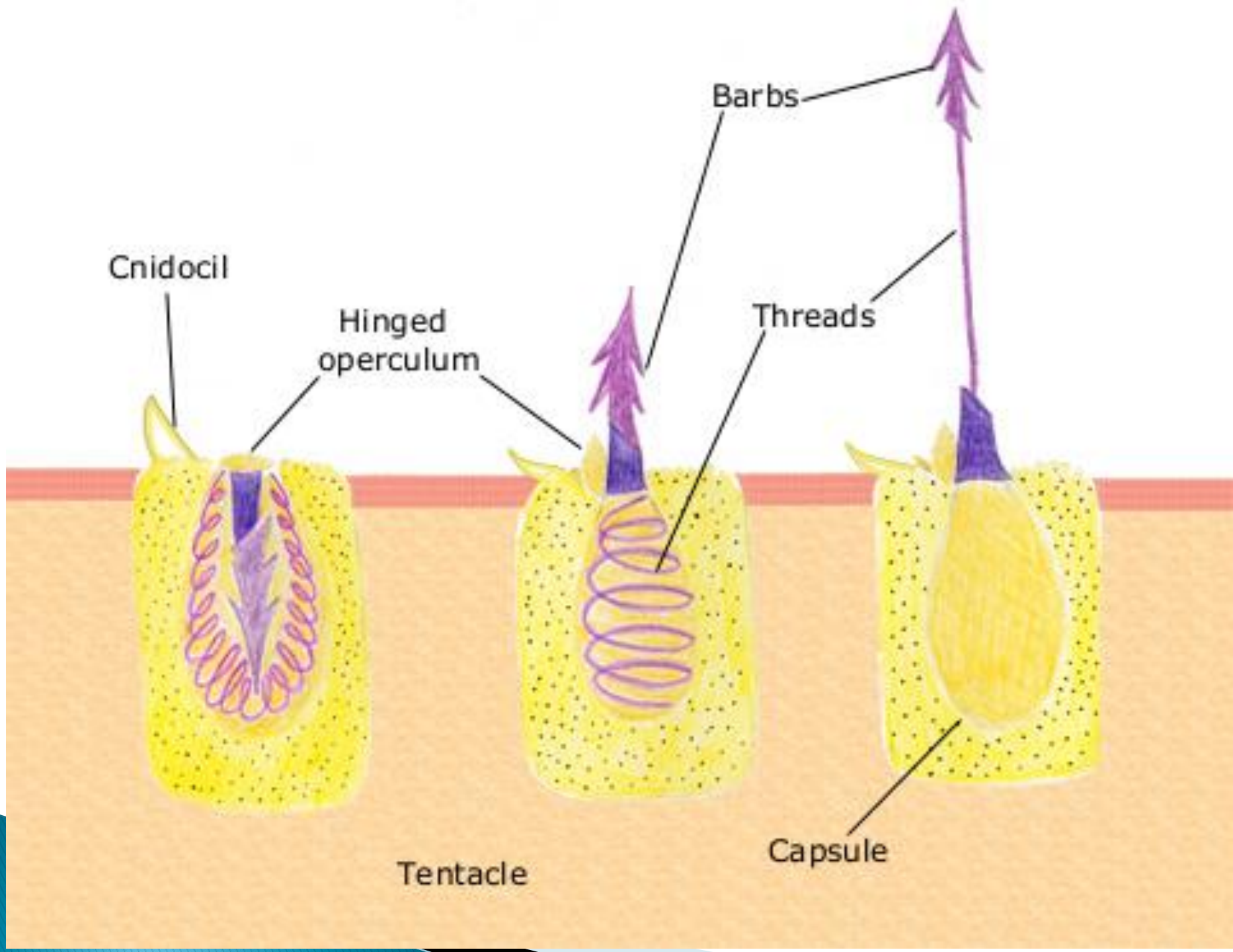
- Tentacles that surround the mouth are covered with specialized cells- cnidocytes

- Cnidocytes produce organelles called nematocysts

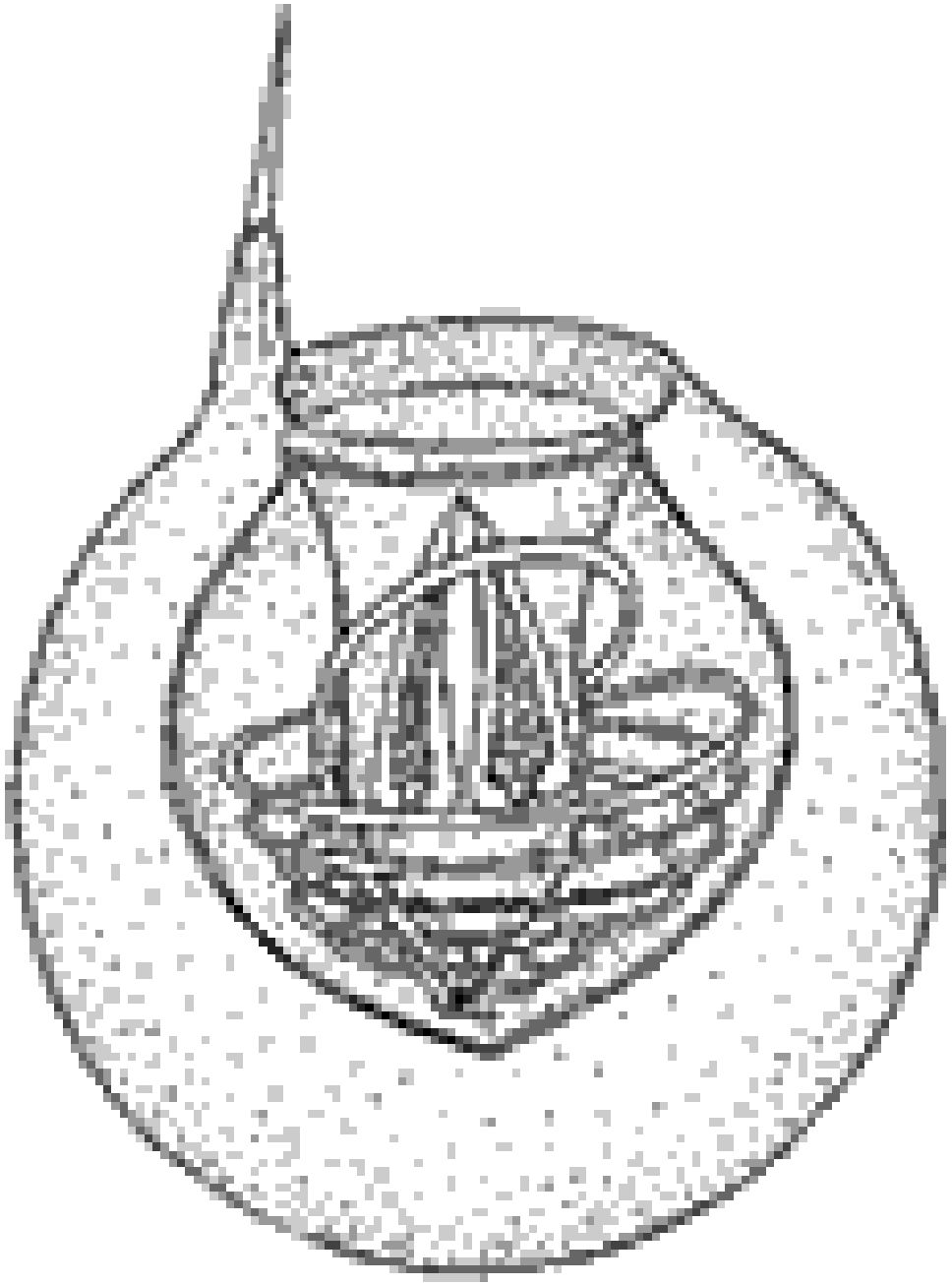
- Nematocysts are stinging organelles that exit the cnidocyte (cnidoblast) with great force once triggered



