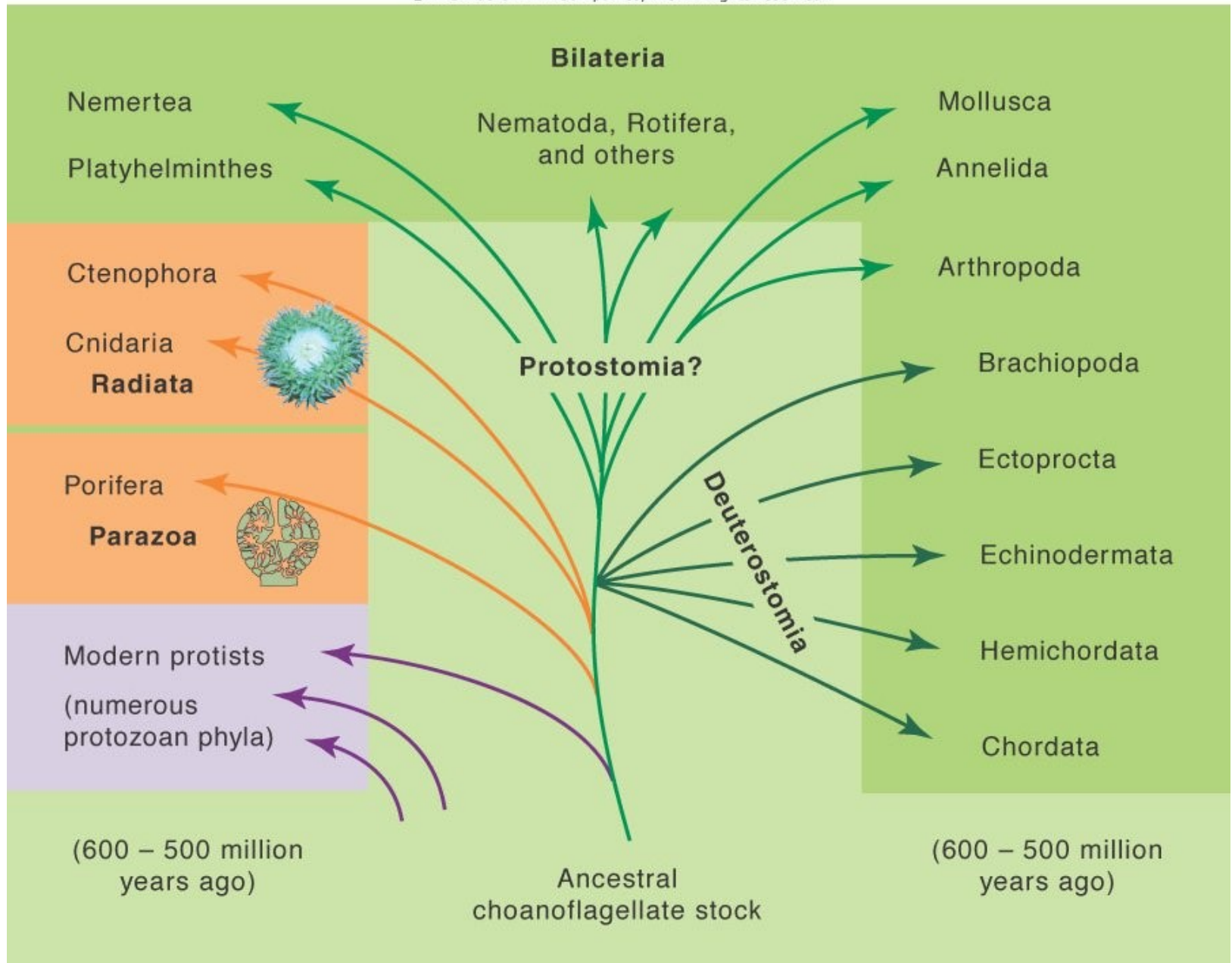


Multicellular and tissue organization

Phylum-Porifera

Dr. Dinesh C. Sharma



Phylum Porifera - Sponges

- Primarily marine animals that consist of loosely organized cells; approx 9k spp, from $< 1\text{cm}$ to $> 1\text{m}$



•Phylum Porifera Overview

- Most primitive of the multicellular animals**
 - There is some debate if sponges are complex colonial protozans and not metazoans.**

Sponges

- Over 7,000 species, approximately 40 species that occur in local waters**
- 2% of all sponges are freshwater, none are terrestrial**
- Sponges occur in shallow water habitats and vary widely in size (up to 1m. high) and shape**
 - Unlike most metazoans they lack:**
- All sponges are sessile filter feeders**

