

Phylum Porifera (Sponges)

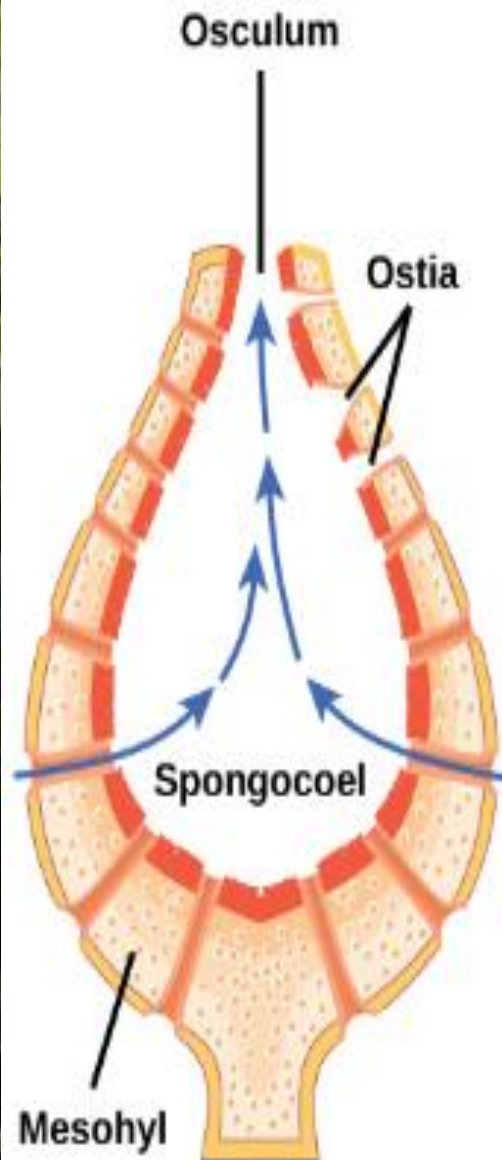


Dr. Khalid M. Salih

Definition

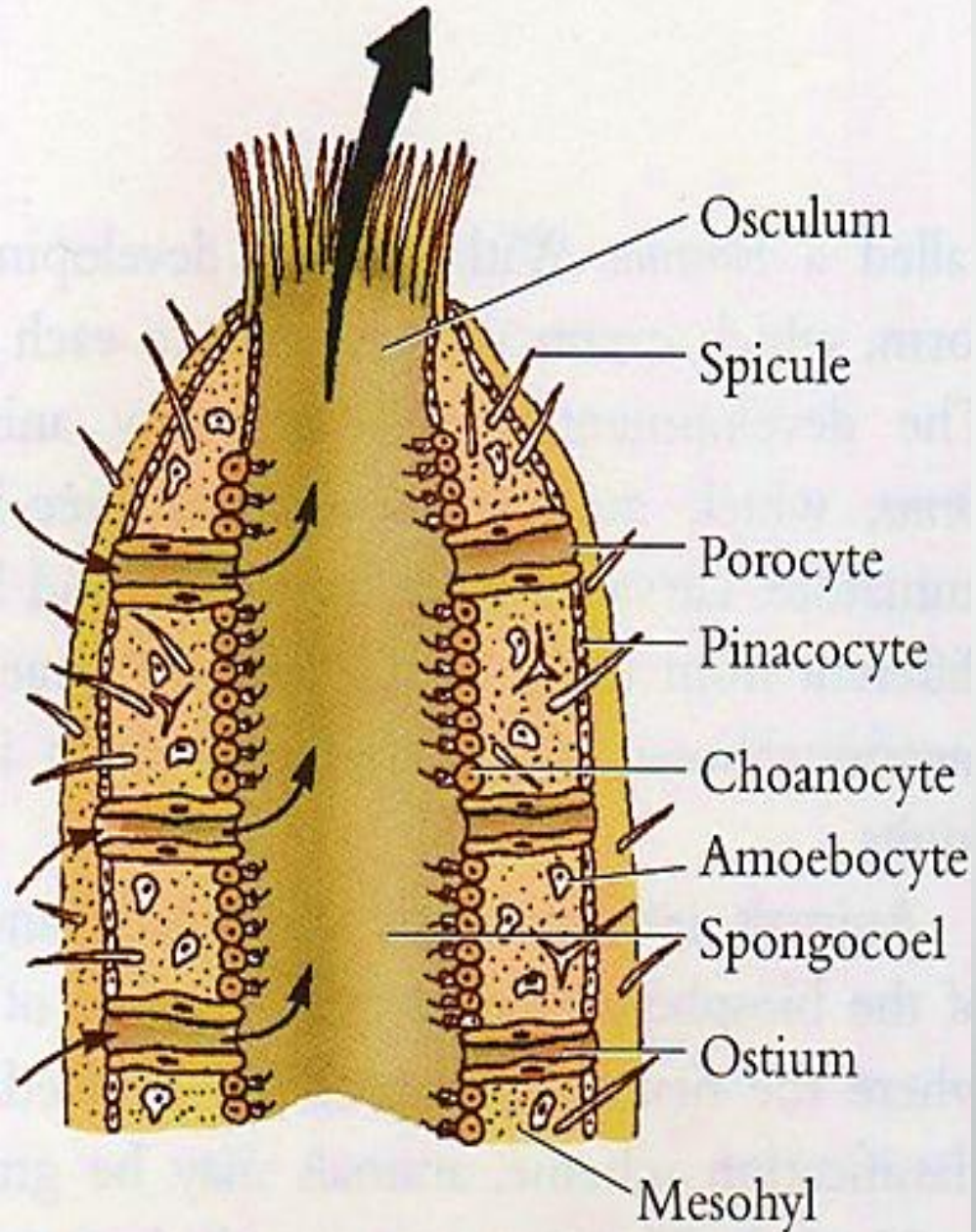
- Porifera is the only phylum of the *Parazoa* (no true tissues) in the Kingdom Animalia.
- More than 5000 animal species of Sponges constitute the Phylum Porifera
- Sponges are mostly marine inhabitants , but few are fresh water.
- They found wherever there are rocks, shells, or coral to provide a suitable substratum.
- Most sponges prefer relatively shallow water, but some groups live in deep water.

Structure of Sponge



- Body wall encloses large cavity called **spongocoel**.
- Water enters spongocoel through numerous pores **ostia**
- Water leaves spongocoel through large aperture **osculum**.
- Body wall consists of jelly-like substance called **mesohyl**
- Mesohyl sandwiched between two thin layers of cells.