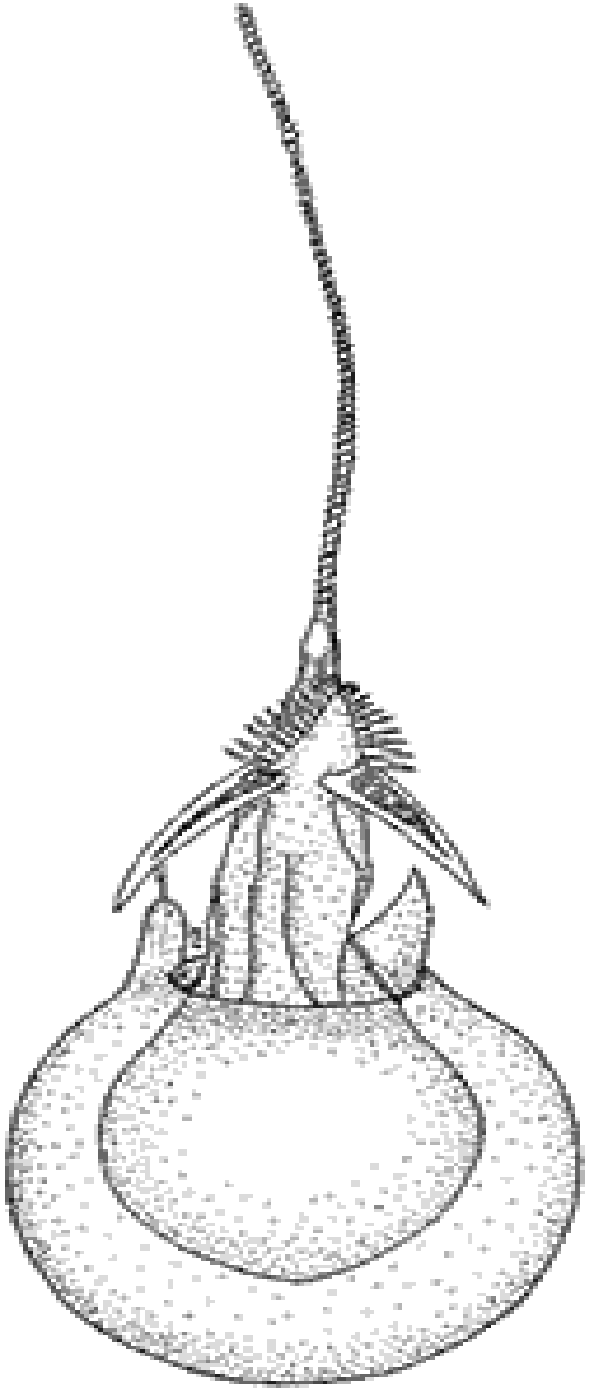
- The nematocyst capsule stores a large concentration of calcium ions, which are released from the capsule into the cytoplasm of the *cnidocyte* when the trigger is activated. This causes a large concentration gradient of calcium across the cnidocyte plasma membrane. The resulting osmotic pressure causes a rapid influx of water into the cell. This increase in water volume in the cytoplasm forces the coiled nematocyst to eject rapidly.


Barbs
Cnidocil
Hinged operculum
Threads
Capsule
Tentacle

- Some nematocysts are adhesive, others have filaments to entangle prey, and others have spines that puncture prey.



undischarged stinging capsule



discharged stinging capsule

1. Tentacles capture prey
2. Cnidocytes release nematocysts into prey, paralizing it.
3. Tentacles push prey into mouth

4. Enzymes in gastrovascular cavity break up prey
5. Gastrodermis cells absorb nutrients
6. Waste exits mouth

Classification of Cnidaria

- Four classes
  - Hydrozoa
  - Scyphozoa
  - Cubozoa
  - Anthozoa

Class Hydrozoa

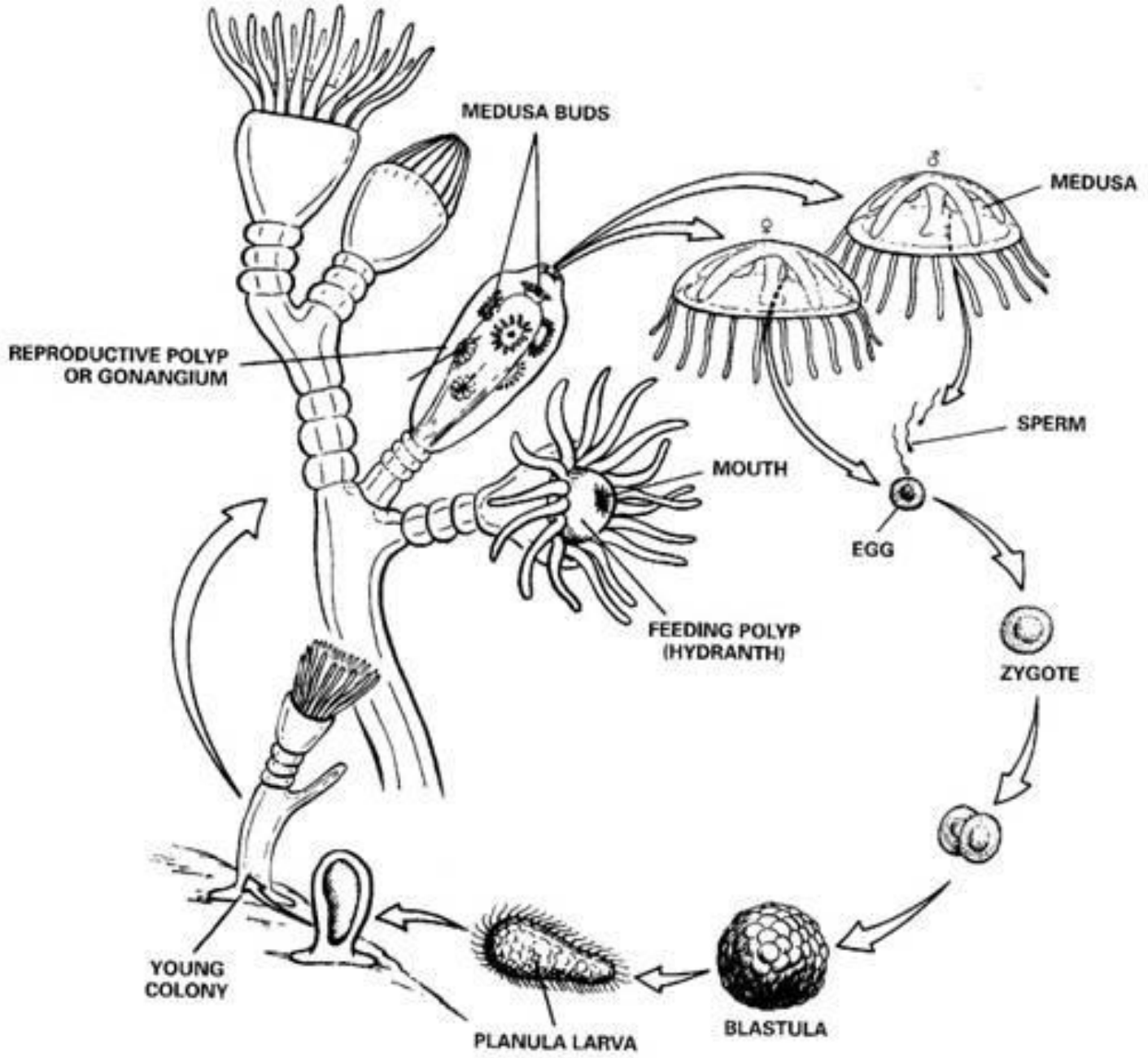
- 3700 species
- Most live as colonial organisms

Obelia

- Many polyps attached to branched stalks
- Some polyps function in gathering food; others are responsible for reproduction