Sponge Diversity



Erect Rope
Sponge



Black-ball sponge



Yellow Tube
Sponge

Phylum Porifera



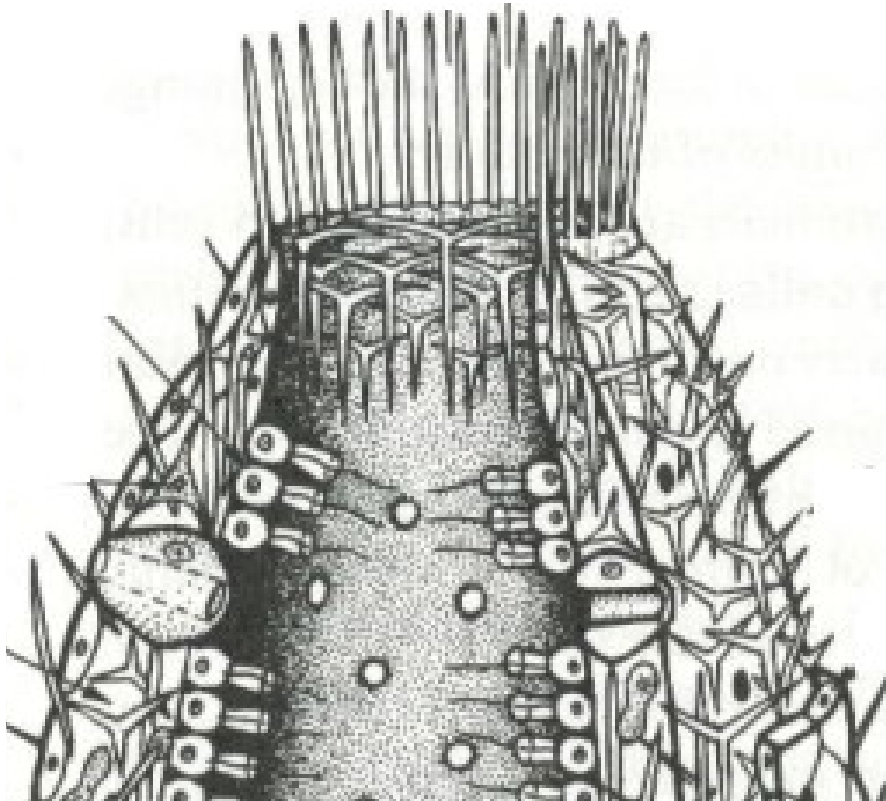
(a) Verongia

Figure



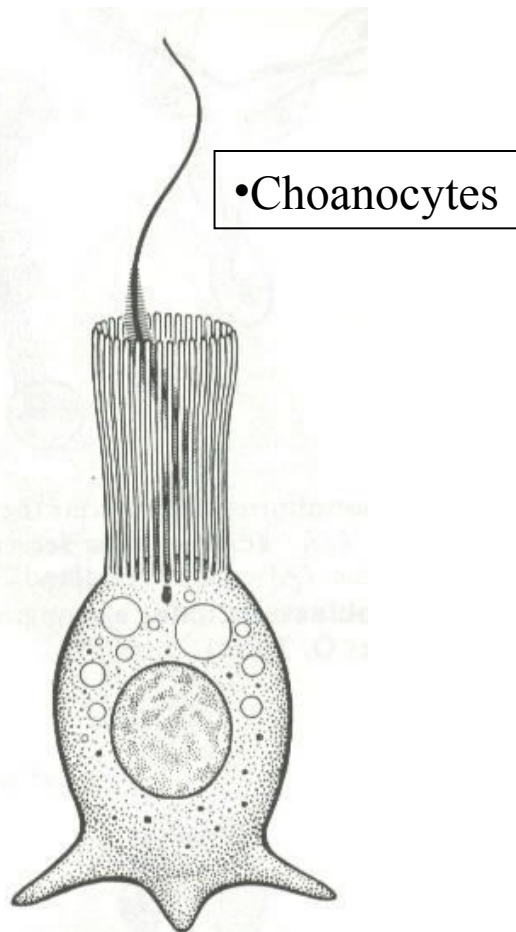
(b) *Axiomella*

Porifera Anatomy



- Spongocoel
- Ostia
- Oscules

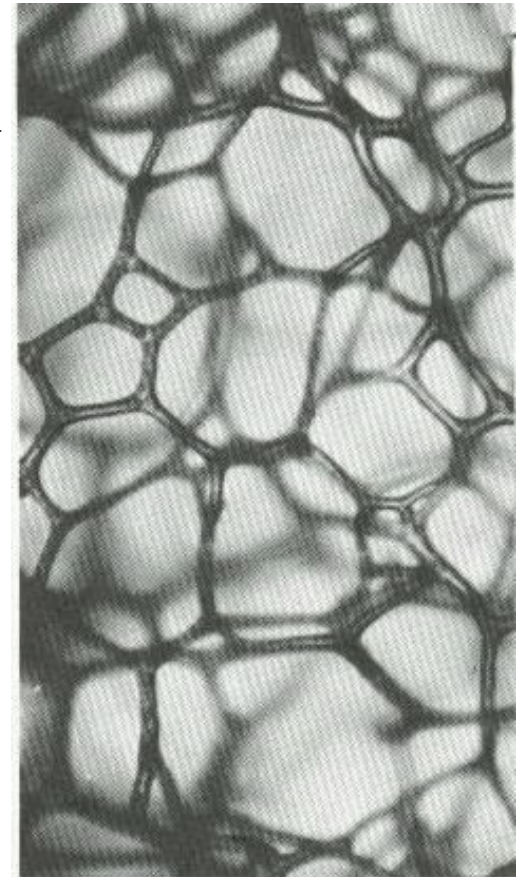
Collar Cells



- Choanocytes: (collar cells) act as a pump to bring water into the sponge

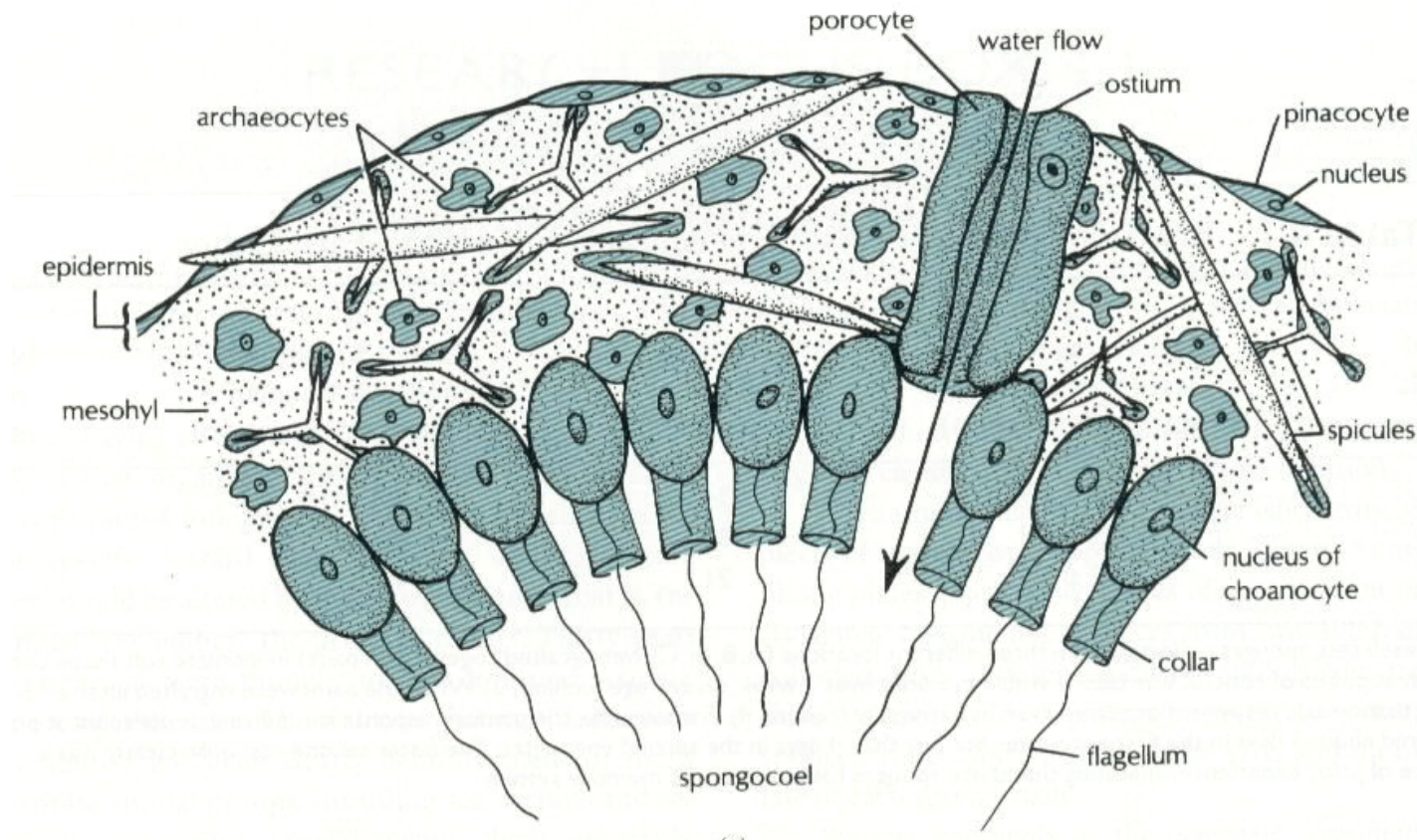
Sponge Support

- Collagen is found between the inner canals and chambers
 - Mesohyl
- Ameboid cells located in the mesohyl, have different roles
 - Archeocytes
 - Sclerocytes



•Phylum Porifera

•Sponge Support



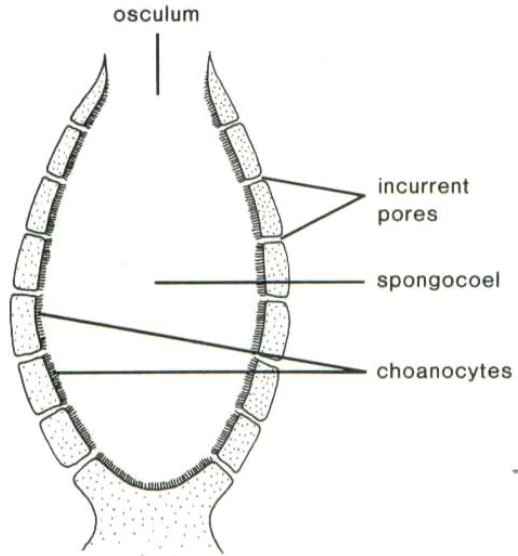
Spicules

- Collagen is stiffened by adding microscopic mineral accretions or additional protein fibers (spongin) or both.
 - Spicules: skeleton structures, made of calcium carbonate (CaCO_3) or silicon dioxide (SiO_2).

