

|                        |                                  |
|------------------------|----------------------------------|
| الانبار                | الجامعة                          |
| العلوم                 | الكلية                           |
| علوم الحياة            | القسم                            |
| الثانية                | المرحلة                          |
| اللافقرات              | اسم المادة باللغة العربية        |
| <b>Invertebrates</b>   | اسم المادة باللغة الانكليزية     |
| ابراهيم عبد النبي شبيب | اسم التدريسي                     |
| المساميات              | عنوان المحاضرة باللغة العربية    |
| <b>Porifera</b>        | عنوان المحاضرة باللغة الإنكليزية |
| 3                      | رقم المحاضرة                     |

## Phylum: Porifera

### Introduction:

The name Porifera (*porus* = pore; *ferro* = to bear). This phylum includes the sponges which are most primitive of multicellular animals. Approximately 10,000 species of sponges are known at present.

### *Characteristics of Phylum Porifera*

1. Multicellular; Body with pores (ostia), canals, and chambers that serve for passage of water.
3. Mostly marine; all aquatic.
4. Radial symmetry or none.
5. Epidermis of flat pinacocytes; most interior surfaces lined with flagellated collar cells (choanocytes) that create water currents; a gelatinous protein matrix called (mesoglea) contains amoebocytes of various types and skeletal elements.
6. Skeletal structure of fibrillar collagen (a protein) and calcareous or siliceous crystalline spicules, often combined with variously modified collagen (spongin).
7. No organs or true tissues; digestion intracellular; excretion and respiration by diffusion.
8. All adults sessile and attached to substratum.
9. Asexual reproduction by buds or gemmules and sexual reproduction by eggs and sperm

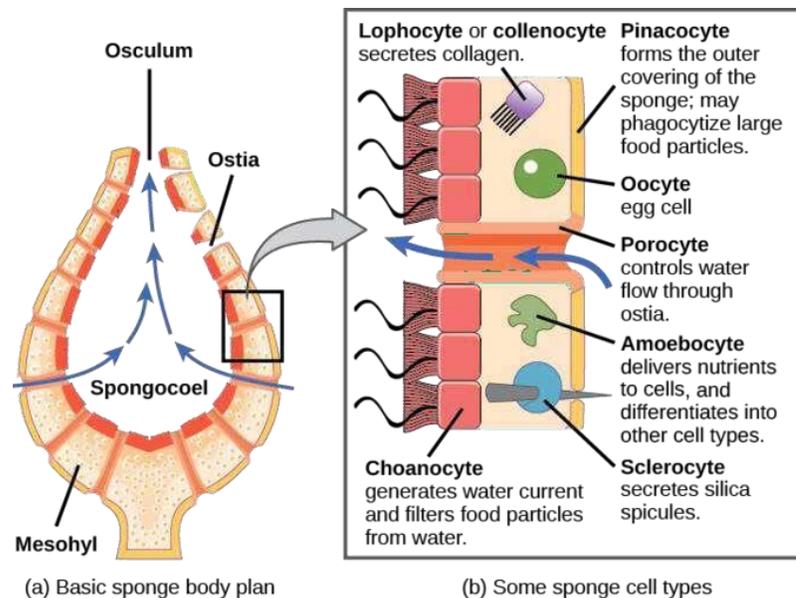
### *Types of cells:*

The sponges also have specialized cells. Therefore, division of function is present in them. Following types of cells are present in phylum porifera.

- 1- **Pinacocytes:** Flattened cells composing dermal epithelium in sponges. Pinacocytes are somewhat contractile and help regulate surface area of a sponge.
- 2- **Porocytes:** Tubular cells that make up the pores of a sponge.
- 3- **Choanocyte:** Which line flagellated canals and chambers, choanocytes are ovoid

cells with one end embedded in mesoglea and the other exposed. The exposed end bears a flagellum surrounded by a collar. Choanocytes not only keep the water moving but also trap and phagocytize food particles that are carried in the water.