Oblia

Peter Parks/Oxford Scientific Films


MEDUSA BUDS
MEDUSA
REPRODUCTIVE POLYP
OR GONANGIUM
SPERM
MOUTH
EGG
FEEDING POLYP
(HYDRANTH)
ZYGOTE
YOUNG
COLONY
PLANULA LARVA
BLASTULA

500 µm

Obelia medusae

Order siphonophores
Physalia physalis

- Portuguese man-of-war
- Exists as a colony of medusea and polyps

- Pneumatophore- a single individual polyp (gas-filled float)
- Dactylozooids- (tentacles) polyps specialized for capturing prey

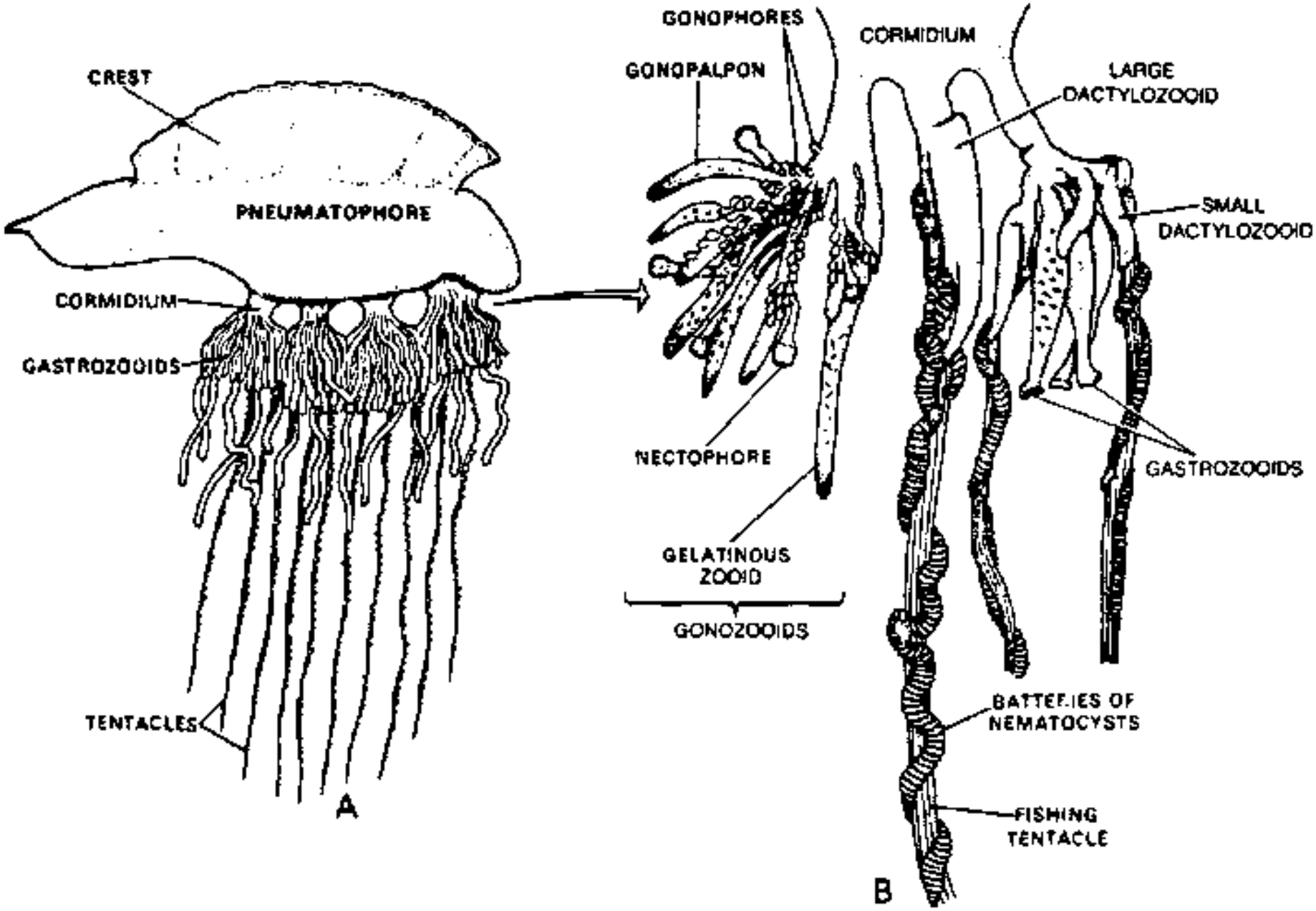


Fig. 13.39 *Physalia*

- Gastrozooids- polyps specialized for digestion
- Gonozooids- polyps specialized for reproduction


Peter Parks/Oxford Scientific Films

Class Scyphozoa

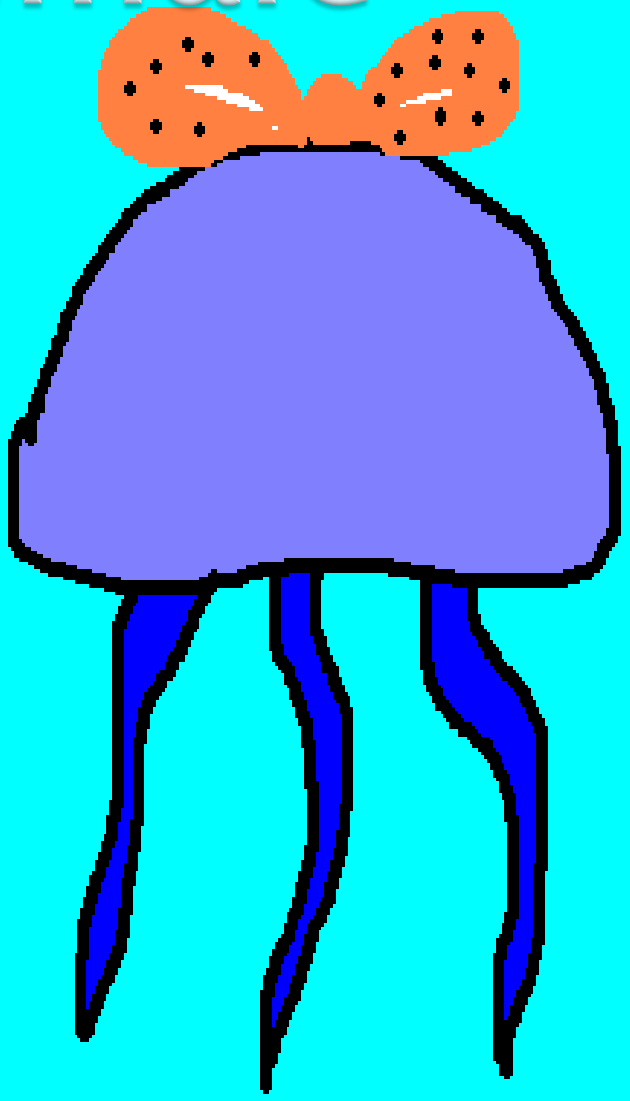
- "Cup Animals"
- Medusa is dominant form of life cycle
- Commonly known as jellyfish

- largest (*Cyanea capillata*, or lion's mane), which has a bell that measures 6 feet across

- Pulsating motion of the cup propels the jellyfish
- Common jellyfish have life cycle that includes both medusa and polyp

