

Phylum Porifera: Sponges

Chapter 12

Initially not considered animals but molecular evidence demonstrate that sponges are phylogenetically grouped with other metazoa (animals)



Phylum Porifera

Sponges are the simplest multicellular animals

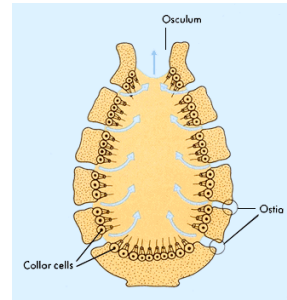
- Poriferans are a highly successful group
- Diversification centers on their ***unique water-current system*** and its degree of complexity.
- Their body is an assemblage of cells embedded in an extracellular matrix and supported by skeleton of spicules and protein



Phylum Porifera

What is a sponge?

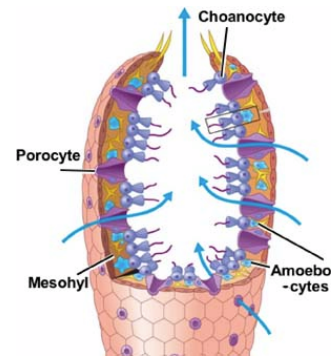
- Body pores 'ostia', canals, chambers that form an unique system of **water currents**
- Mostly marine
- Radial symmetry or none



Phylum Porifera

What is a sponge?

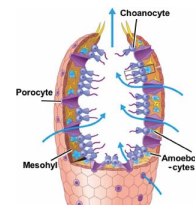
- Body is an aggregation of several types of differentiated cells for various functions:
 - **Pinacocytes and archaeocytes:** flat in the outer surface, feeding
 - **Choanocytes:** flagellated, create currents
 - **Archaeocytes or amoebocytes:** digestion
 - Skeletal elements



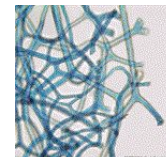
Phylum Porifera

What is a sponge?

- Body consist of a gelatinous protein matrix (**mesohyl**-functions as an [endoskeleton](#) in most sponges) and calcareous or siliceous spicules and/or spongin
- No organs or true tissues
- Digestion intracellular, excretion and respiration by diffusion



spicules

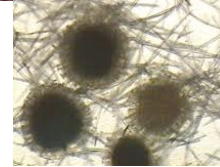


spongin

Phylum Porifera

What is a sponge?

- All adults are sessile and attached to the substratum
- Asexual reproduction by buds or gemmules
- Sexual reproduction by eggs and sperm= free living larvae



gemmules

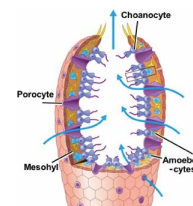
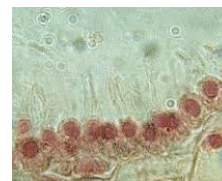


Sponge larvae

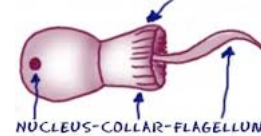
Phylum Porifera

Types of cells: **Choanocytes**

- Embedded in mesohyl
- Line canals and chambers
- The flagellum is exposed and its surrounded by a **collar** made of **microvilli**
- The beating flagellum pulls water through the collar trapping food particles
- The food particle is then passed to neighboring cells called **archaeocytes** for digestion.
- Digestion is intracellular
- Choanocytes also have a role in reproduction



A CHOANOCYTE.
THE COLLAR IS MADE
OF SEVERAL MICROVILLI

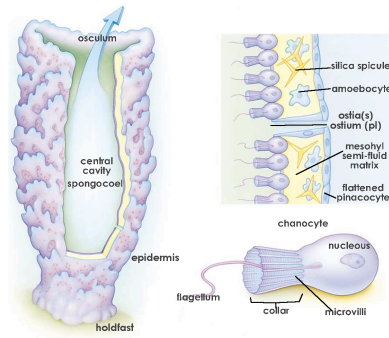


Phylum Porifera

Types of cells: **Archaeocytes**

- Also known as amoebocytes because of their shape
- Move within the mesohyl
- They **phagocytize** particles at the pinacoderm and received from choanocytes
- They can differentiate in any other kind of cell.