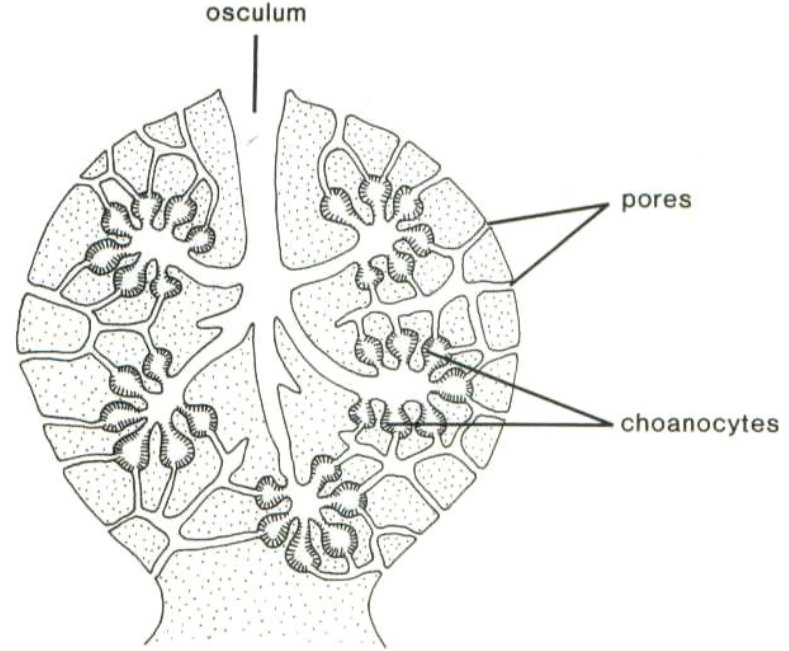


•Spicules

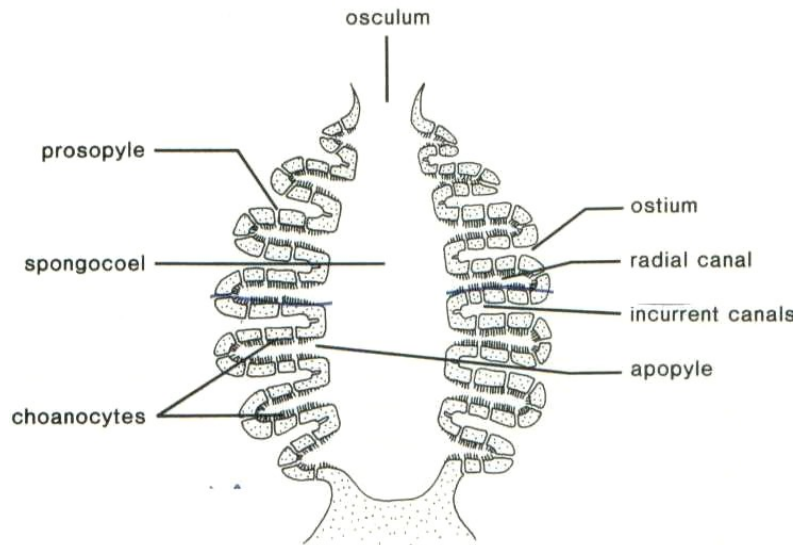
Sponge Types



ascon



leucon

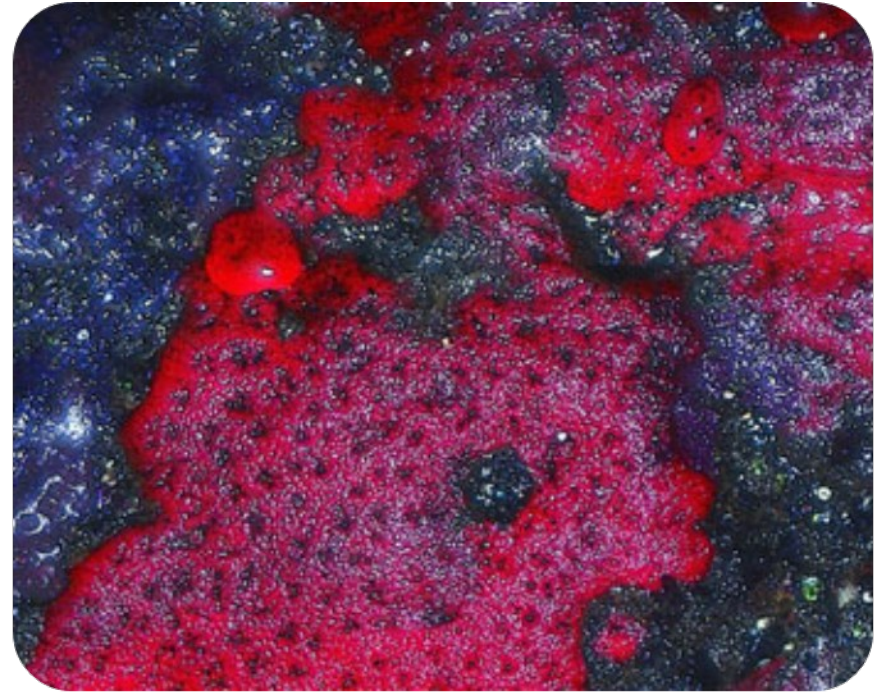


sycon

A. Characteristics of members of Phylum

Porifera include:

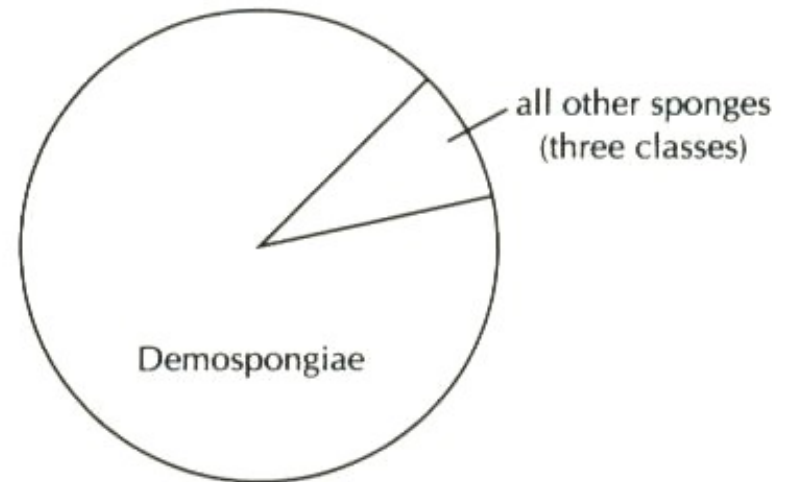
1. asymmetrical or radial symmetry
2. 3 types of cells - pinacocytes, mesenchyme cells (amoebocytes) and choanocytes
3. Central cavity or several branching chambers, through which water flows for filter feeding
4. no tissues or organs



Porifera Classification

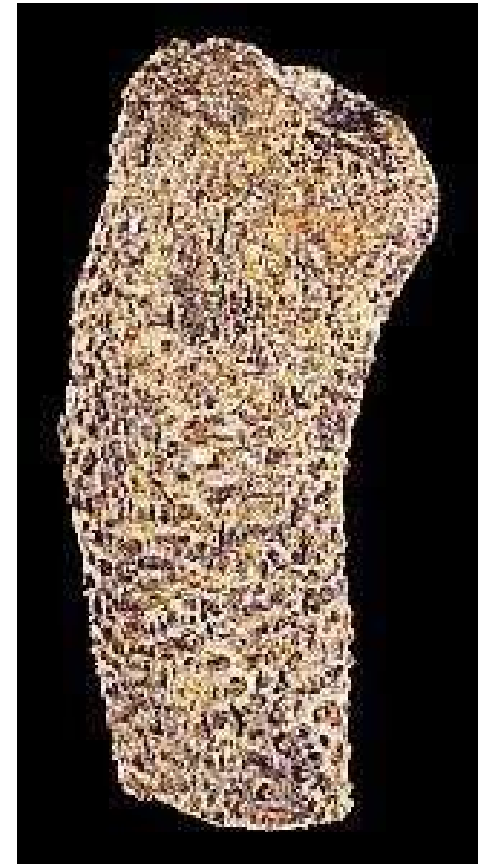
- Phylum Porifera
 - Class Calcarea
 - Class Demospongiae
 - Class Hexactinellida
 - Sclerospongiae is no longer considered a class

Taxonomic Detail



Class Calcarea

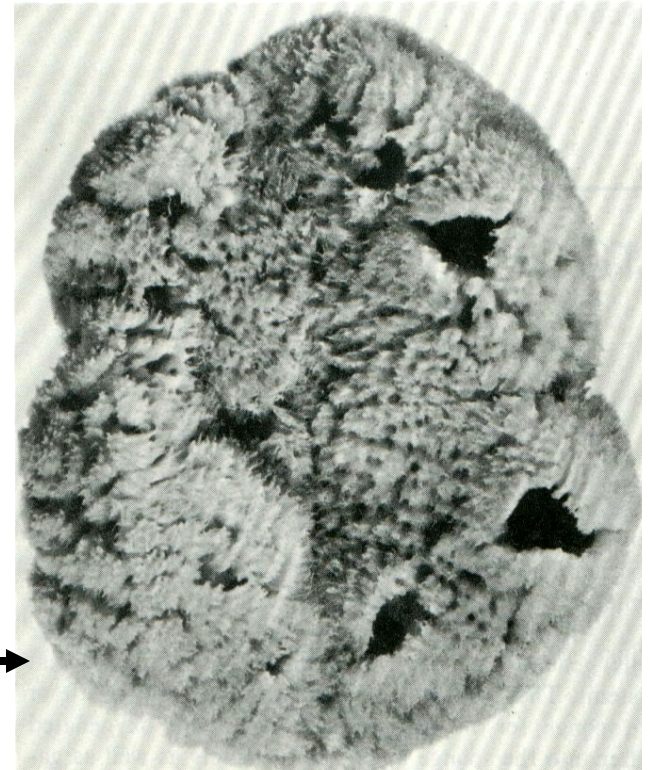
- Have spicules made of calcium carbonate
- Mostly small in size (<15 cm.), and form irregular masses
- Never contain spongin, restricted to shallow water, and strictly marine