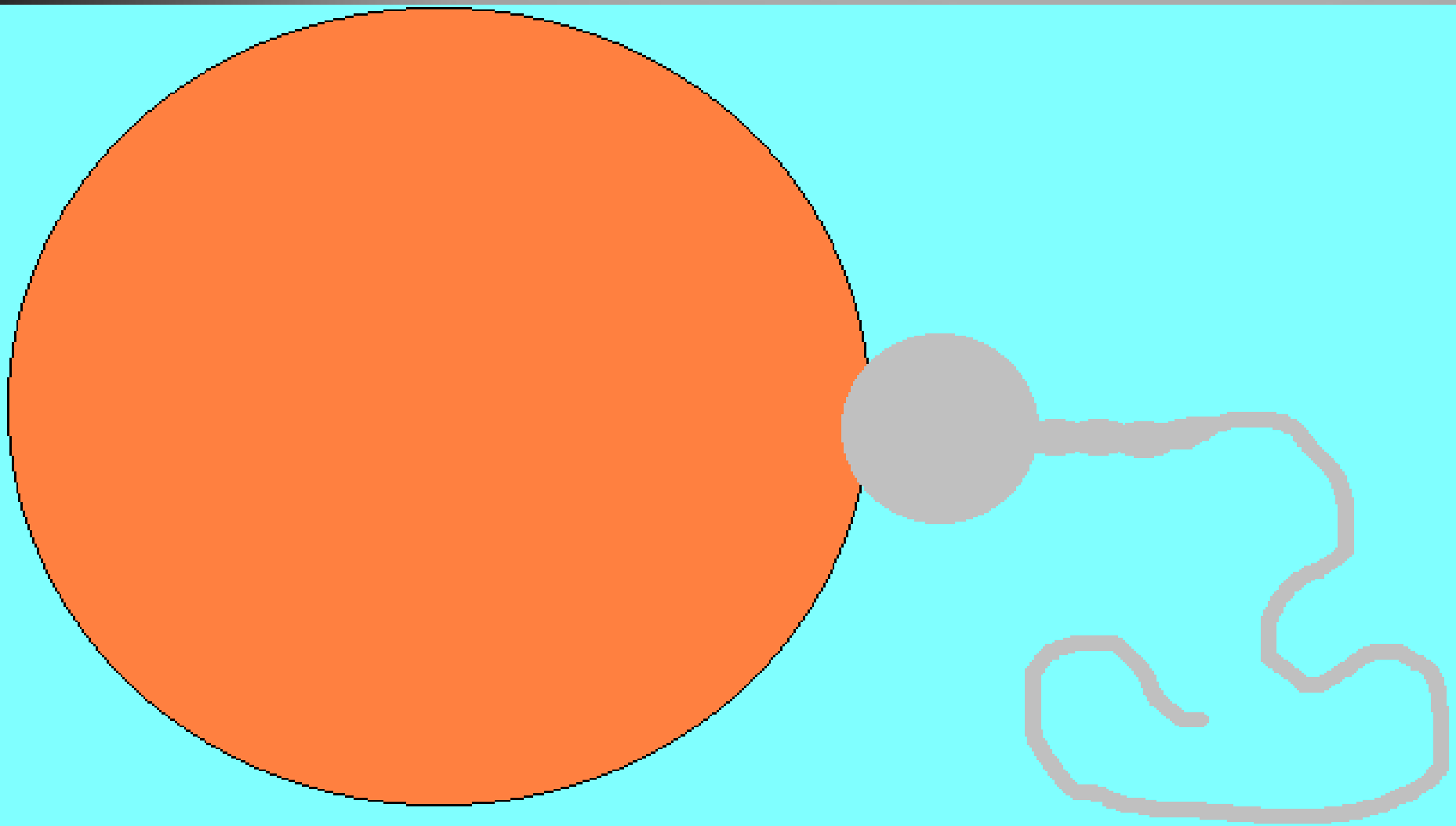
- Common jellyfish reproduction

1. Adult Male and Female

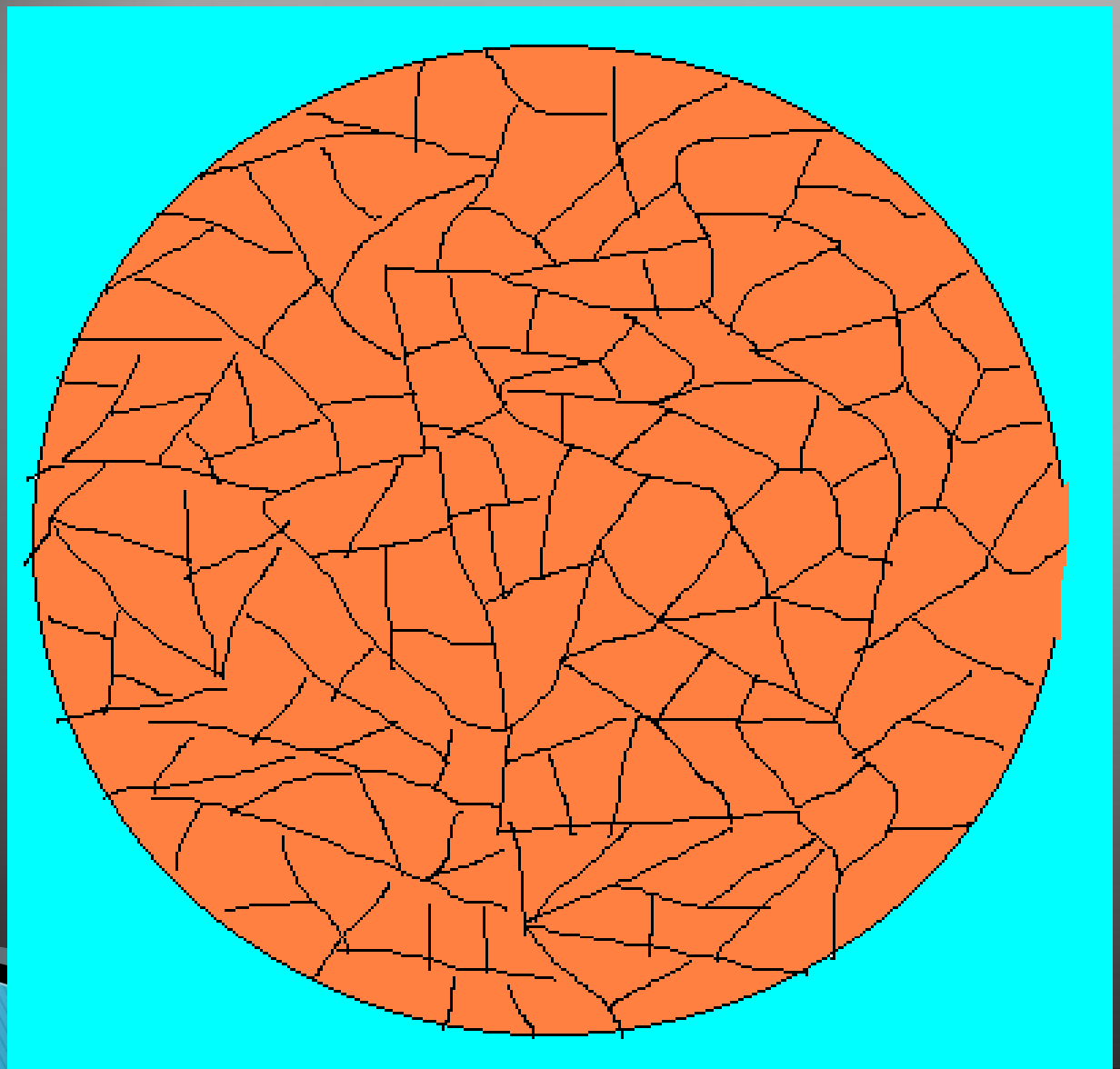


2. Egg and Sperm are Released

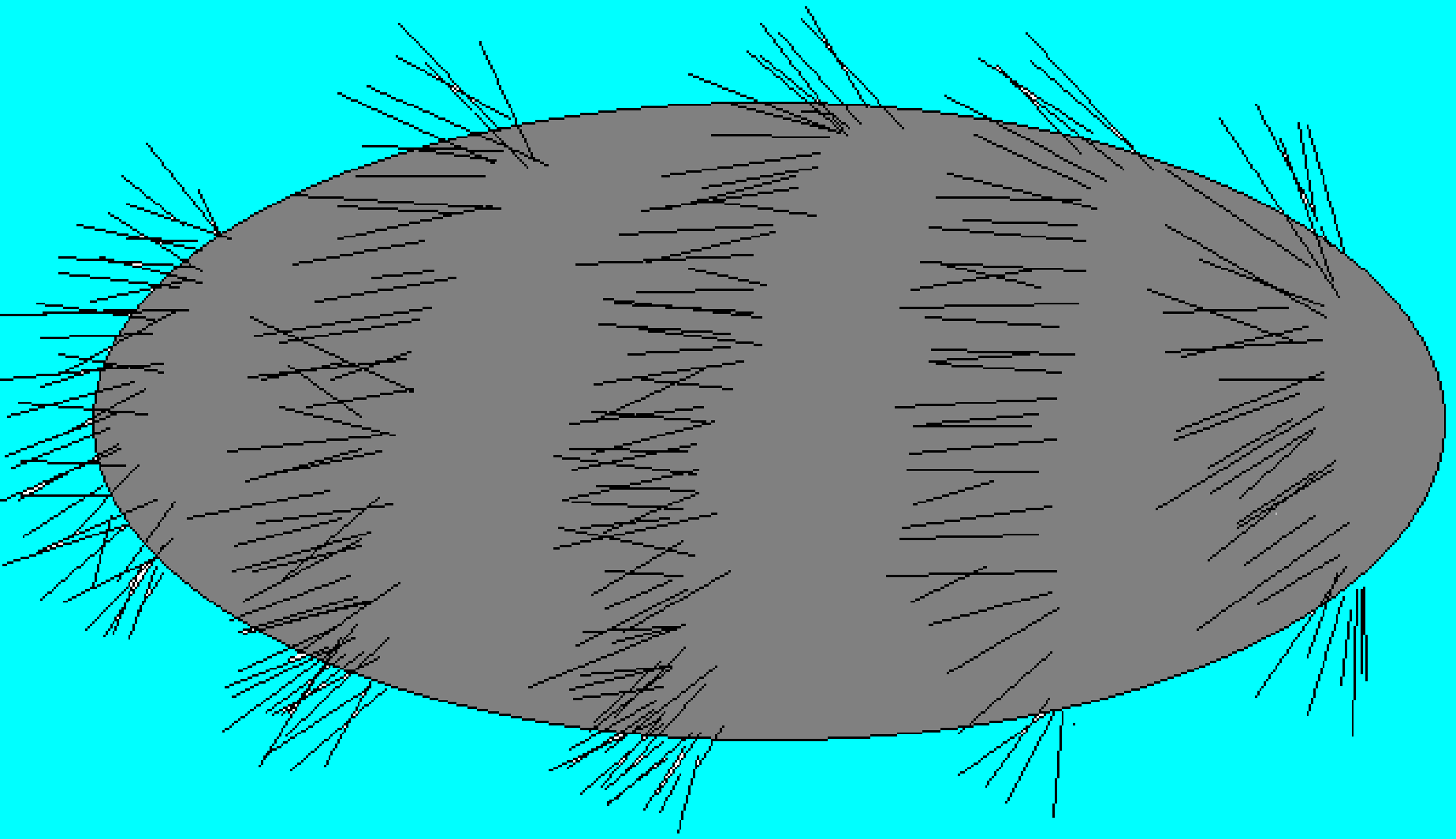
Fertilization