- 4- **Myocytes:** are usually arranged in circular bands around oscula or pores, where they help regulate rate of water flow.
- 5- **Archaeocytes** Archaeocytes are ameboid cells that move about in the mesoglea and carry out a number of functions. They can **phagocytize** particles at the pinacoderm and receive particles for digestion from choanocytes. Archaeocytes apparently can differentiate into any of the other types of more specialized cells in the sponge.
  - a- **Sclerocytes**, secrete spicules.
  - b- **Spongocytes**, secrete the spongin fibers of the skeleton
  - c- **Collencytes** secrete fibrillar collagen
  - d- **Lophocytes** secrete large quantities of collagen but are distinguishable morphologically from collencytes.



### *Types of Skeletons*

Its skeleton gives support to a sponge, preventing collapse of canals and chambers. The major structural protein in the animal kingdom is collagen, and fibrils of collagen are found throughout the intercellular matrix of all sponges. In addition, various Demospongiae secrete a form of collagen traditionally known as spongin. Several types of spongin, differing in chemical composition and form (fibers, spicules, filaments, spongin surrounding spicules, and so on) are found in various demosponges. Demospongiae also secrete siliceous spicules. Calcareous sponges secrete spicules composed mostly of crystalline calcium carbonate and have one, three, or four rays .

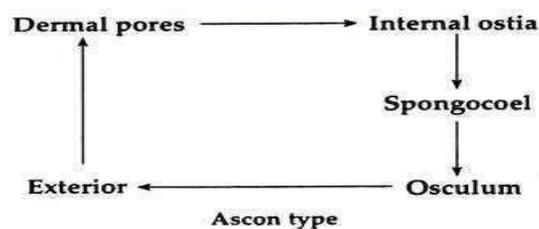
### *Body opening:*

The only body openings of these unusual animals are pores, usually many tiny ones called ostia for incoming water, and a few large ones called oscula (sing., osculum) for water outlet. These openings are connected by a system of canals, some of which are lined with peculiar flagellated collar cells called choanocytes (previously discussed).

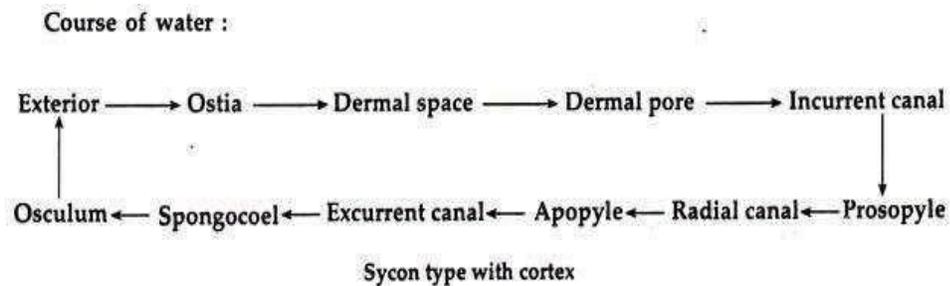
### *Types of Canal Systems*

Most sponges have one of three types of canal systems: asconoid, syconoid, or leuconoid .