Body Wall Layers



1. The outer layer (epidermis)

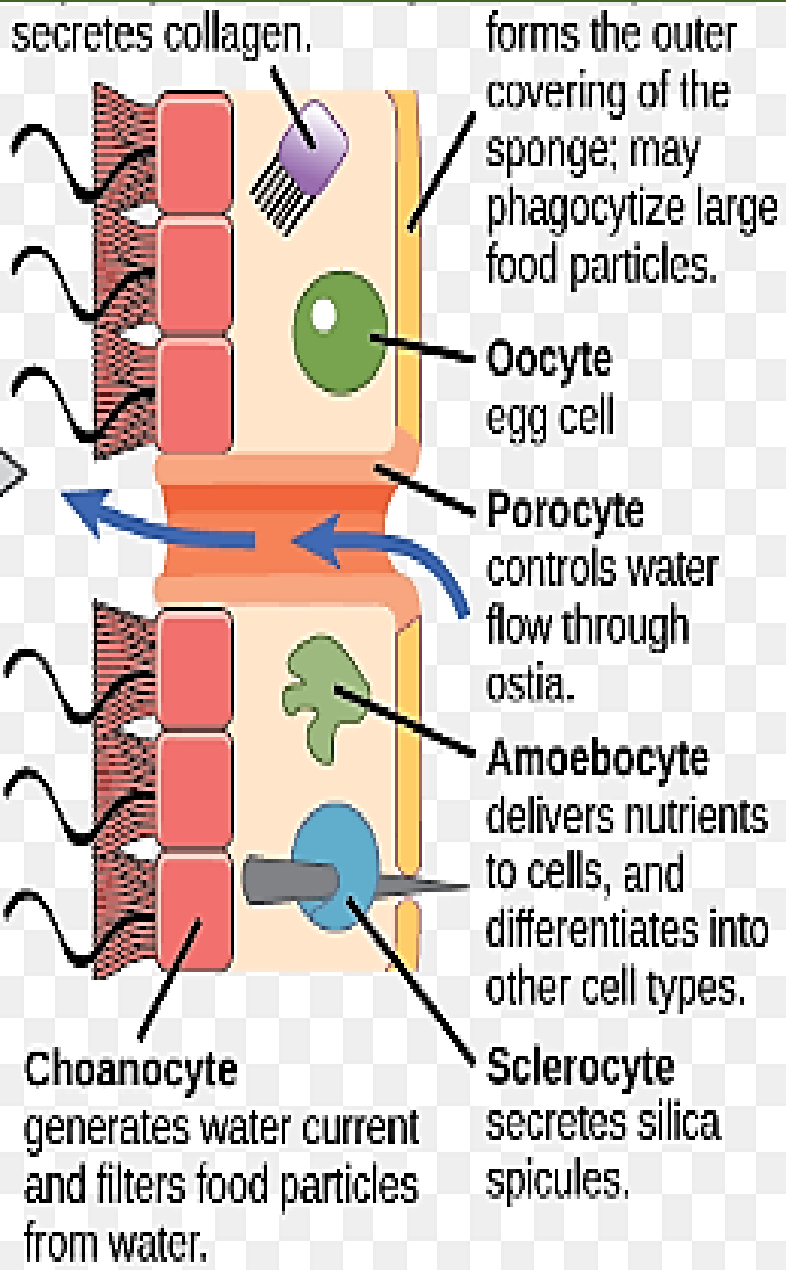
a) *Pinacocytes* (Plate-like cells):

- Cover the exterior and some interior surfaces.
- Digest food particles that are too large to enter the ostia.
- At the base of the animal are responsible for anchoring it.

b) *Porocytes* (Tube-like cells):

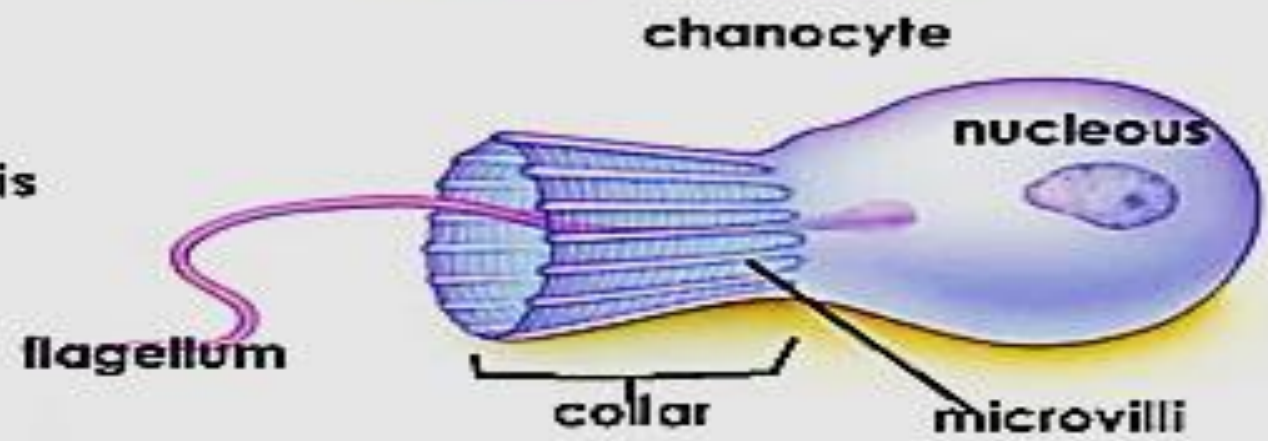
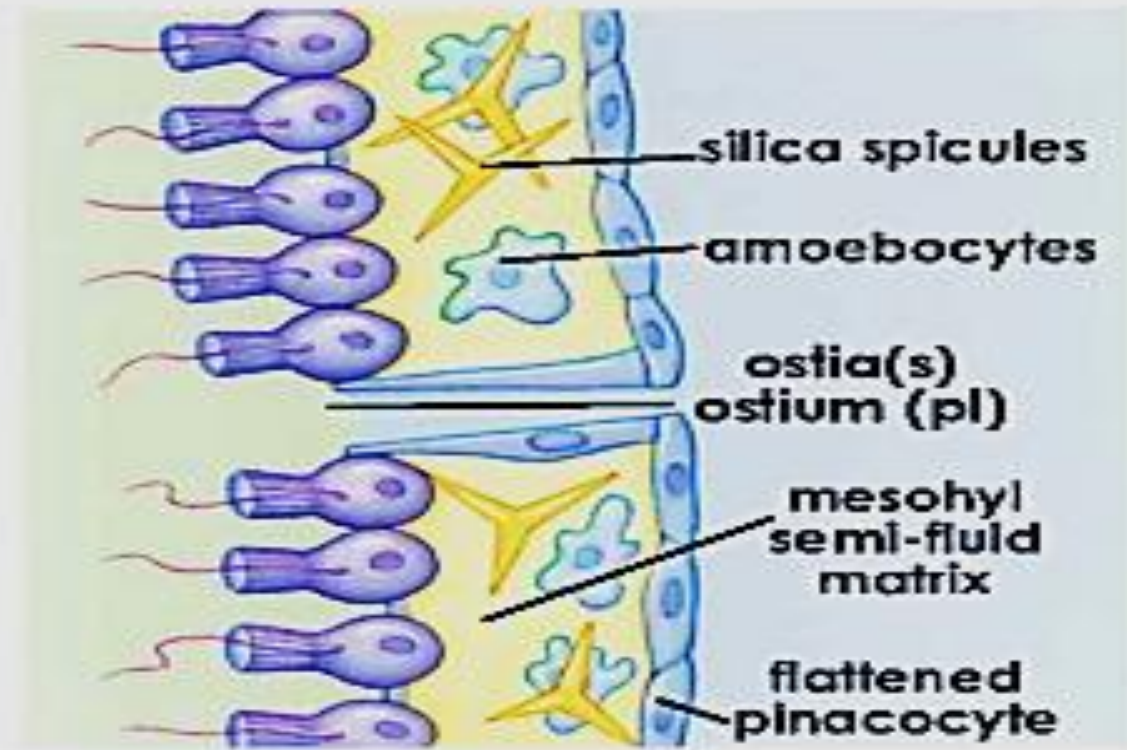
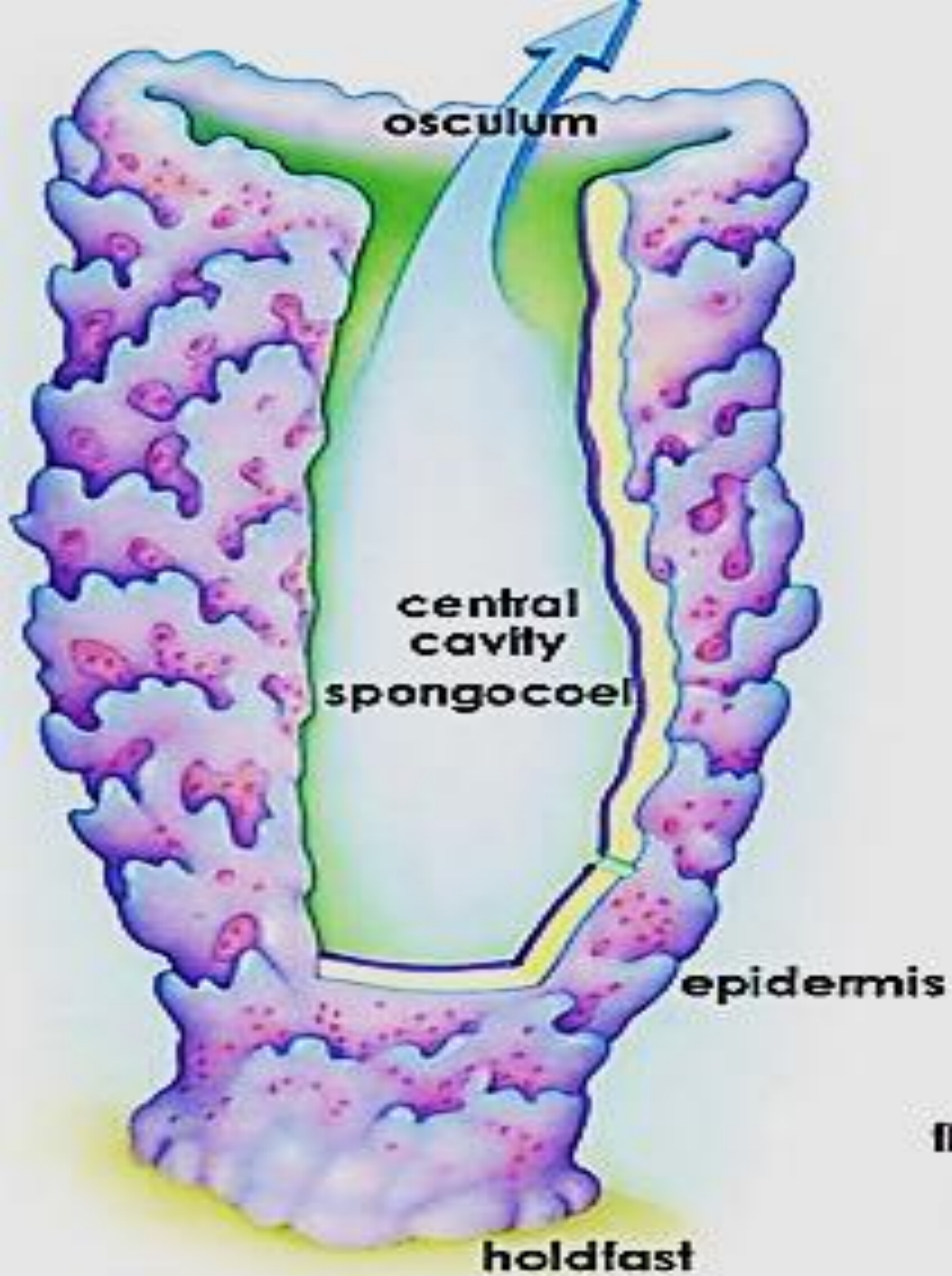
- Form closable inlet valves around **ostia**
- They are contractile and can change the size of the openings of the ostia
- Controlling the flow of water through the sponge.