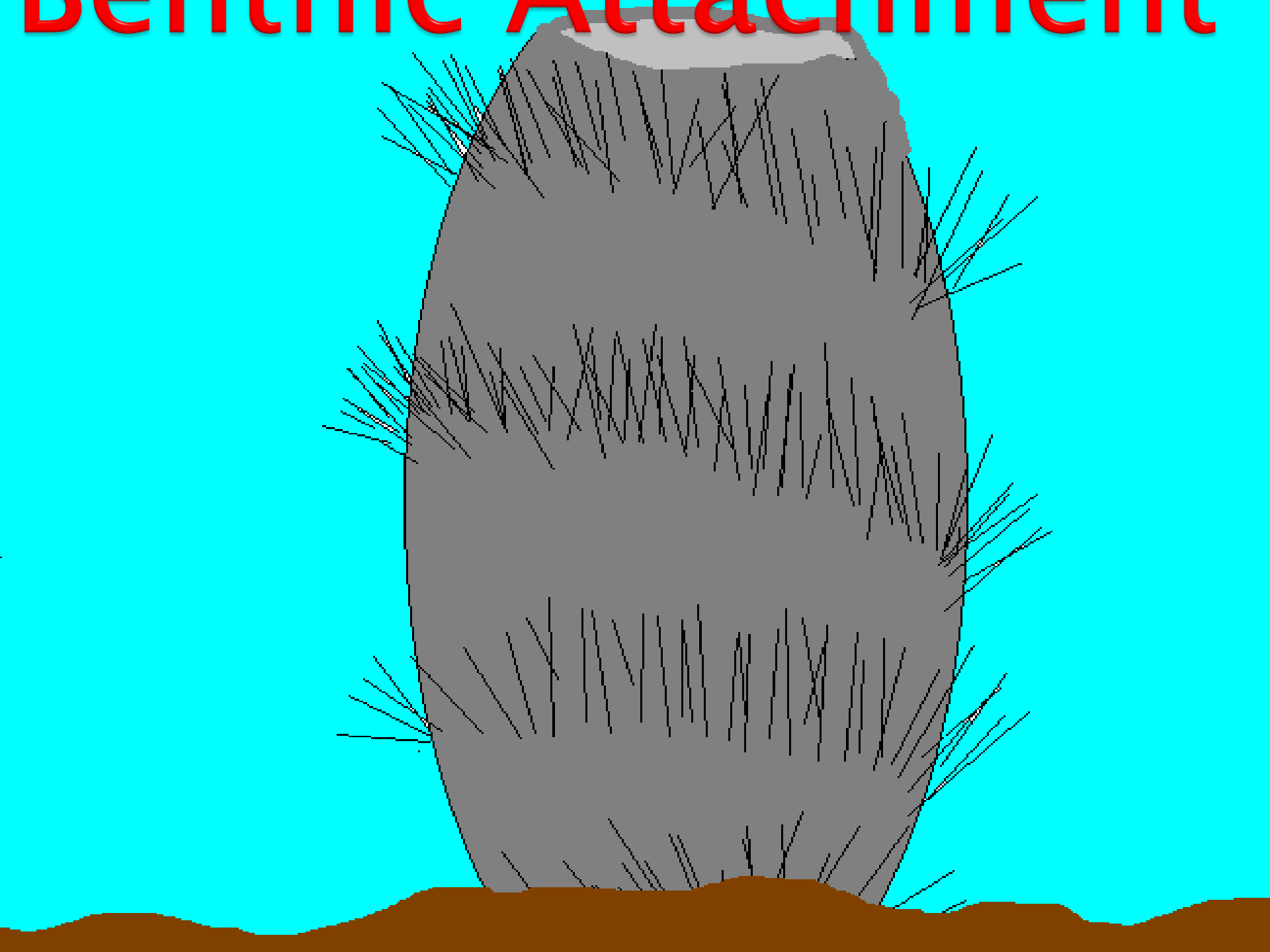
Blastula Formation

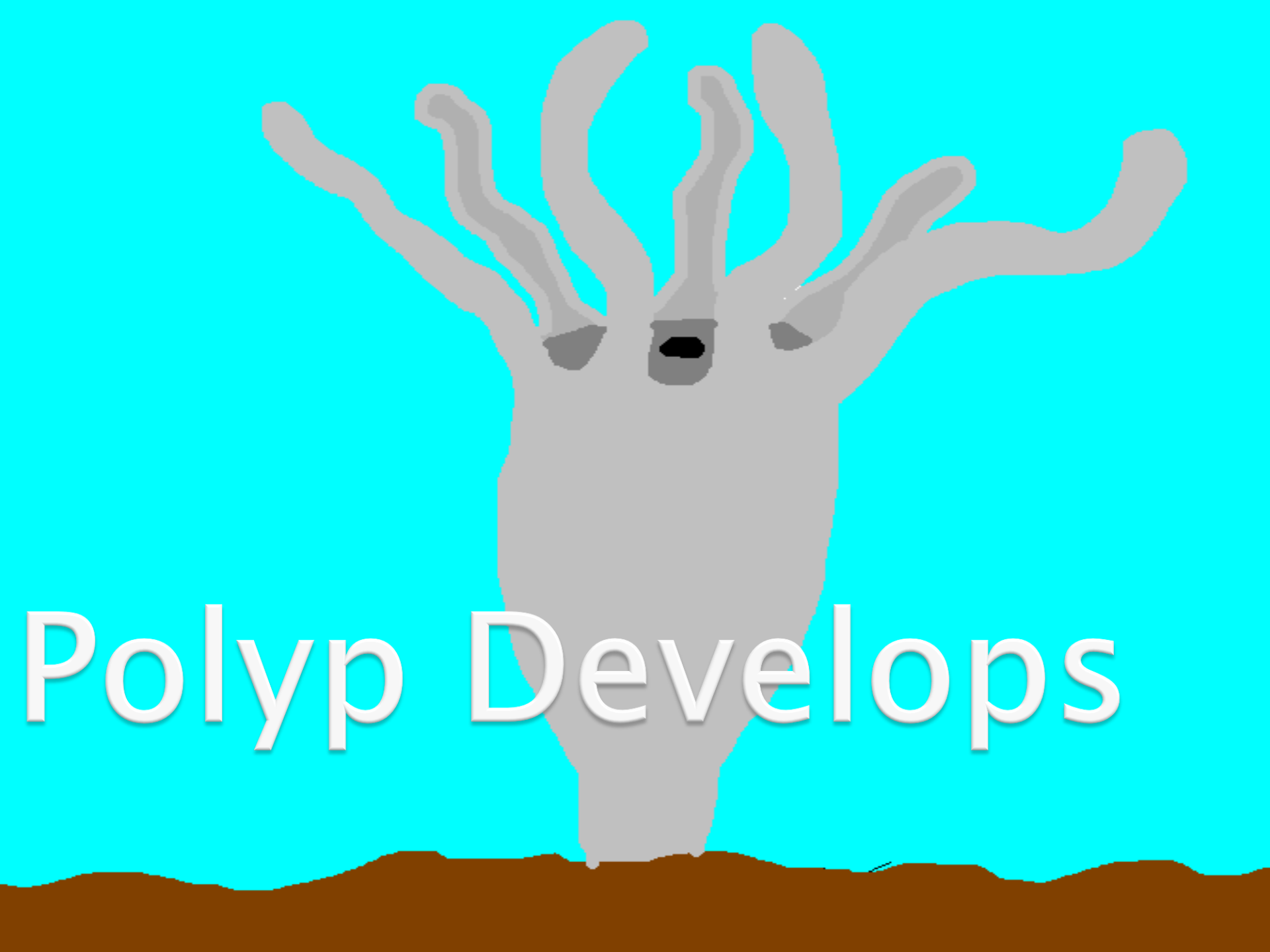


Planula Development

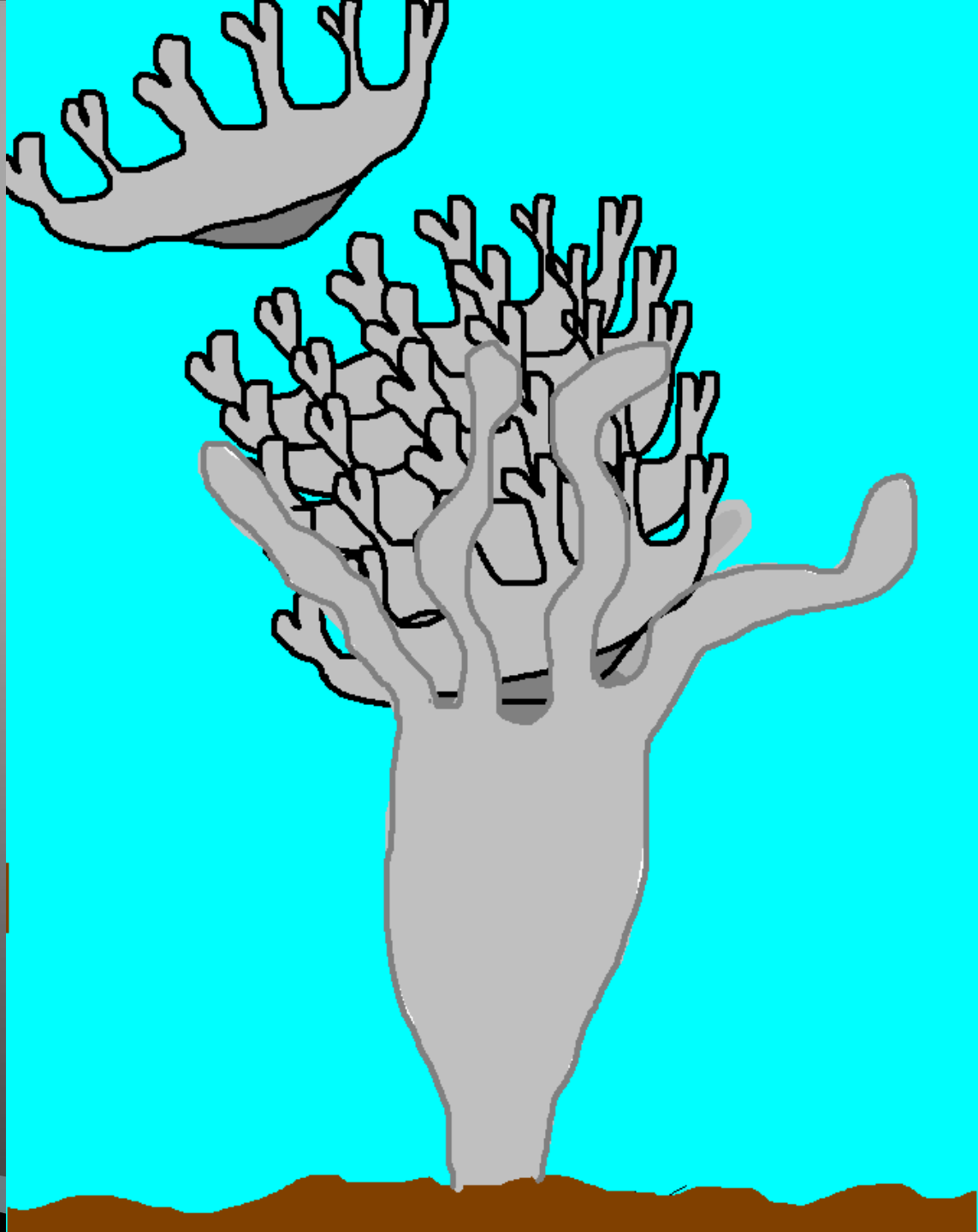


Benthic Attachment

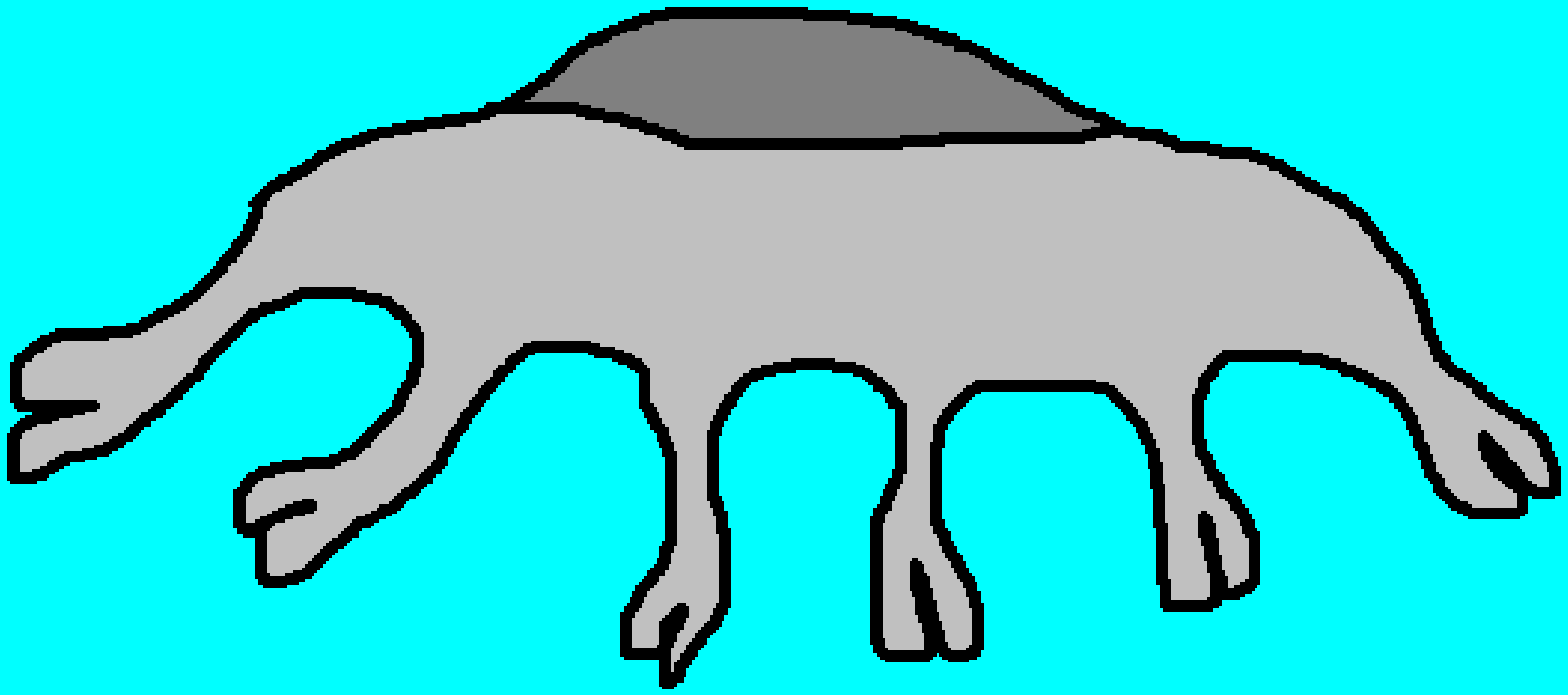