•Phylum Porifera

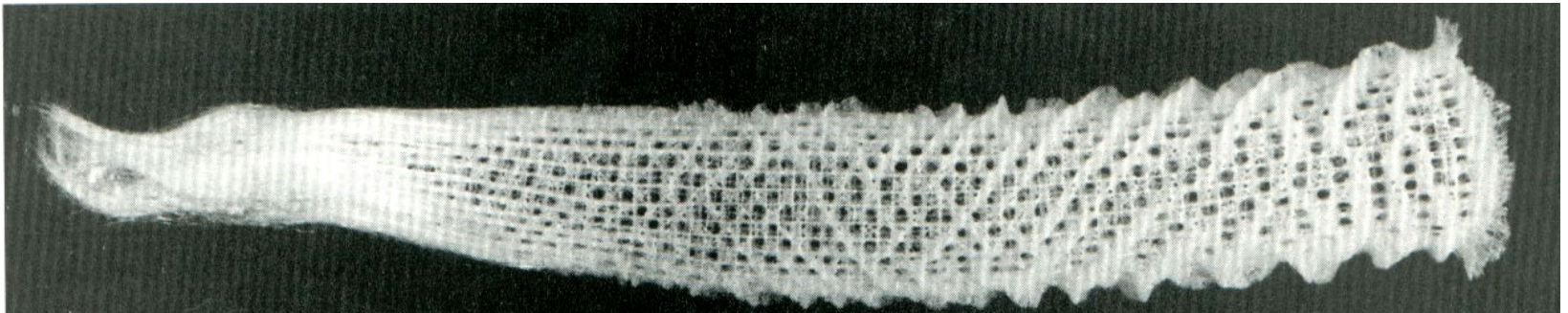
Class Demospongiae (Most sponges)

- Have spicules made of silicon dioxide (SiO_2) or spongin or a combination of both
- Most sponges belong to this class (90%)
 - Nearly all are leuconoid body type
- Mostly found on the continental shelf
- *Spongia spp.* (Bath sponge)



Class Hexactinellida (Glass sponges)

- Spicules are made of silica
- Usually found in deep water on soft substrates in the tropics 200-1,000m.
- Spicules are six pointed and have a lattice-like structure
- Cup, vase or urn shape



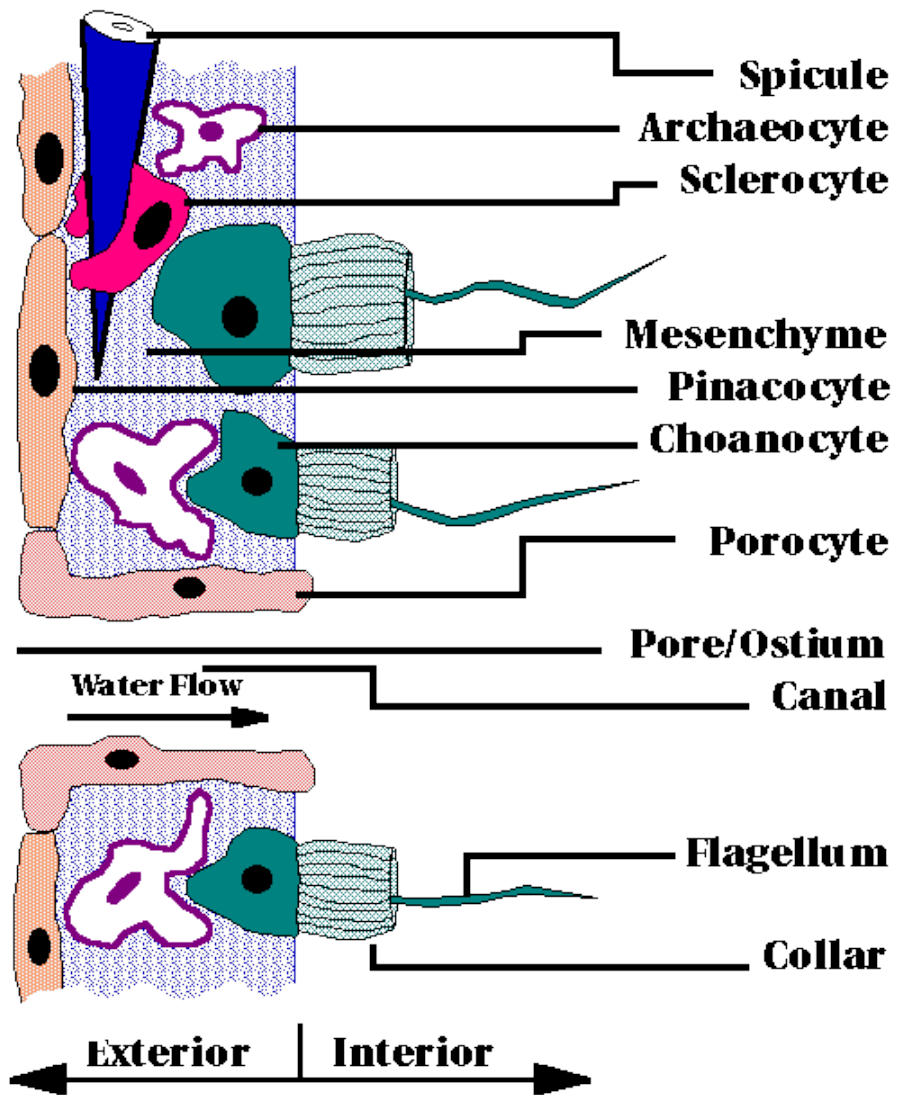
• *Euplectella* (Deep sea Glass sponge)