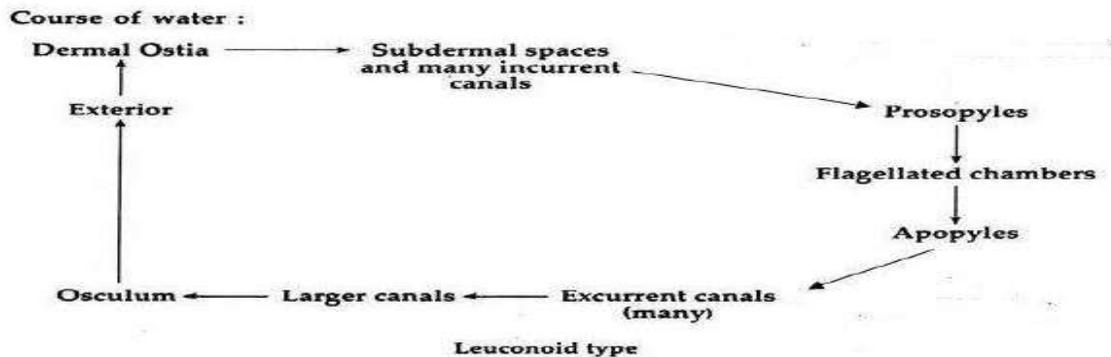
1- **Asconoids (Flagellated spongocoels):** Asconoid sponges have the simplest organization. They are small and tube shaped. Water enters through microscopic dermal pores into a large cavity called a spongocoel, which is lined with choanocytes. Choanocyte flagella pull water through the pores and expel it through a single large osculum. Asconoids are found only in the Calcarea.



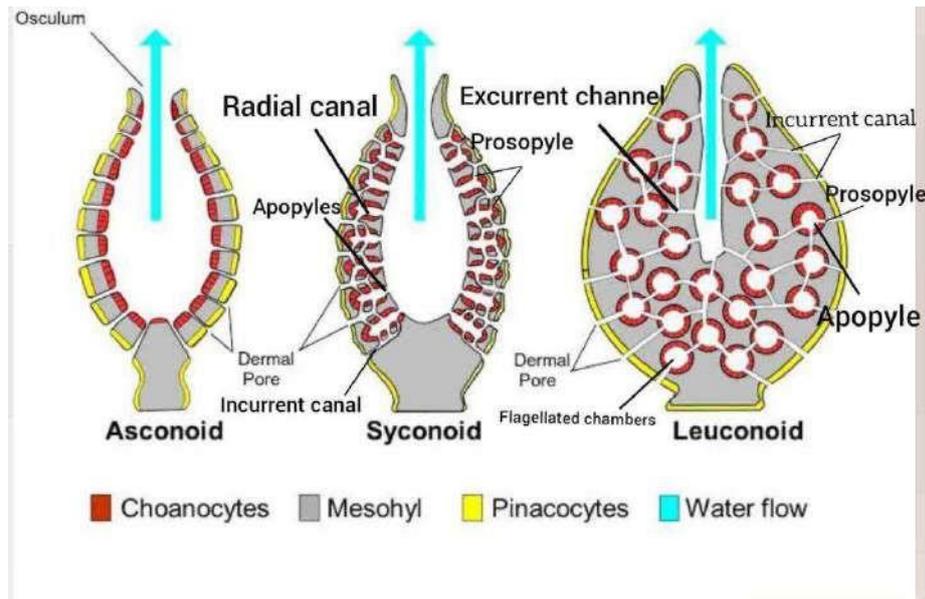
**2- Syconoids: Flagellated Canals** Syconoid sponges look somewhat like larger editions of asconoids, from which they were derived. They have a tubular body and single osculum, but the body wall, which is thicker and more complex than that of asconoids, contains choanocyte-lined **radial canals** that empty into the spongocoel. The spongocoel in syconoids is lined with epithelial-type cells rather than flagellated cells as in asconoids. Water enters through many dermal ostia into incurrent canals and then filters through tiny openings called prosopyles into the radial canals. Food is ingested by the choanocytes, whose flagella force the water through internal pores (apopyles) into the spongocoel. From there it emerges through an osculum. Syconoids are found in classes Calcarea and Hexactinellida.