Body Wall Layers



3. Mesohyl

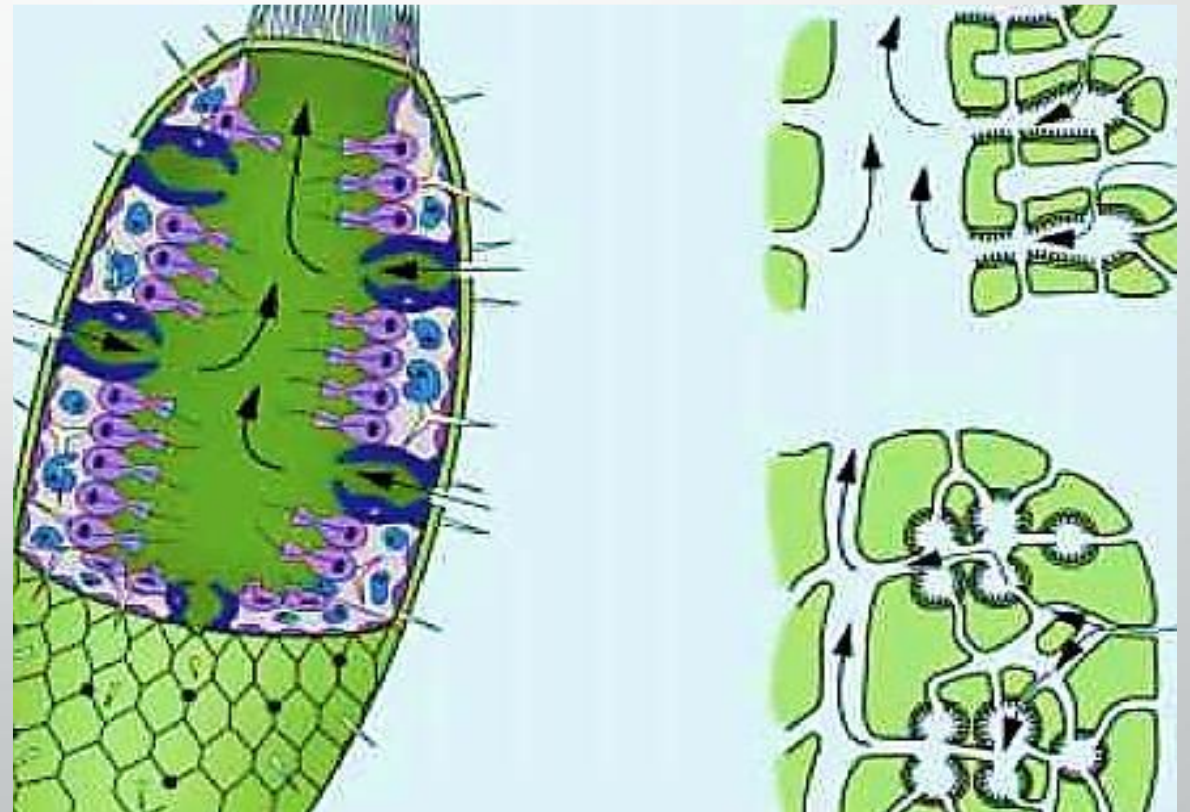
- Connective tissue supported by the skeletal elements.
- Contain *Archaeocytes* move by pseudopodia (*Amoebocytes*).
- These cells change into another cells to perform their main functions:
 1. Pick up food from choanocytes, digest it, carry nutrients to other cells.
 2. Carry oxygen to other cells, and eliminate waste products.
 3. Convert into *Oocytes & Spermatoocytes* (for sexual reproduction)
 4. They are the basis of some asexual reproductive *gemmules*.
 5. They maintain the structure of the sponge via converting into:
 - *Spongioblast* that secrete the spongin fibers of the skeleton.
 - *Scleroblast* that secrete spicules
 - *Collencyte* that secrete collagenous fibrils.