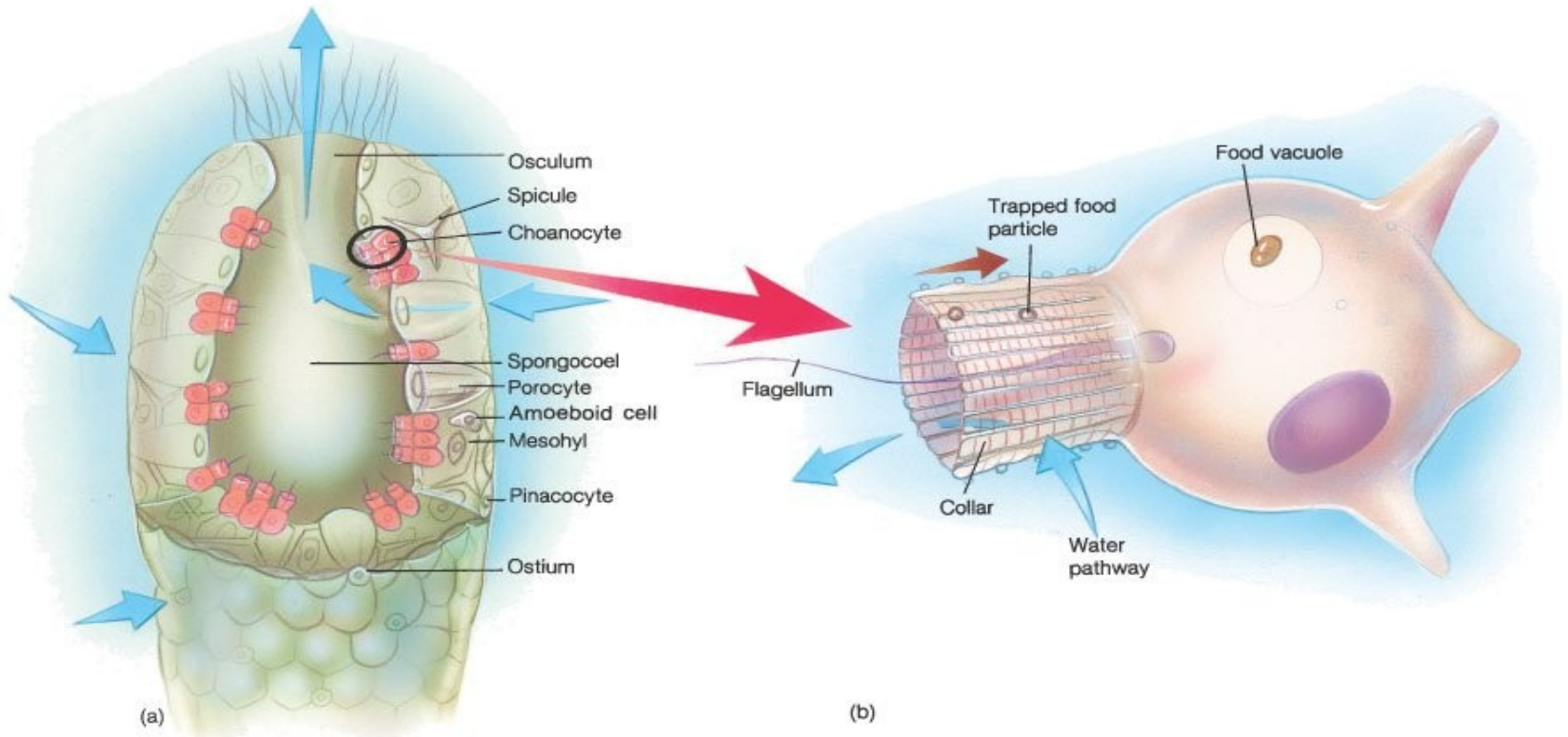
B. Cell types, Body wall, and Skeletons

1. sponge cells are specialized for particular functions (division of labor)

- i. Pinacocytes
- ii. Mesenchyme
- iii. Choanocytes

MICROSCOPIC VIEW OF A PORIFERAN WALL



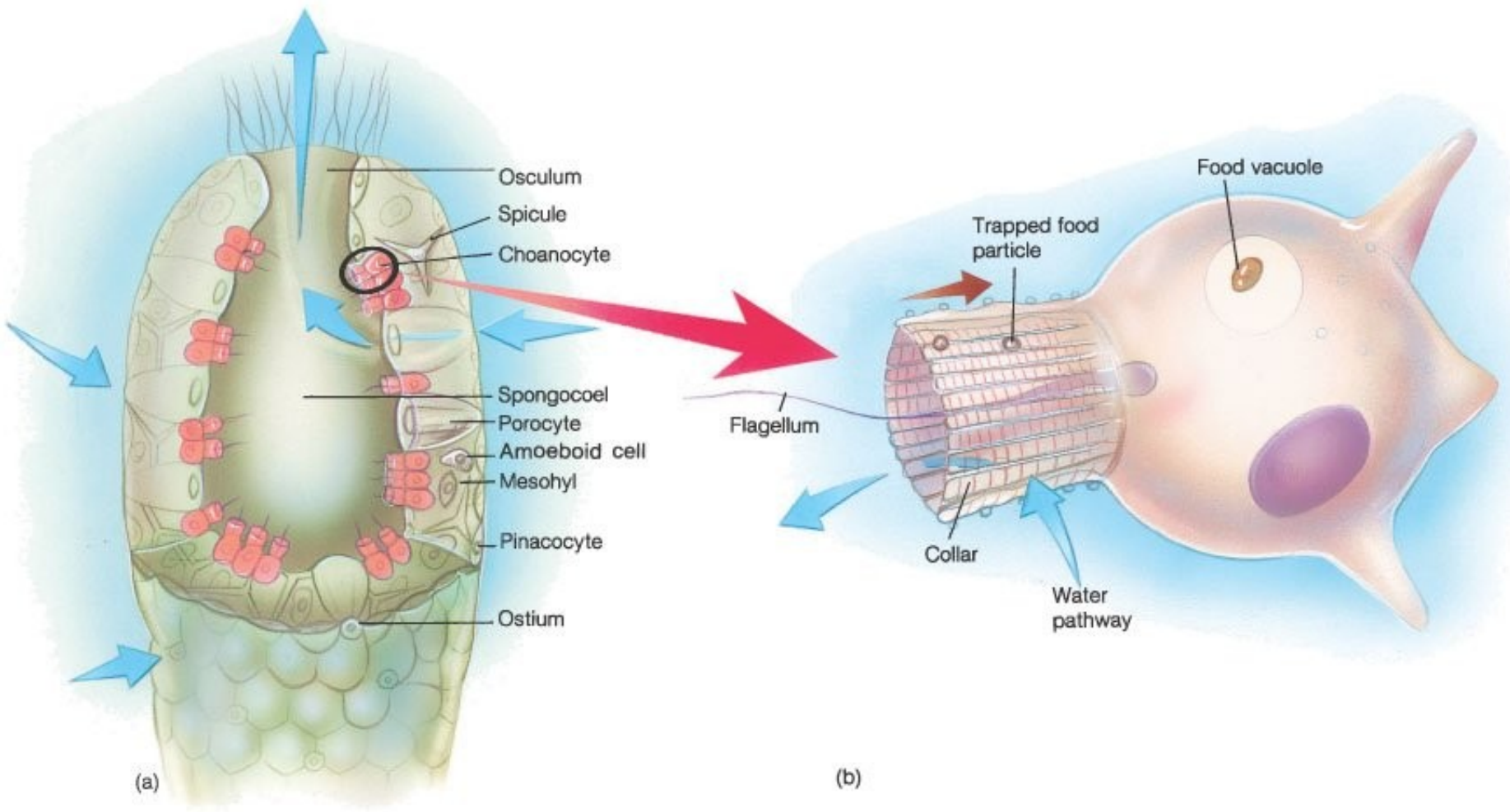


c. beneath mesenchyme, lining inner chambers are choanocytes - collar cells. Flagellated cells with ring of microvilli surrounding flagella. Microfilaments connect microvilli, forming a net that helps filter edible particles (Fig. 9.5)

Figure 9.5

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Morphology of a Simple Sponge



C. Sponges are supported by skeleton that may consist of spicules - needlelike spikes.

1. spicules are formed by amoeboid
2. made of CaCO_3 or silica
3. may take on a variety of shapes (t
4. alternatively, skeleton may be made of spongin, a fibrous protein made of dried beaten and washed to produce commercial sponges