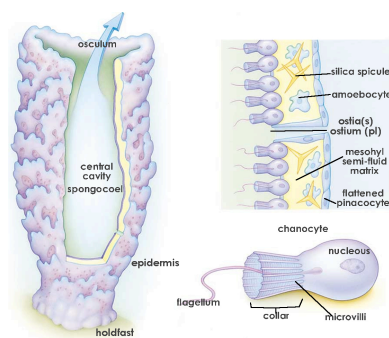
Types of amoebocytes include
Sclerocytes: secrete spicules
Spongocytes: secrete spongin
Collencytes: secrete collagen
Lophocytes: secrete a different type of collagen



Phylum Porifera

Types of cells: **Pinacocytes**

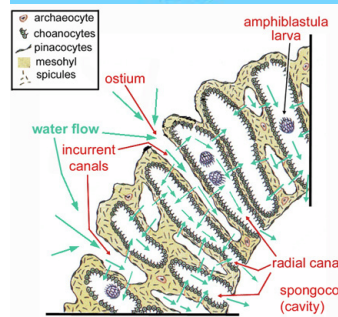
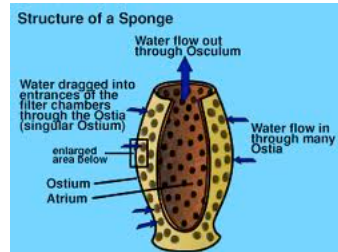
- Closest to a true tissue in sponges:
 - **Pinacocytes** cells= **pinacoderm**
 - Flat
 - Can ingest food by **phagocytosis**
 - Help to regulate surface area of the sponges
 - Some are modified-contractile **myocytes** located around oscula or pores to help regulate rate of water flow



Phylum Porifera

Feeding

- Collect particles from the water pumped through the internal channels= **suspension feeding**.
- Water enters through small incurrent pores called **dermal ostia** located in the outer layer=**pinacoderm**
- Inside water pass the **choanocytes** where food particles are collected
- Choanocytes passes food to amoebocytes (archaeocytes)
- Other cells involved in nutrition= pinacocytes

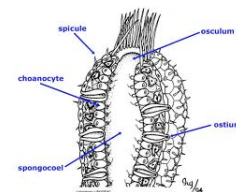


Quarter-Section of Moderately Complex Sponge

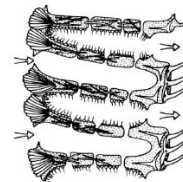
Phylum Porifera

Canal systems

- There are three main design for a sponge body:
 - **Asconoid**: choanocytes lie in the spongocoel
 - **Syconoid**: choanocytes lie in canals
 - **Leuconoid**: choanocytes lie in distinct chambers



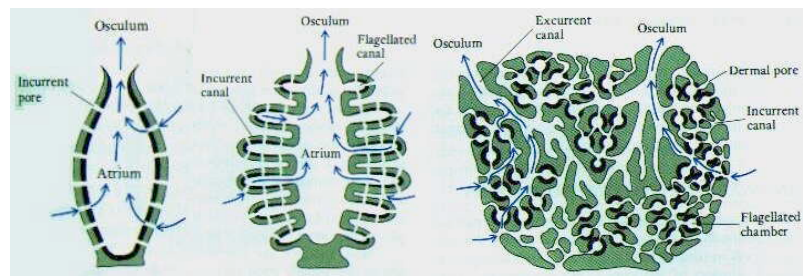
Asconoid



Syconoid



Leuconoid



Asconoid

Syconoid

Leuconoid

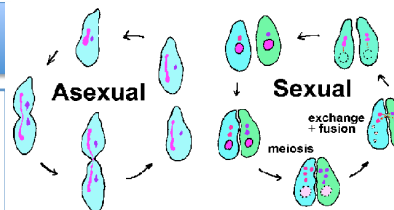
These three systems demonstrate an increase in complexity and efficiency of the water pumping mechanisms, but they do not imply an evolutionary sequence.

The leuconoid system shows an increase in surface area so it efficiently meets food demands. This type of system has evolved independently multiple times in sponges.