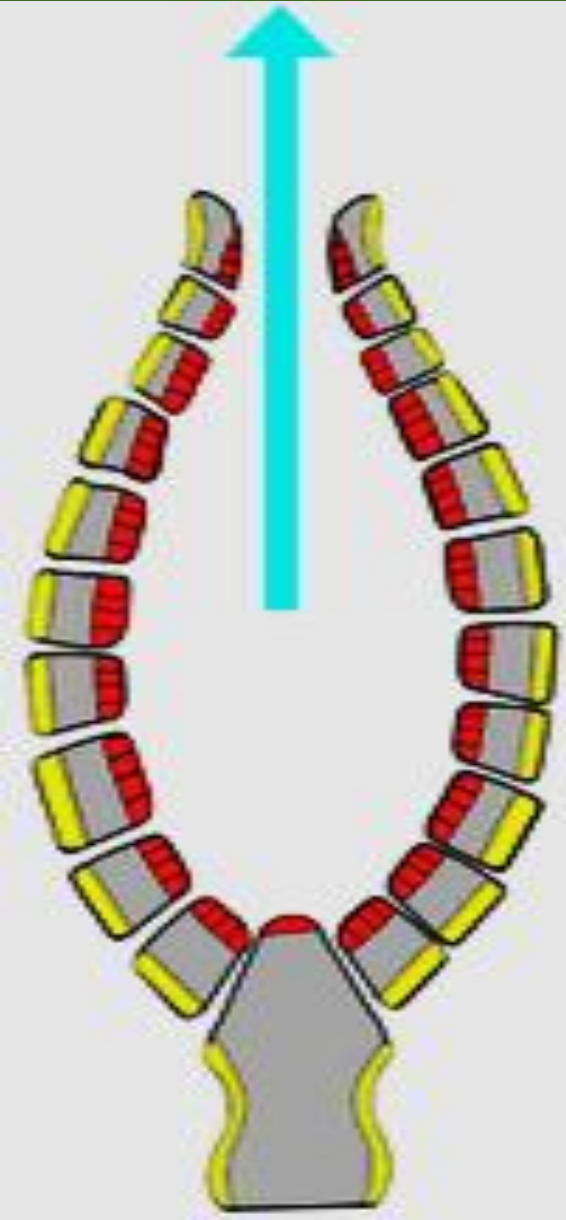
Water Flow & *Sponge Shape*

- Most of the canals system are lined with choanocytes to keep the water flowing through the canals in the correct direction (enters the ostia to spongocoel and leaves through osculum) by beating their flagellum.
- There are three main types of canal system in sponges that result in different shapes:

1. *Asconoid sponges*
2. *Syconoid sponges*
3. *Leuconoid sponges*

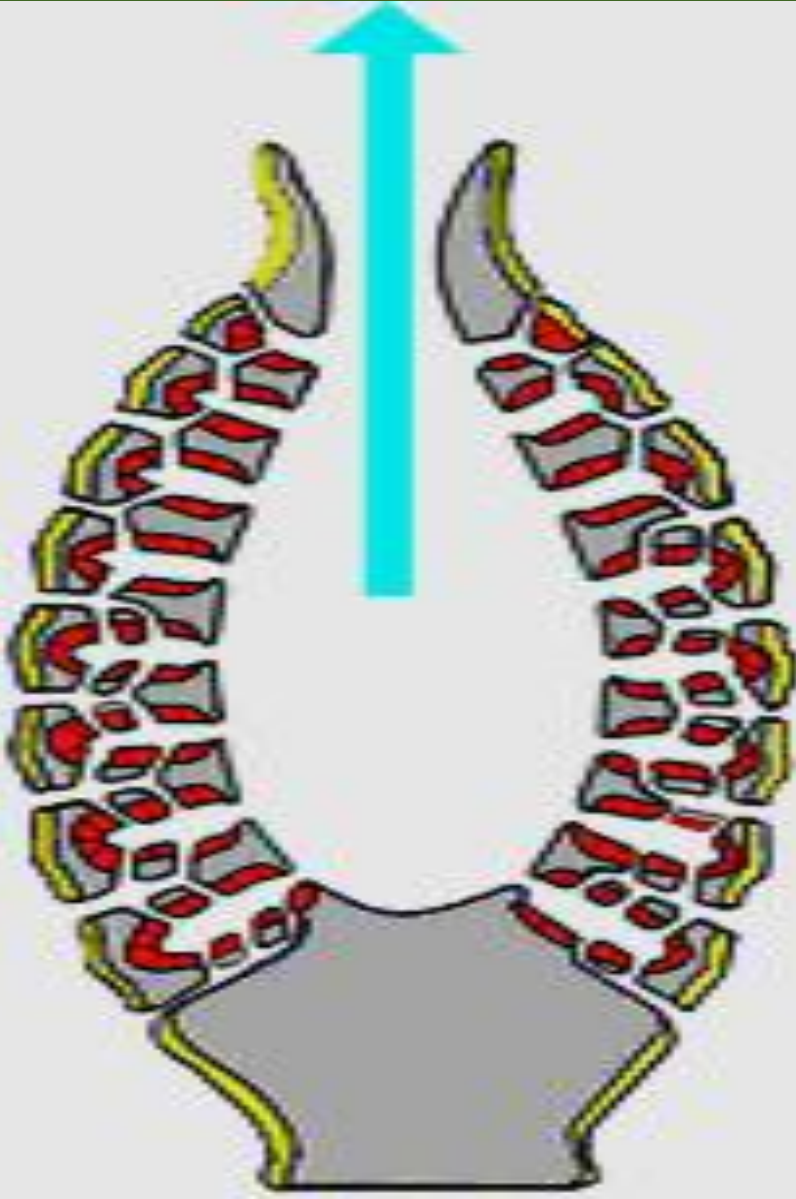


1. Asconoid shape



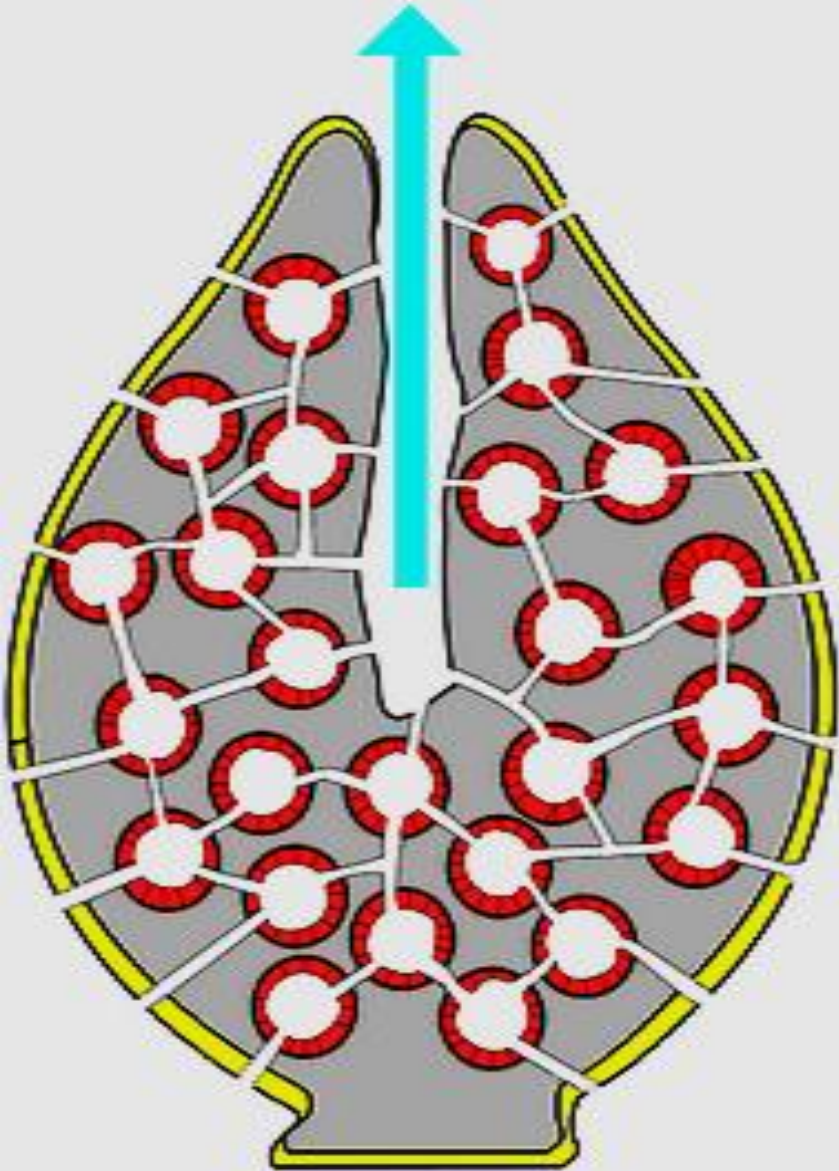
- The simplest body structure in sponges.
- The canals run straight from ostia to spongocoel.
- All the spongocoel is lined with choanocytes
- Diameter is seldom exceed 1 mm (limits the size of animal)
- Grow in groups attached to some object in shallow seas.