**3- Leuconoids: Flagellated Chambers** Leuconoid organization is the most complex of the sponge types and permits an increase in sponge size. As a result of further process of out folding of the choanocyte layer and thickening of body wall, the leuconoid type of canal system develops. The choanocyte layer of the radial canal of the syconoid stage evaginates into many small chambers, and these may repeat the process, so that clusters of small rounded or oval flagellated chambers replace the elongated chambers of the syconoid stage. The choanocytes are limited to these chambers. The interior of the sponge becomes permeated by many incurrent and ex-current canals join to form larger ex-current canals and spaces which lead to the oscula. The surface is covered with epidermal epithelium and is pierced by many dermal pores (ostia) and oscula. The dermal pores lead into incurrent canals that branch irregularly through the mesenchyme. The incurrent canals lead into the small rounded flagellated chambers by opening still termed prosopyles. The flagellated chambers open by apertures called apopyles into ex-current channels, and these unite to form larger and larger tubes, of which the largest lead to the oscula. Most sponges are of the leuconoid type, which occurs in most Calcarea and in all other classes.



**Example: *Euspongia***



### *Sponges Feeding*

Sponges feed primarily on particles suspended in the water pumped through their canal systems. Detritus particles, planktonic organisms, and bacteria. Pinacocytes may phagocytize particles at the surface, but most larger particles are consumed in the canals by archaeocytes that move close to the lining of the canals. Sponges also absorb dissolved nutrients from the water passing through the system. Protein molecules are taken into choanocytes by pinocytosis. Digestion is entirely intracellular (occurs within cells).

### *Respiratory and Excretory organs*

There are no respiratory or excretory organs; both functions apparently occur by diffusion in individual cells. Contractile vacuoles are found in archaeocytes and choanocytes of freshwater sponges.

### *Reproduction*

#### **1-Asexual Reproduction:**

**a-Reduction bodies:** Many fresh water and marine sponges disintegrate in adverse environmental conditions particularly in winter, leaving small rounded balls called reduction bodies. Each body consists of an internal mass of amoebocytes, covered externally by a pinacoderm and spicules. When favorable conditions return, these reduction bodies grow into complete new sponges.

**b-Budding:** In budding, numerous archaeocytes gather near the surface resulting in a small outgrowth on the pinacoderm. The bud thus formed grows outward to produce a small individual, which either remains attached with the parent individual or gets detached and attached to a nearby rock to grow into an independent colony.

*c-Gemmules Production:*

Gemmules are formed in freshwater sponges and some marine sponges. Here, archaeocytes collect in the mesohyl and become surrounded by a spongin coat incorporating siliceous spicules. When the parent animal dies, the gemmules survive and remain dormant, preserving the species during periods of freezing or severe drought. Later, cells in the gemmules escape through a special opening, the micropyle, and develop into new sponges.

*2-Sexual Reproduction:*

Sponges have no organs but amoebocytes form eggs and sperms in the mesenchyme ; first eggs are produced and later the sperms. The amoebocytes get filled with food and become large, they become round to form eggs. Other amoebocytes divide to produce many sperms, a sperm has an oval head and a long tapering tail. Eggs of one sponge are fertilized by sperms from another sponge to form zygotes.

*Regeneration*

Sponges have the ability to repair injuries and to restore lost parts, a process called regeneration. Regeneration does not imply a reorganization of the entire animal, but only of the wounded portion. The regeneration power is used for cultivation of bath sponge industrially.

*Classification of Phylum Porifera*

**Class Calcarea** Have spicules of calcium carbonate that often form a fringe around the osculum (main water outlet); spicules needle shaped or three or four rayed; all three types of canal systems (asconoid, syconoid, leuconoid) represented; all marine. Examples: *Sycon*, *Leucosolenia*.

**Class Hexactinellida** Have six-rayed, siliceous spicules extending at right angles from a central point; spicules often united to form network; body often cylindrical or funnel shaped; flagellated chambers in simple syconoid or leuconoid arrangement; habitat mostly deep water; all marine. Examples: Venus' flower basket (*Euplectella*), *Hyalonema*.

**Class Demospongiae** Have siliceous spicules that are not six rayed, or spongin, or both; leuconoid-type canal systems; one family found in fresh water; all others marine. Examples: *Thenea*, *Cliona*, *Spongilla*, *Myenia*, and all bath sponges.