Figure 9.6

Sponge Spicules

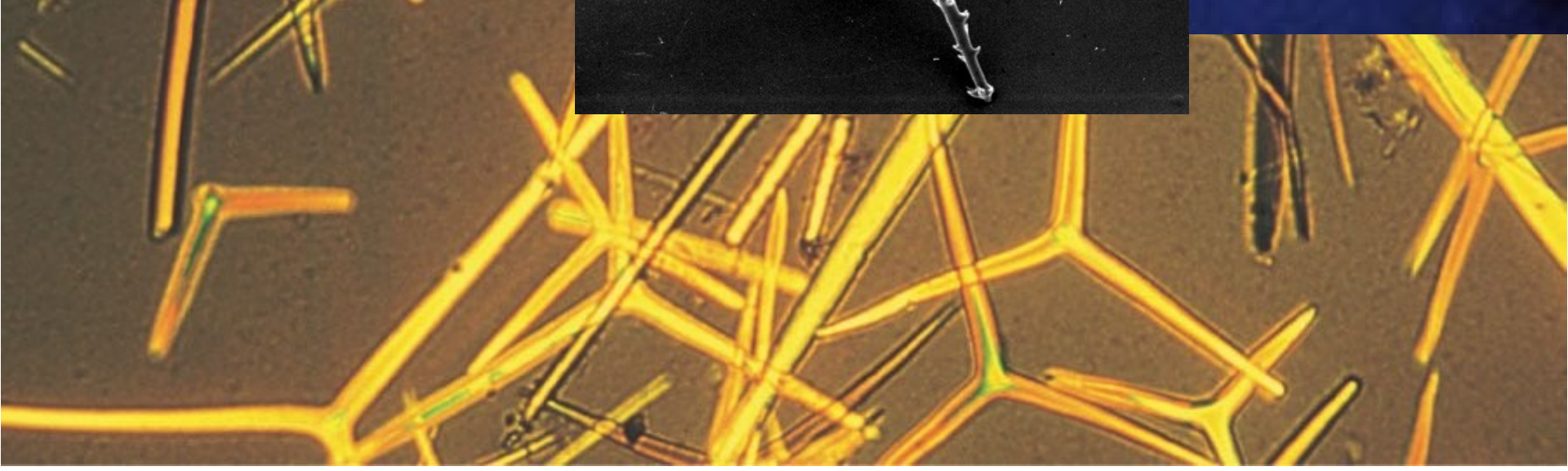
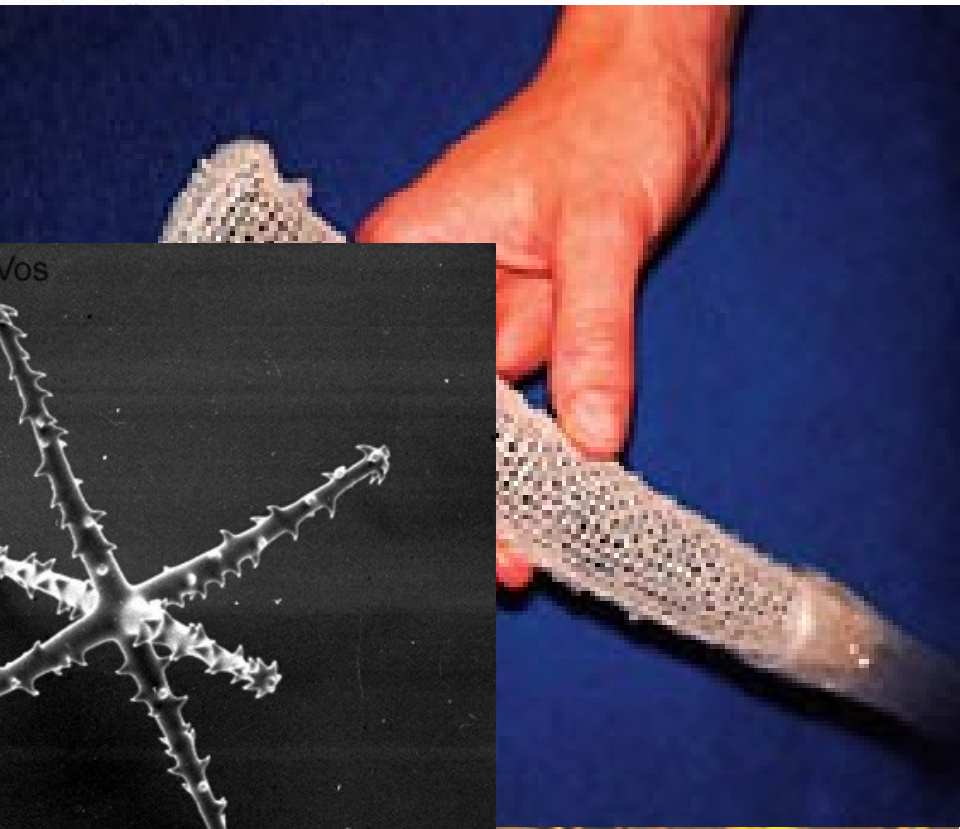
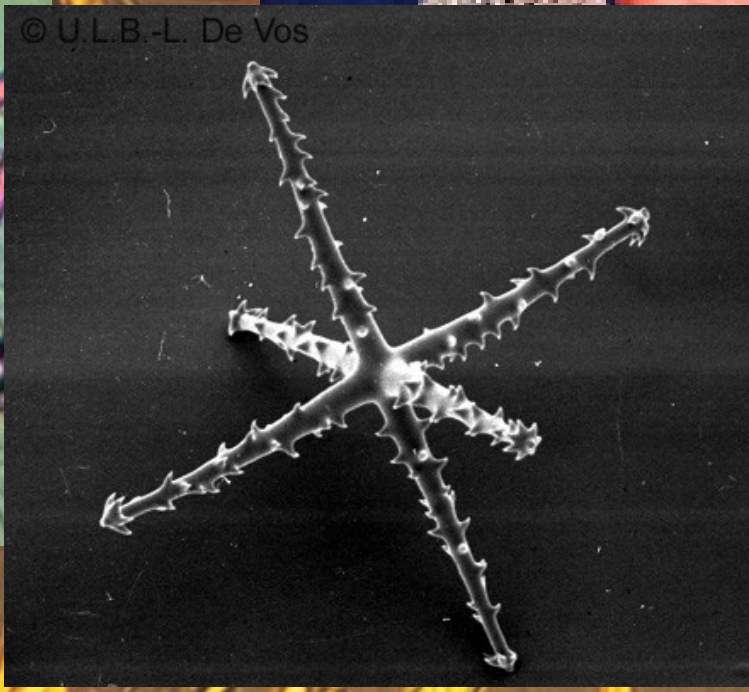
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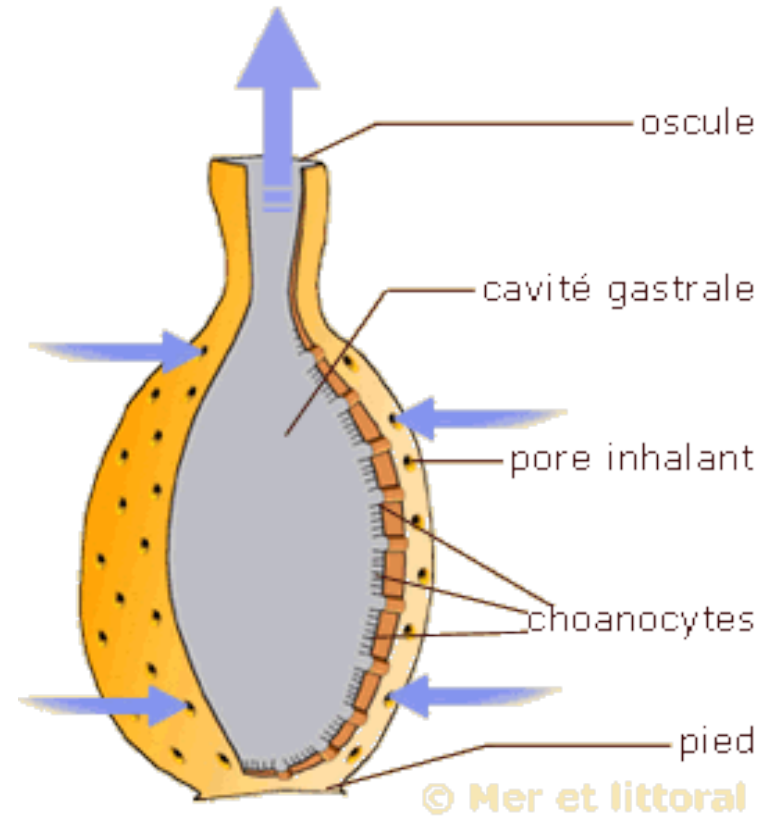


D. Water currents and body forms - sponges lives depend on the water currents that choanocytes create

1. water brings food and O₂, removes wastes
2. methods of food filtration and circulation reflect body forms in the phylum. 3 types: (fig. 9.7)
 - i. Ascon body form
 - ii. Sycon body form
 - iii. Leucon body form

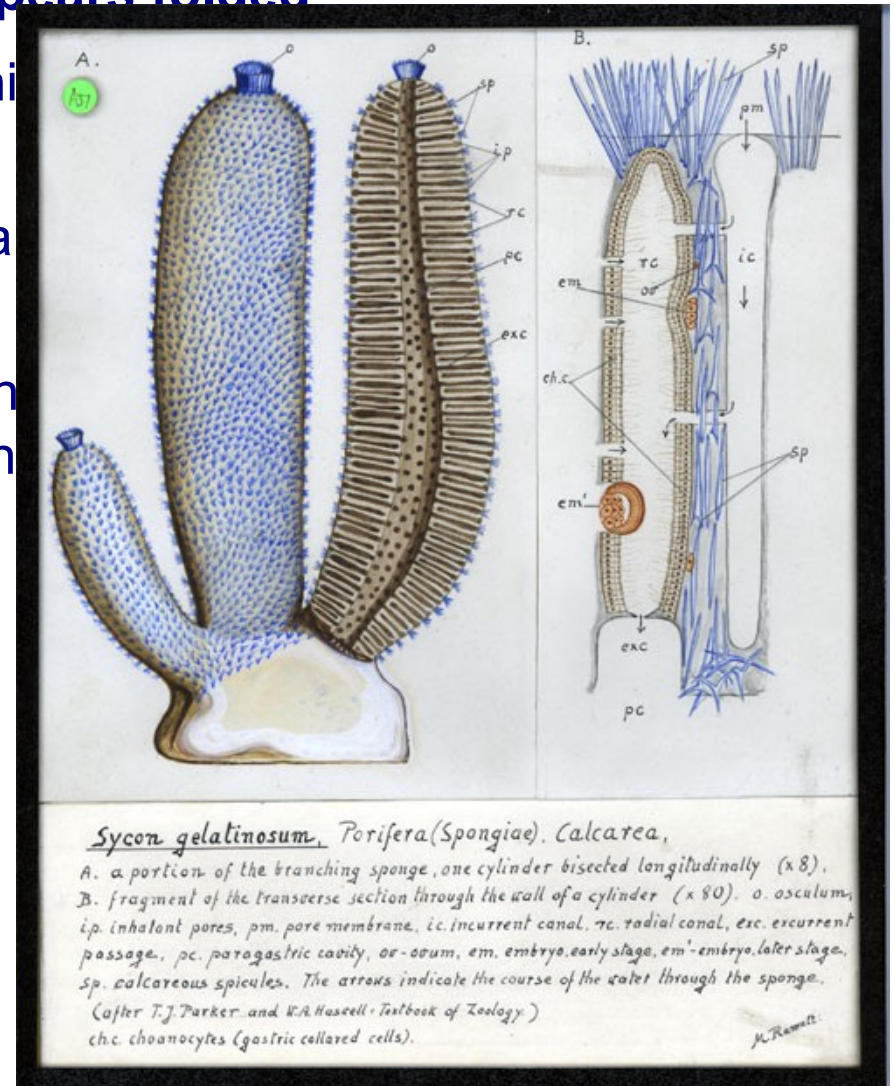
i. ascon body form -
simplest and least
common. Vase-like
form;