2. Syconoid sponges



- Slightly complicated by branching canals.
- Water not flow straight in to the spongocoel.
- Body wall is pleated & become thicker (few cm. diameter).
- The spongocoel is not lined with choanocytes only the canals.
- This increase in the number of choanocytes and pumping
- Do not form groups as do asconoid sponges.

3. Leuconoid shape

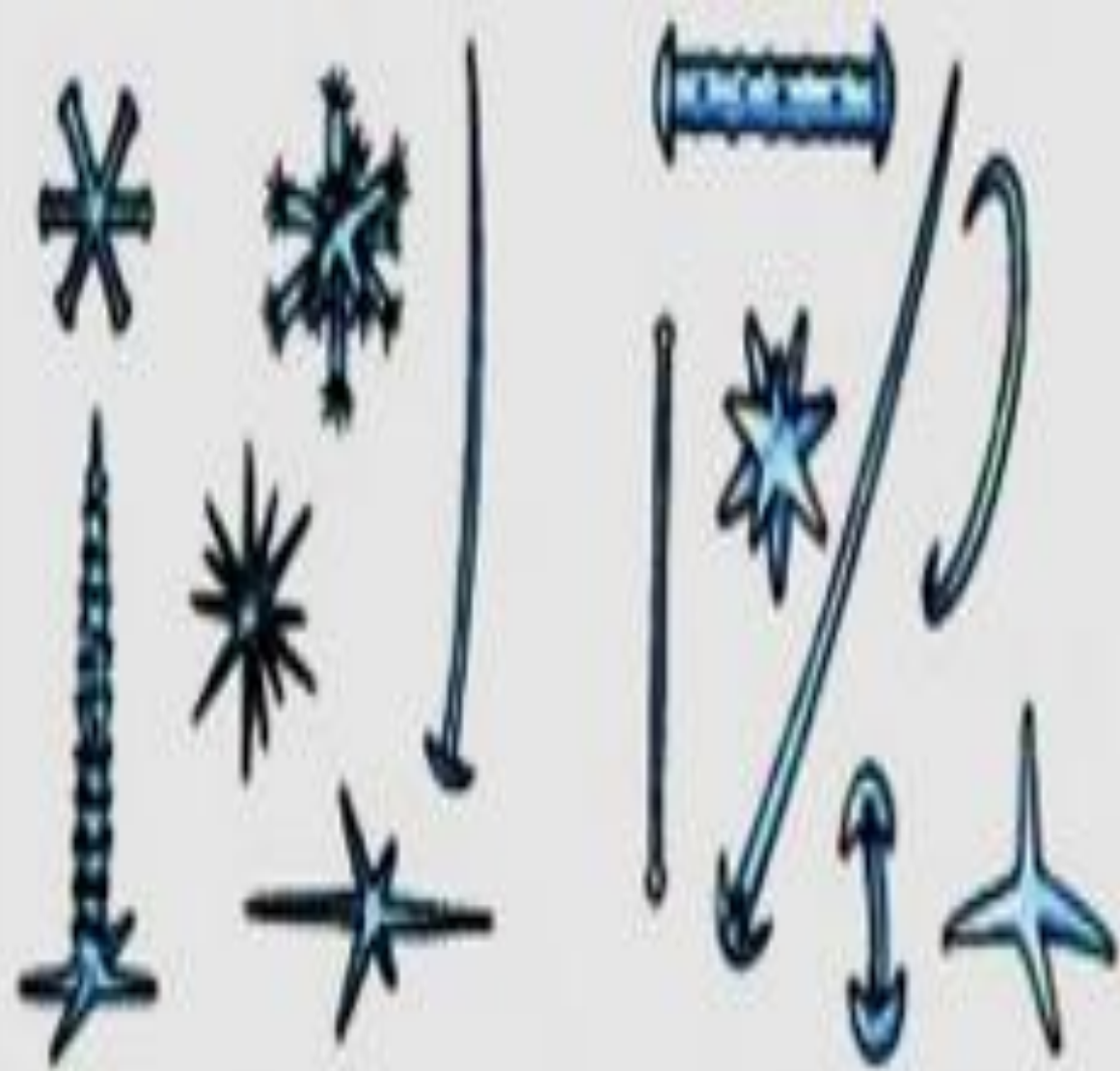


- More complicated (longer canals & more branched)
- There are no choanocytes in the canals.
- Canals lead to **chambers** lined by **choanocytes**.
- No real spongocoel just a central exit leading to **osculum**.
- Body wall grow in any direction to over 1 m in diameter.
- Water flow slower & makes choanocytes easier to trap food.
- Live in large groups each sponge having its own osculum.

Sponge skeleton

The mesohyl of sponges is stiffened by skeleton of two main components:

- 1. *Spongin Fibers*** (Protein fibrils) forms a tough fibrous network that Conjunction with the spicules.
- 2. *Spicules*** (Crystals) produced from compounds precipitated by **scleroblast**:
 - vary in shape from simple rods to three-dimensional stars with up to six rays
 - Spicules are either **calcareous** (calcium carbonate) or **siliceous** (silicate salts).
 - Serve at least two roles in the sponge:
 - a) Kind of mesh-work internal skeleton
 - b) Protective device against predation.



Siliceous spicules



Spongin fibers



Calcareous spicules

Sponge Classification

Spicules are important in the classification of sponges into three classes:

1. **Calcarea (calcareous sponges):**

- Have spicules of calcium carbonate that have 1, 3 or 4 rays, without spongin fibers.
- They found as asconoid, syconoid, or leuconoid.