Phylum Porifera

Reproduction: Asexual

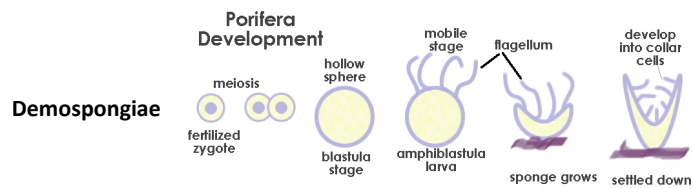
- Collect particles from the water pumped through the internal channels
- Water enters through small incurrent pores called **dermal ostia** located in the outer layer=**pinacoderm**
- Inside water pass the **choanocytes** where food particles are collected



Phylum Porifera

Reproduction: Sexual

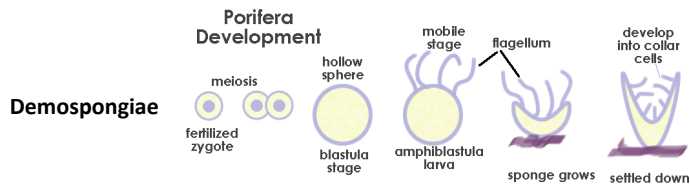
- Most sponges are **monoecious** (hermaphrodites)
- Sperm arises from **chonocytes**
- In Calcarea and Demospongiae oocytes also arise from chonocytes
- In other demospongiae sponges oocytes can derive from archaeocytes
- External fertilization



Phylum Porifera

Reproduction: Sexual

- In viviparous species -the zygote is retained in and derives nourishment from its parent
- Then the zygote develops in a ciliated free-living larva
- The sperm is release by an individual and the choanocytes of another individual phagocytize the sperm transforming themselves in carrier cells, taking the sperm through the mesohyl to the oocytes.



Phylum Porifera

Reproduction: Sexual

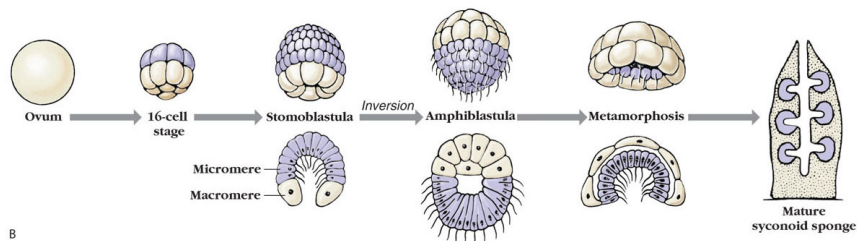
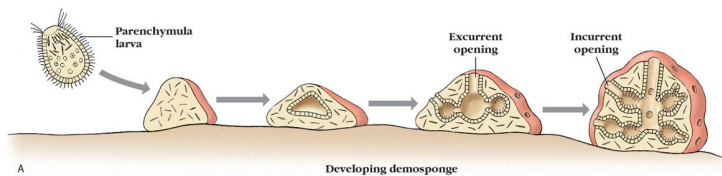
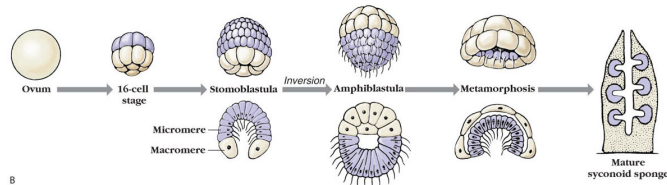
- In oviparous species-both oocytes and sperm are release into the water column
- The free-living larvae= **parenchymula** is solid-bodied is the most common, but there are other 6 types of larvae.
- Sponges exhibit direct development. Flagellated cells migrate to the center and become choanocytes



Phylum Porifera

Reproduction: Sexual

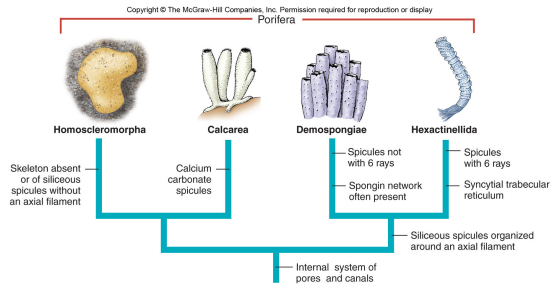
- Calcareous sponges a **hollow blastula** is formed (stomoblastula). Then turns inside out exposing directly the flagellated cells (**micromeres**).
- In the amphiblastula the flagellated cells are in the interior part, which then become choanocytes & amoebocytes
- Non-flagellated (**macromeres**) cells are in the posterior part and become the pinacoderm