- 1. ostia are outer openings of porocytes and lead directly to chamber called spongocoel
- 2. choanocytes line spongocoel and their flagellar movements draw water into the spongocoel thru the ostia
- 3. water exits sponge thru osculum, single large opening at the top of the sponge



ii. sycon body form - sponge wall appears folded

- 1. water enters thru dermal pores, which leads to radial canals
- .pores in body walls open to radial canals
- .choanocytes line radial canals and water from ostia, thru incurrent canals and out the osculum.



iii. leucon body forms have an extensively branched canal system.

- 1. Water enters the ostium and moves thru branched incurrent canals,
- 2. incurrent canals lead to chambers leading away from the chamber
- 3. proliferation of chambers spongocoel. Often there are flagellates in the canals.

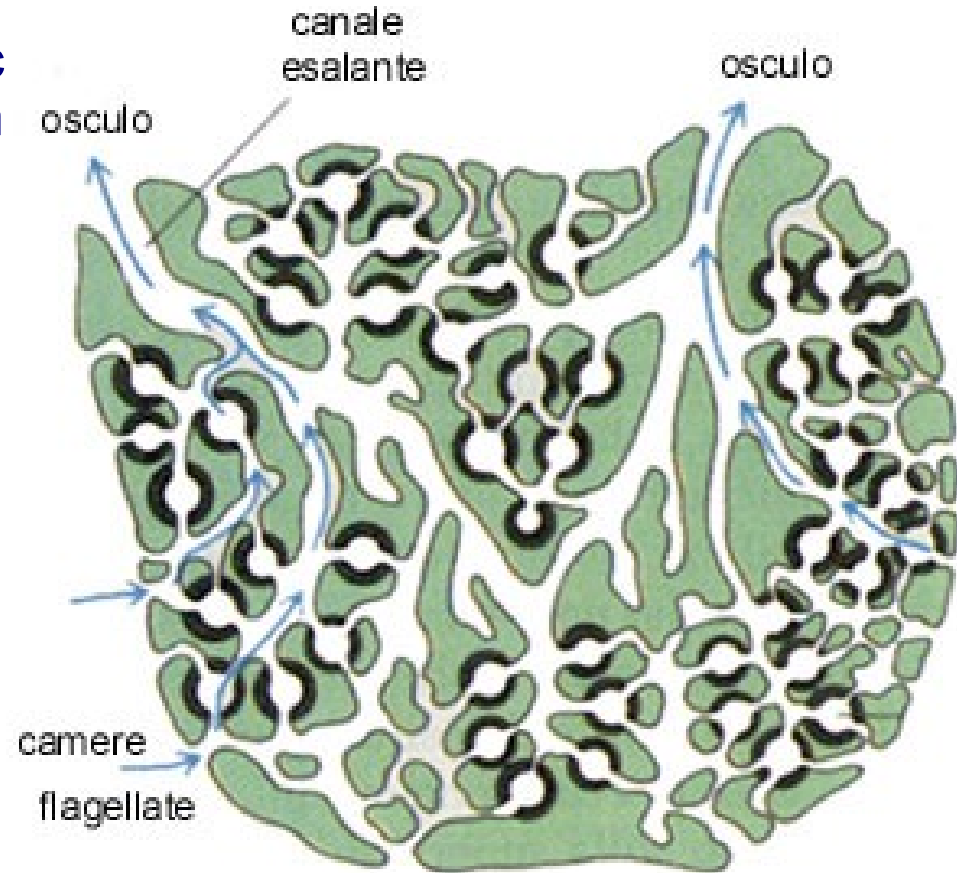
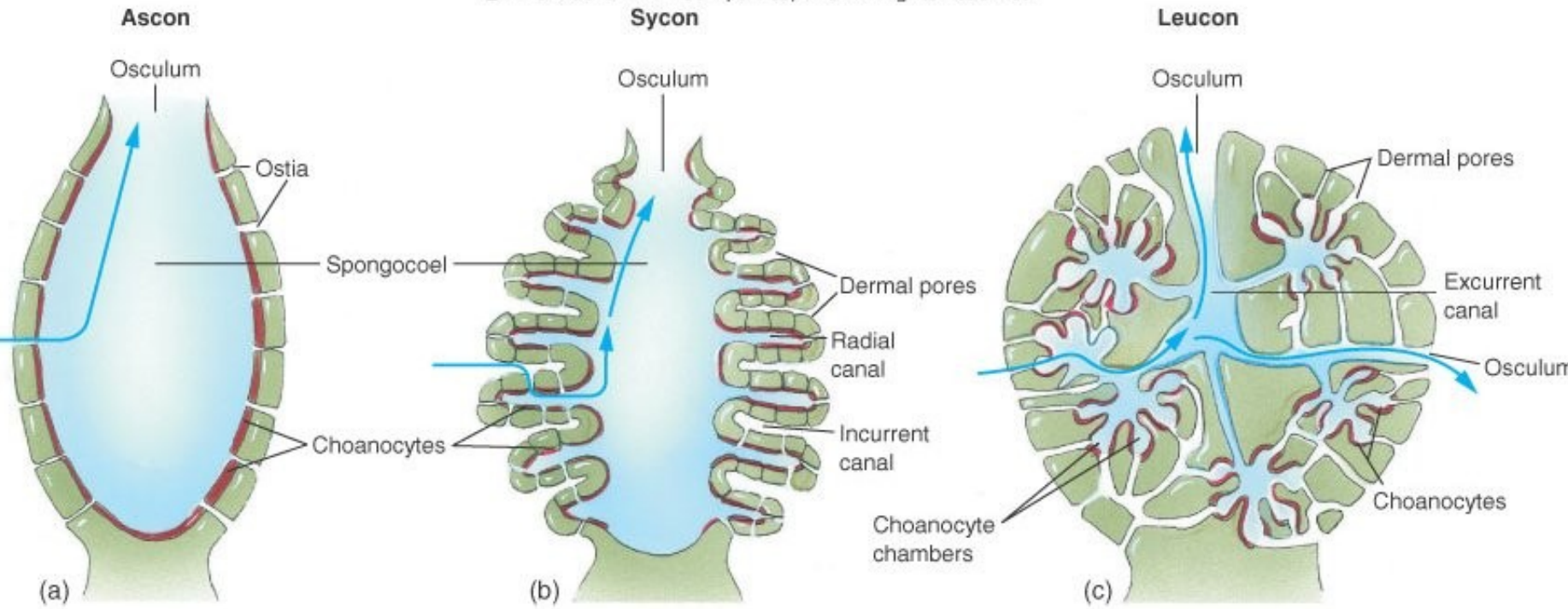