Sponge Classification

2. Hexactinellida (glass sponges):

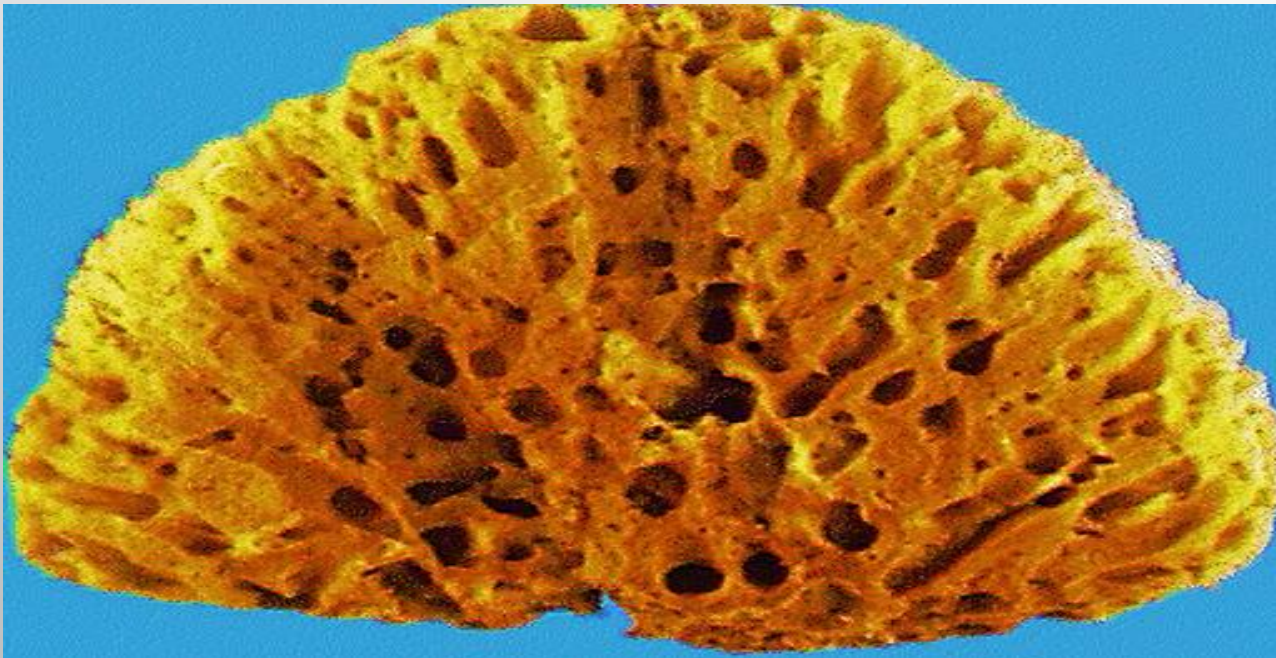
- Have spicules made from silica that are 6 rayed, without spongin fibers
- Found in leuconoid shape only



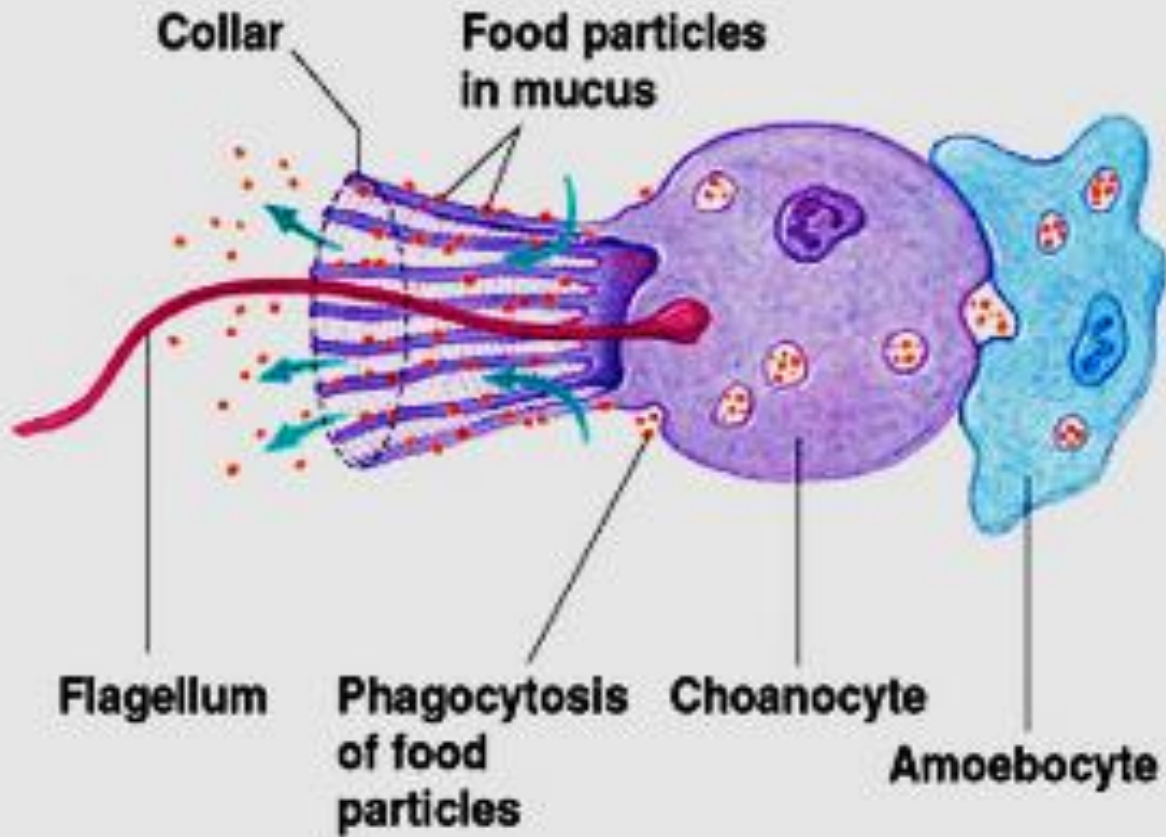
Sponge Classification

3. Demospongiae (demosponges):

- Have spicules made from silica with 1, 2, or 4 rays joined by meshwork of spongin fibers.
- Found as leuconoid shape only.



Sponge Feeding



There are several methods of feeding:

1. **Phagocytosis** (Most marine sponges)

- Large food particles Filtered by *pinacocytes*
- Small particles captured by *choanocytes*
- *Archaeocytes* transport food packaged in vesicles from cells that directly digest food to those that do not

Sponge Feeding



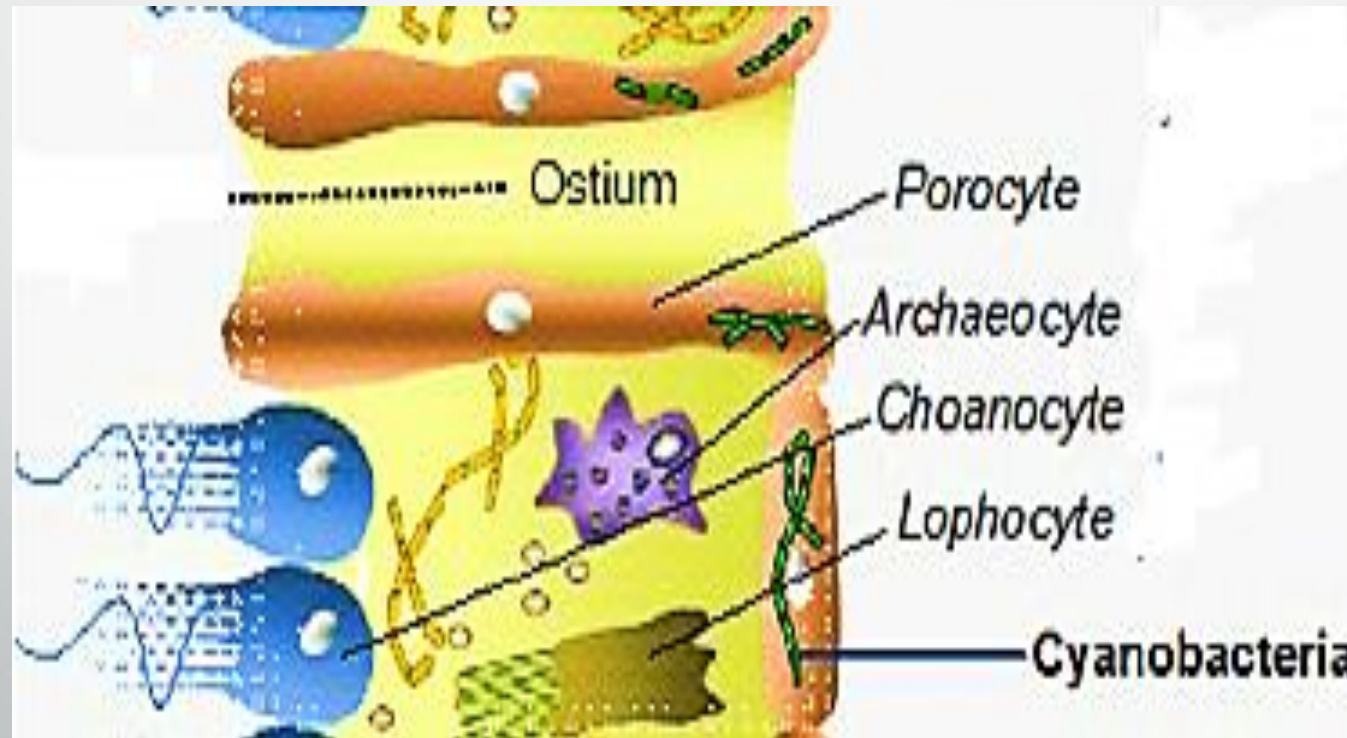
2. *Carnivorous sponges* (few species)