Development of the calcareous syconoid sponge *Sycon*

Phylum Porifera

- Classification
 - Class Calcarea
 - Class Hexactinellida
 - Class Demospongiae

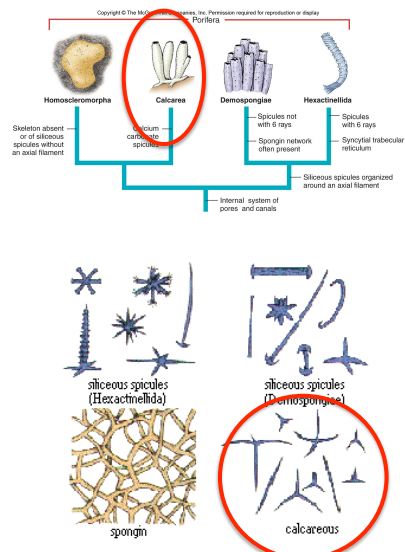


5,000–10,000 known species

Phylum Porifera

- Class Calcarea
 - Spicules of calcium carbonate
 - Spicules are monaxons or 3-4 rays
 - Small and tubular
 - Marine
 - Canal systems: asco, syco, and leuconoid

Examples seen in the lab: *Sycon*, *Leucosolenia*

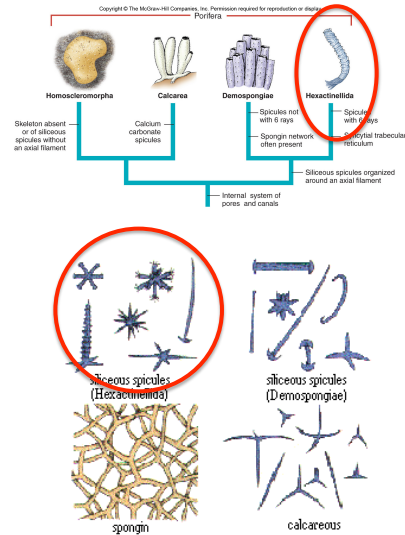


Phylum Porifera

• Class Hexatinellidae

- Spicules of silica
- Spicules are 3D
- Vase or funnel shaped
- Canal systems: syco, and leuconoid
- Deep water, marine
- Body composed of a tissue called **trabecular reticulum**, which is bilayer with amoebocytes or choanoblasts

Examples seen in the lab: *Euplectella*

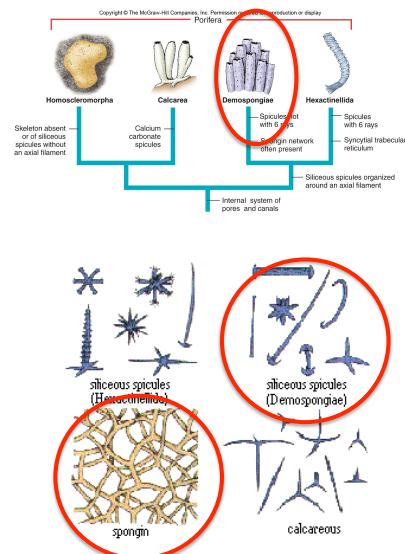


Phylum Porifera

• Class Demospongiae

- 95% of the living species are here
- Spicules of silica, but not rayed
- Spicules may be bound together with spongin
- Marine and freshwater
- Canal systems: leuconoid

Examples seen in the lab: *Spongia*



Carnivore sponges!

Sponges of the family Cladorhizidae are especially unusual in that they typically feed by capturing and digesting whole animals. That's right, these sponges are actually carnivorous! They capture small [crustaceans](#) with their spicules which act like Velcro when they come in contact with the crustacean exoskeletons. Cells then migrate around the helpless prey and digestion takes place extracellularly.



Participation 4: A what class belong the carnivore sponges? How do they trap their prey?

**In addition
Review Questions: Cap. 12 preguntas 2, 3, 4, 5, 6, 910,**

For Monday next week