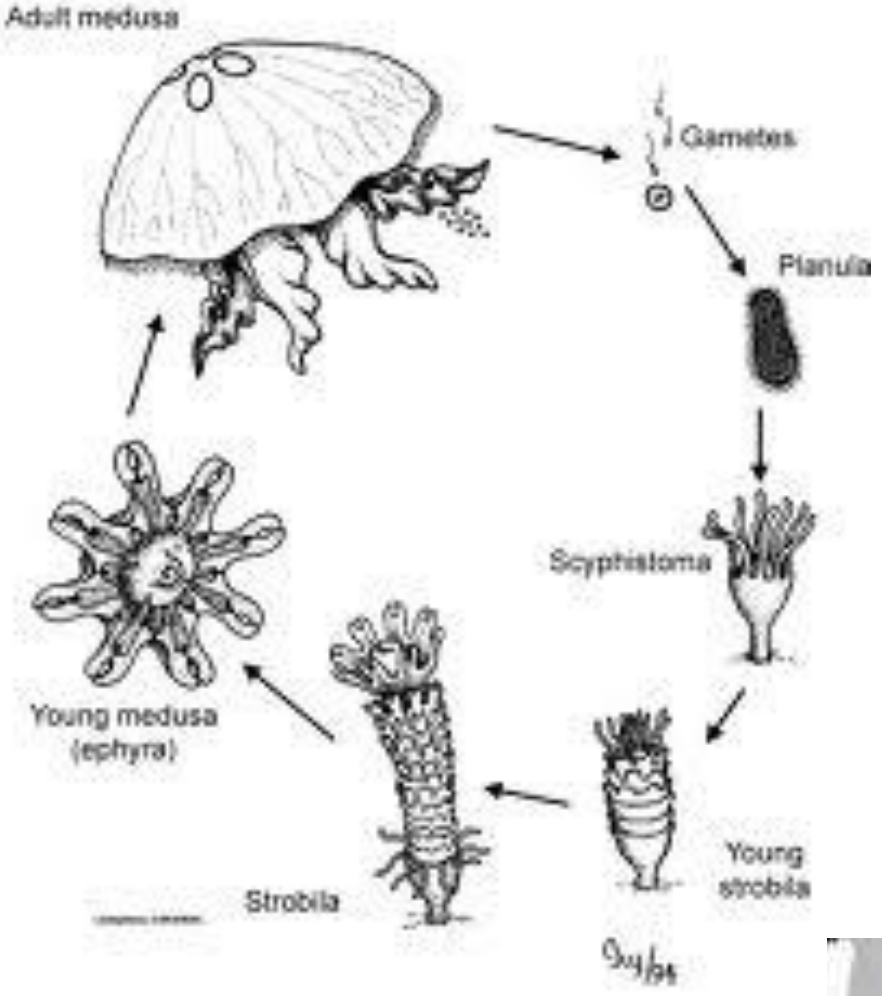

Polyp Develops

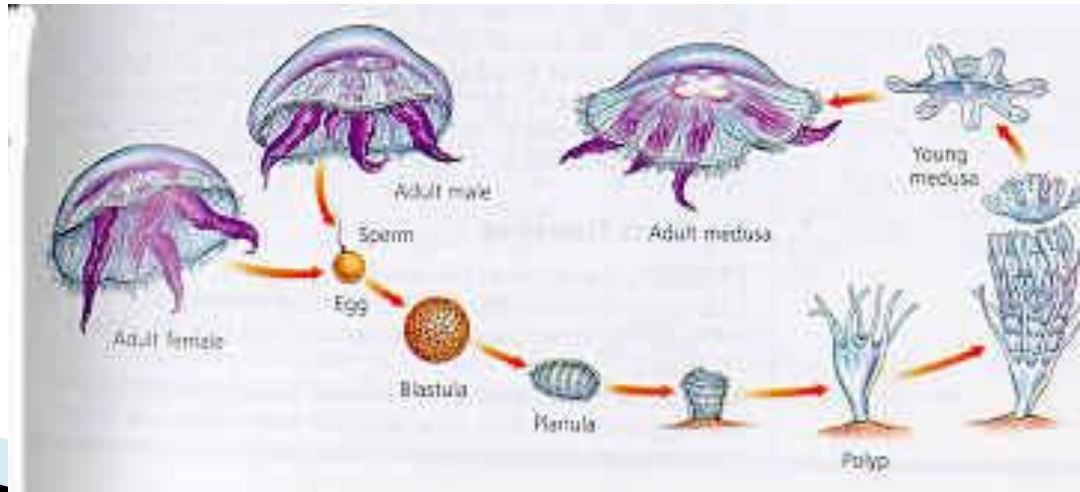
Stacks of Medusae form and detach



Young Medusa is Released




Adult medusa
Gametes
Planula
Scyphistoma
Young medusa
(ephyra)
Strobila
Young
strobila


Adult male
Sperm
Egg
Adult female
Blastula
Planula
Adult medusa
Young
medusa
Polyp

Class Cubozoa

- Box Jellies
- Most advanced and deadly
- eyespot

- (Irukandji, *Carukia barnesi*) which is the size of your fingernail.