When the supply of food particles is very poor, so they prey on crustaceans and other small animals.

Sponge Feeding

3. Endosymbiosis (Freshwater & many marine species)

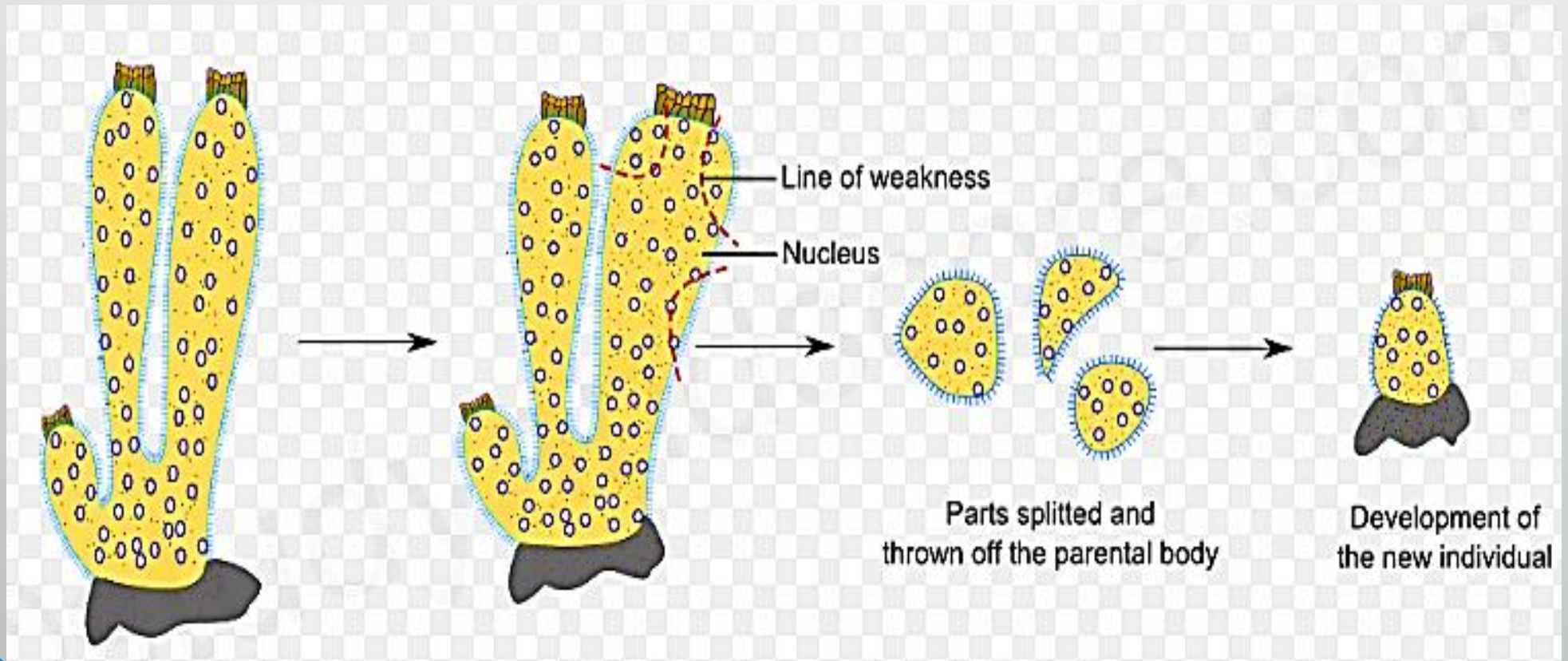
- Archaeocytes & other cells of sponges host *endosymbionts* (green algae & cyanobacteria)
- Benefit from nutrients produced by these photosynthesizing organisms.



Asexual reproduction of Sponge

1. Fragmentation:

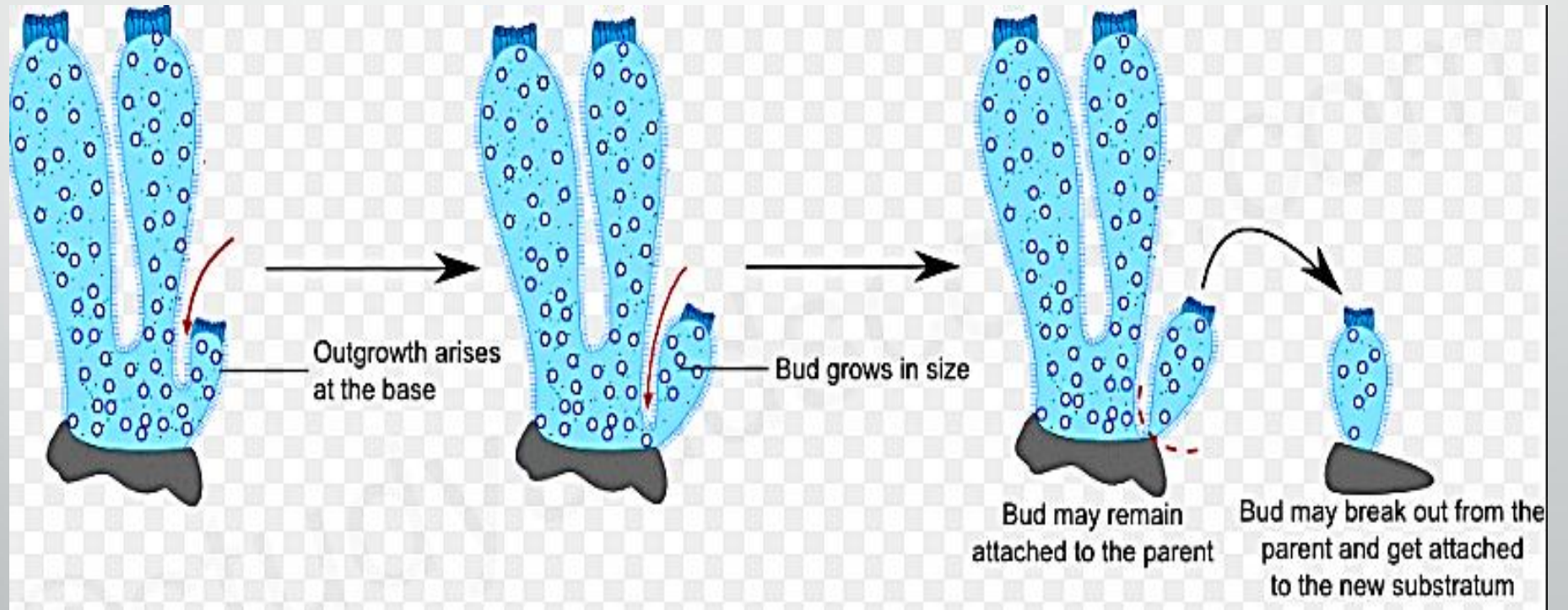
- Pieces of sponge are able to regenerate into whole new sponges.