Figure 9.7

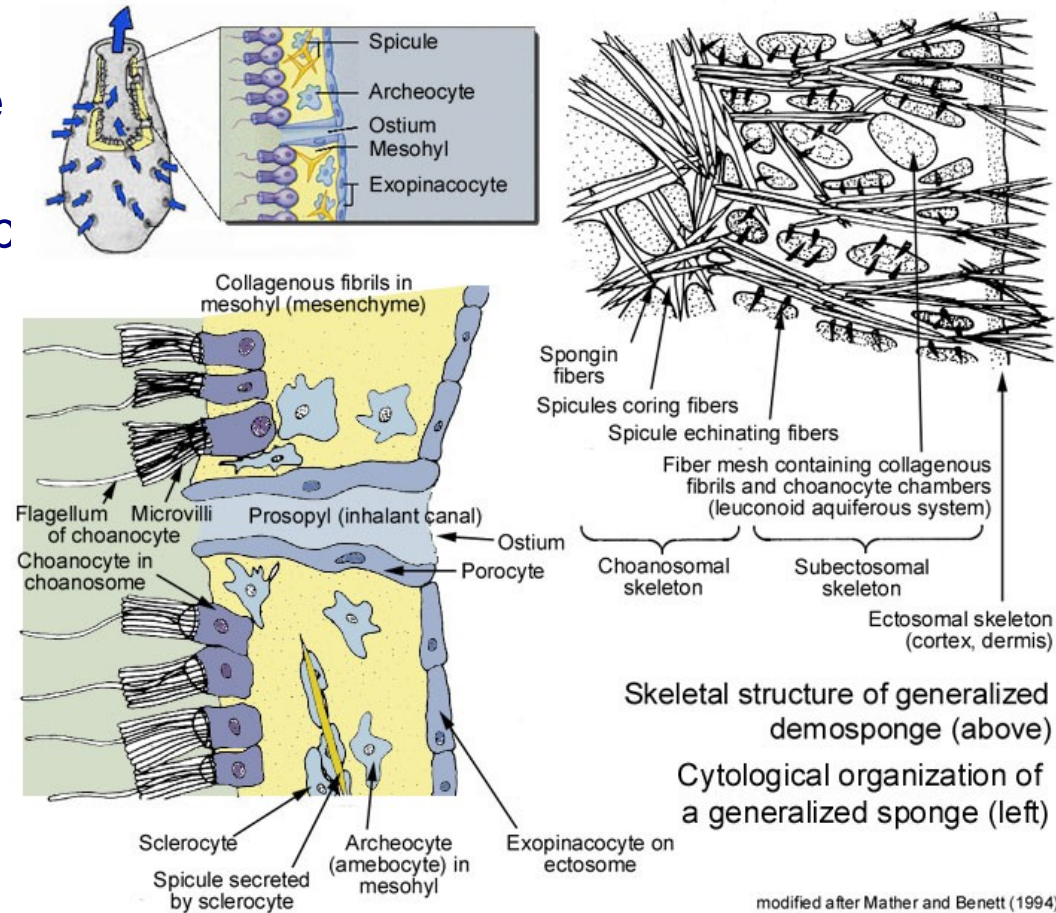
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Maintenance functions

- 1, sponges feed on particles that range in size from .1 to 50 μm .

- a. bacteria
- b. microscopic algae
- c. protists
- d. other suspended p



2. important in reducing coastal turbidity

- a. 1 leucon sponge, 1 cm in diameter and 10 cm high, filters 20 liters of water/day!

3. a few sponges are carnivorous - catch small crustaceans (deep water) with spicule-covered filaments

.

4. feeding methods - choanocytes filter small suspended particles.

- a. Water passes thru collar near base and moves into spongocoel at open end of collar
- b. suspended food is trapped on collar and moved along microvilli to base of collar, where it is incorporated into a food vacuole
- c. lysozymal enzymes and pH changes digest particle in vacuole
- d. partly digested food passed to amoeboid cells, that distribute it.

5. other feeding methods -

- a. pinacocytes lining incurrent canals may phagocytize larger food particles. Sponges may also absorb nutrients in sea water thru active transport

- Reproduction - most sponges are monoecious - both sexes occur in same individual; do not usually self fertilize because eggs and sperm ready at different times.
 - 1. certain choanocytes lose collars and flagella and undergo meiosis to form flagellated sperm
 - 2. other choanocytes may undergo meiosis and form eggs. Eggs retained in mesohyl of parent

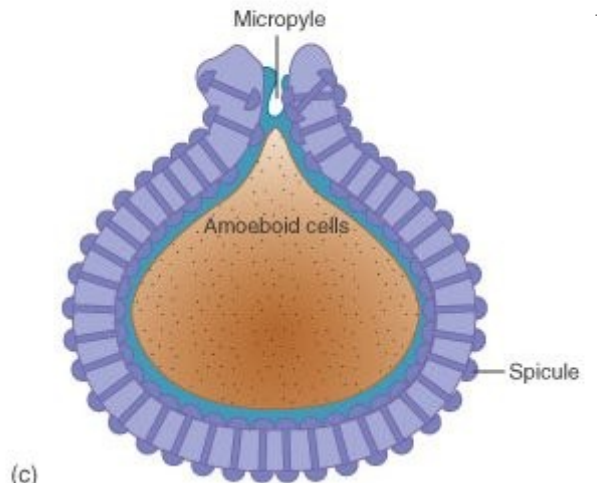
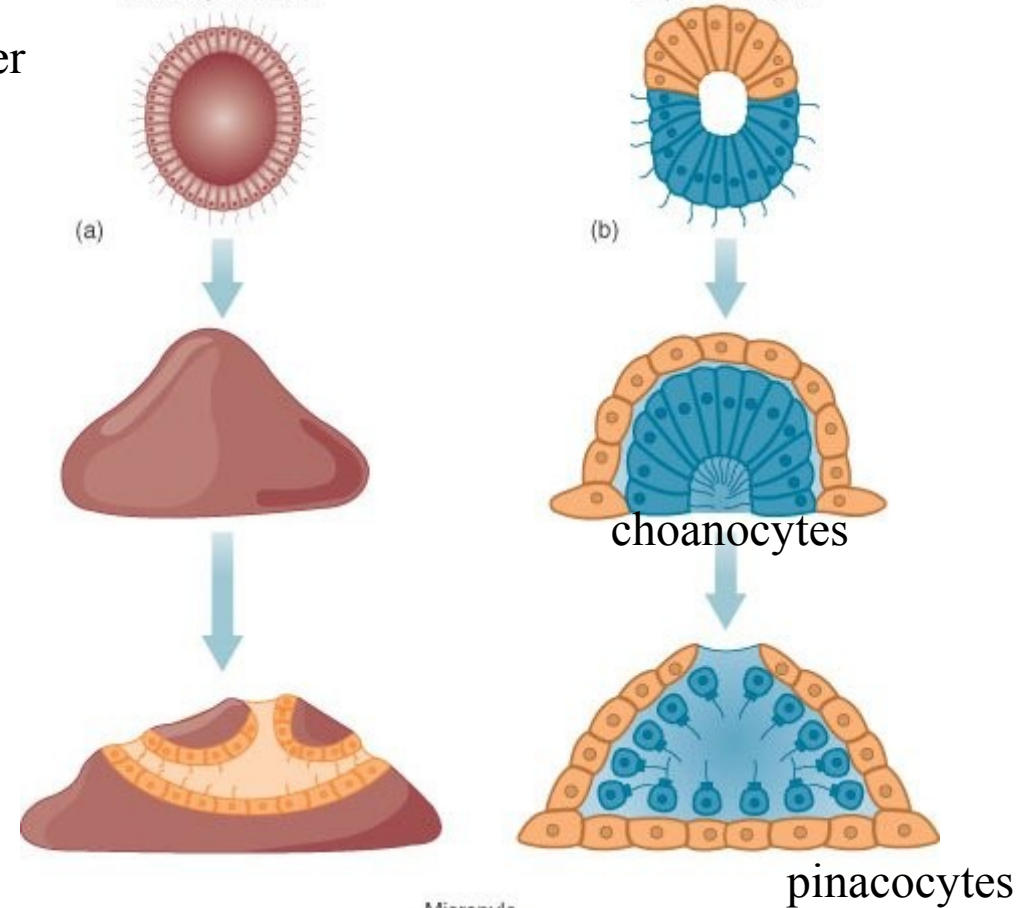
- 3. sperm cells exit one sponge by osculum and enter another with incurrent water. they are trapped by choanocytes and put in vacuoles.
- 4. sperm lose collar and flagella, become ameboid and transfer sperm to eggs
- 5. early development occurs in mesohyl, then a flagellated larva forms. Larva breaks free, free-swims for up to 2 days before settling to substrate and develops into adult form (Fig. 9.8)

Figure 9.8 (abc)

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Parenchymula larva Amphiblastula larva

Flagellated cells cover
outer surface

Development of Sponge Larval Stages



(c)