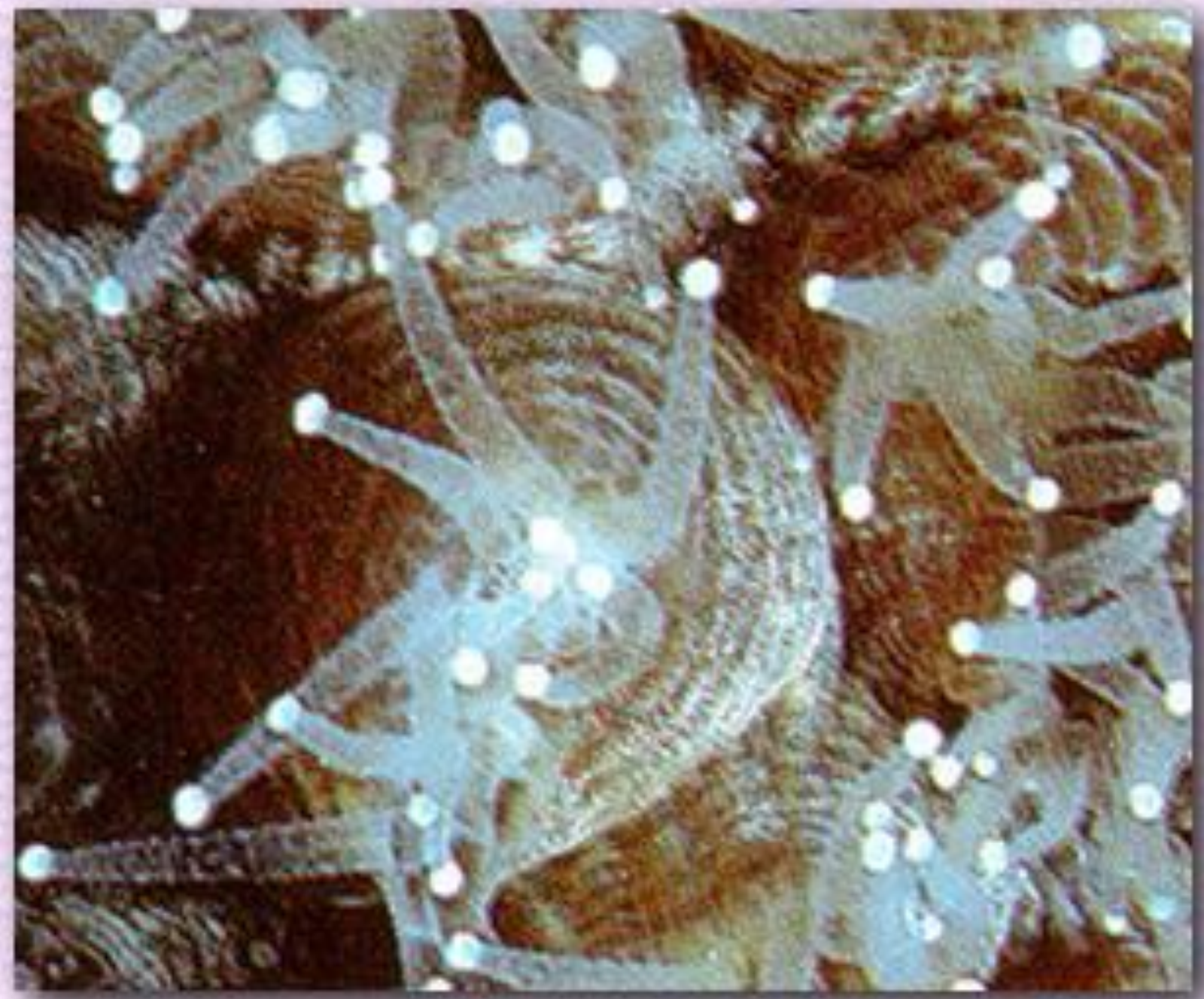
Class Anthozoa

- "Flower Animals"
- ~6100 Species
- Examples include Sea anemones and corals

- Sea anemones are benthic polyps
  - Commonly found in coastal areas
  - Feed on fishes and other small animals

- Symbiotic relationship with clownfish.
- Corals are small polyps that usually live in colonies.

- Each polyp cements its calcium carbonate skeleton to the skeletons of others
- Live symbiotically with algae

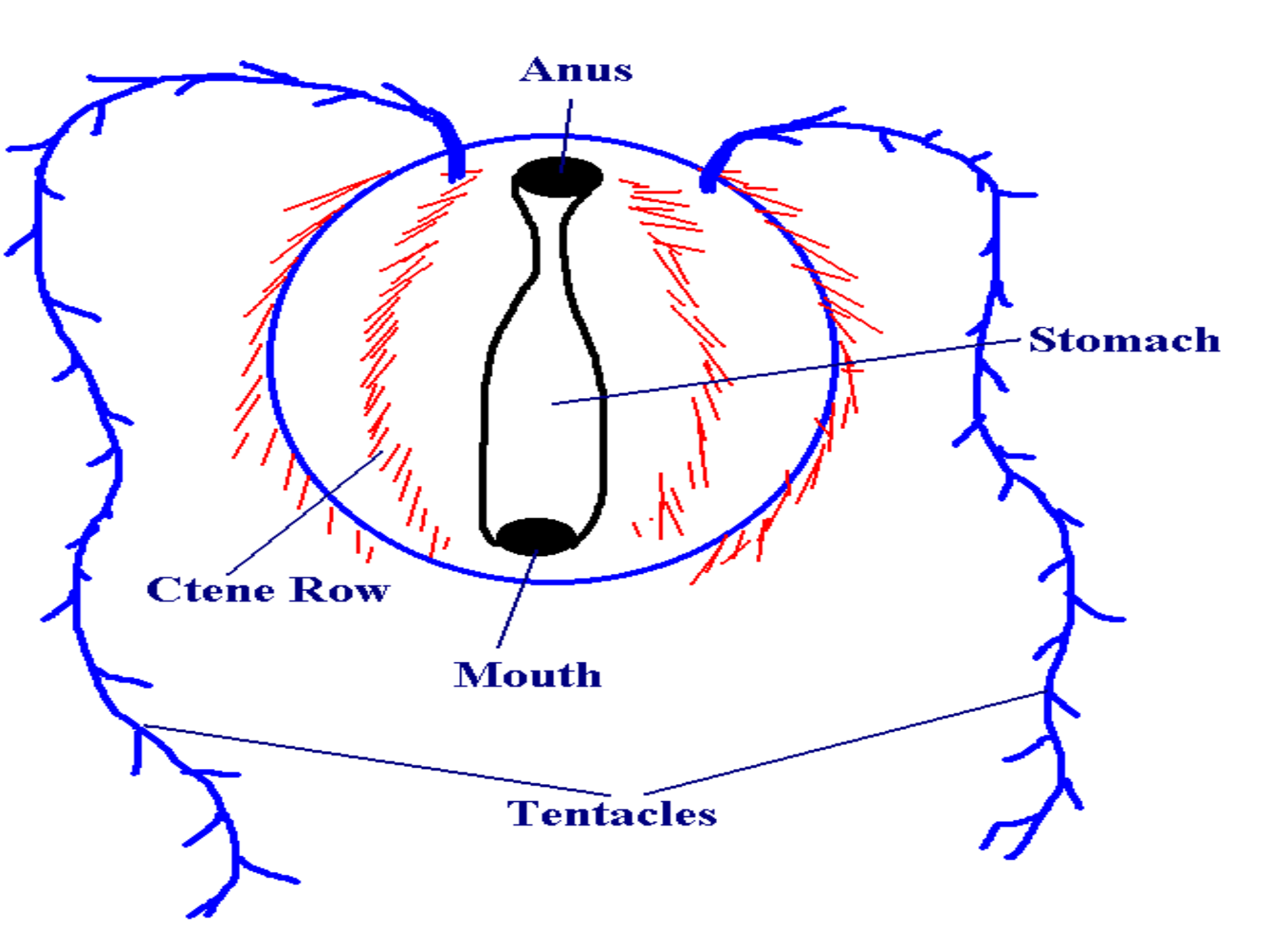


Phylum Ctenophora

- "Comb holder"– comb jellies
- ~100 species
- Move by beating cilia (ctenes) lined along body

- Secrete sticky substance from colloblasts.
  - Some have cnidocytes they recycle from eating cnidarians

- Two tentacles
- Bioluminescent


Anus
Stomach
Ctene Row
Mouth
Tentacles