Asexual reproduction of Sponge

2. Budding:

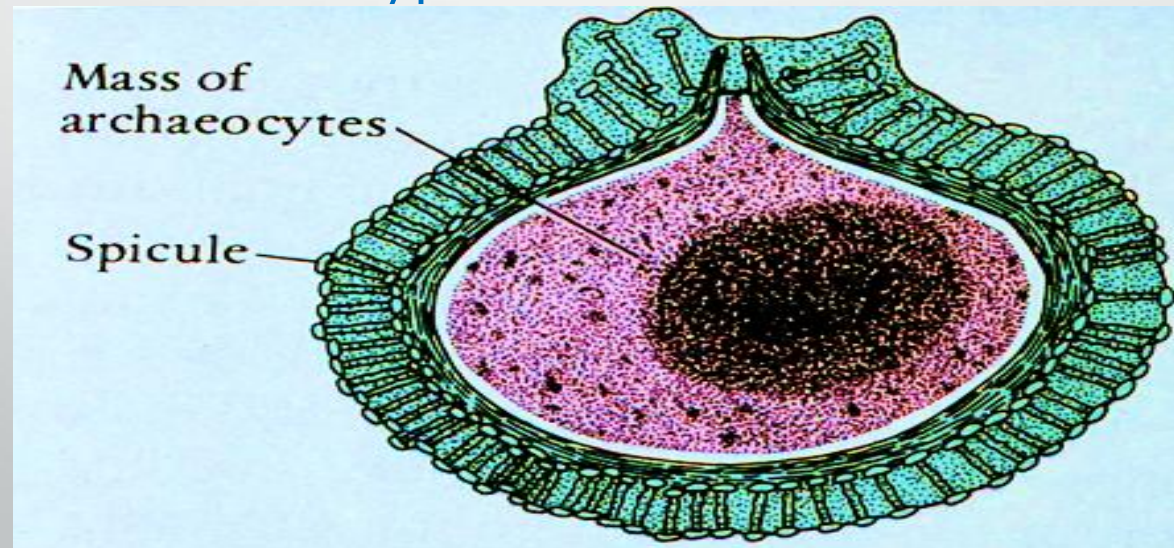
The buds may remain attached to the parent or separate from it, and each bud develops into a new individual.



Asexual reproduction of Sponge

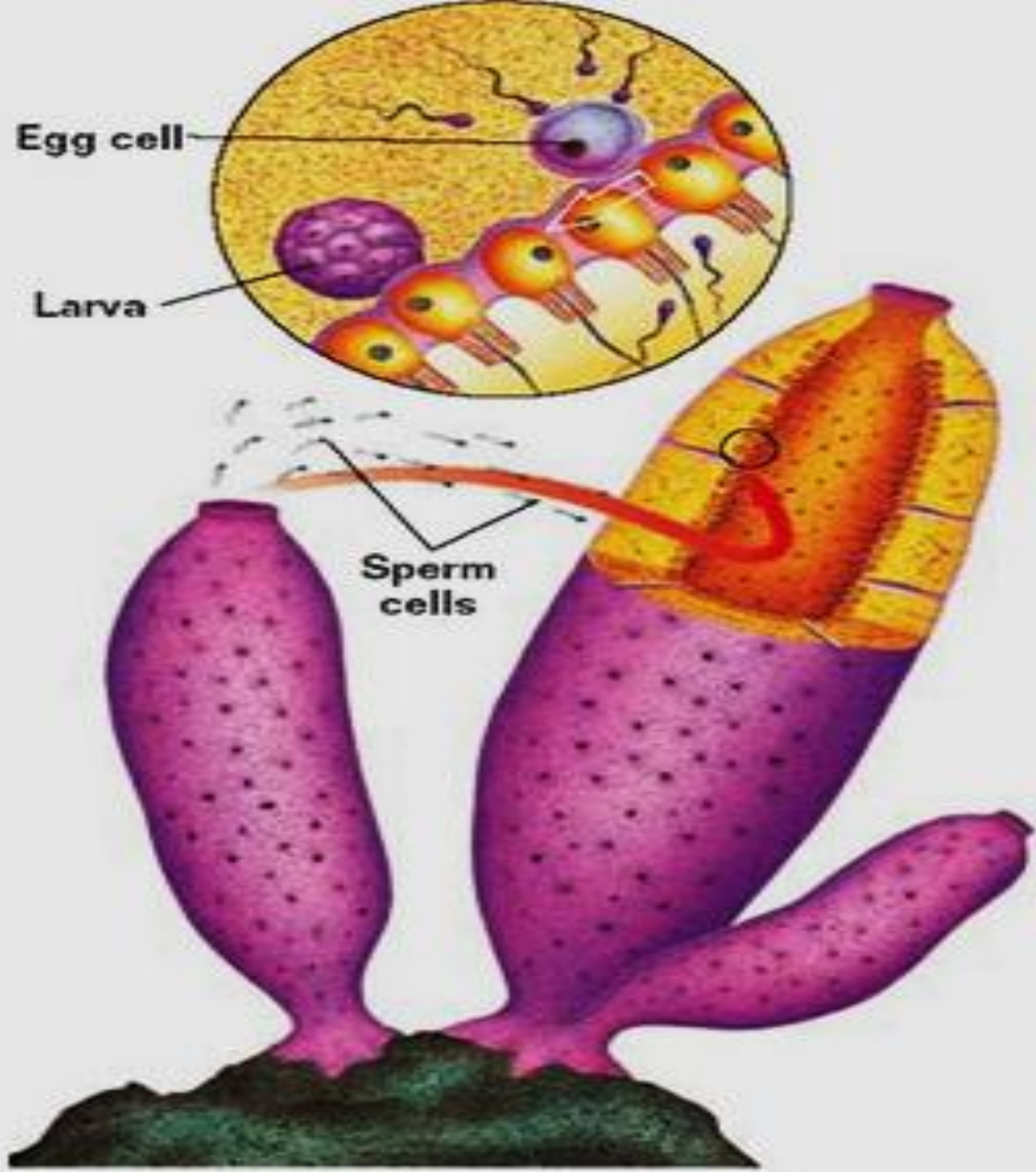
3. Gemmules:

- Freshwater sponges & several marine species, form resistant structures called *gemmules* that can withstand adverse conditions such as drying or cold and later develop into new individuals.
- Gemmules are aggregates of sponge *archeocytes* and food, covered by a hard coating containing spicules or spongin fibers.
- When a gemmule germinates, the archeocytes round the outside of the cluster and transform into other cell types needed to make a functioning sponge.



Sexual Reproduction in Sponge

- Most sponges are *hermaphrodites* (function as both sexes, the same individual producing eggs and sperm), but in some species the sexes are separate.
- **Sperms** are produced by choanocyte, while **Eggs** are formed by transformation of archeocytes, or of choanocytes in some species.
- **Fertilized eggs** either released into the water or retain until they hatch into a swimming larvae.
- The larvae are flagellated and swim about freely for a short time and attaching to a suitable substrate and develop into young sponges.



THANK YOU

