



# PHYLUM PORIFERA



*Callyspongia siphonella*  
Colonial Tube Sponge

IB BIOLOGY HL 2018  
By Karen Sutanto, Grade 12

# Definition



**Porifera:** The word porifera means **pore bearer** in Latin. This is the group of organisms known commonly as **sponges**.

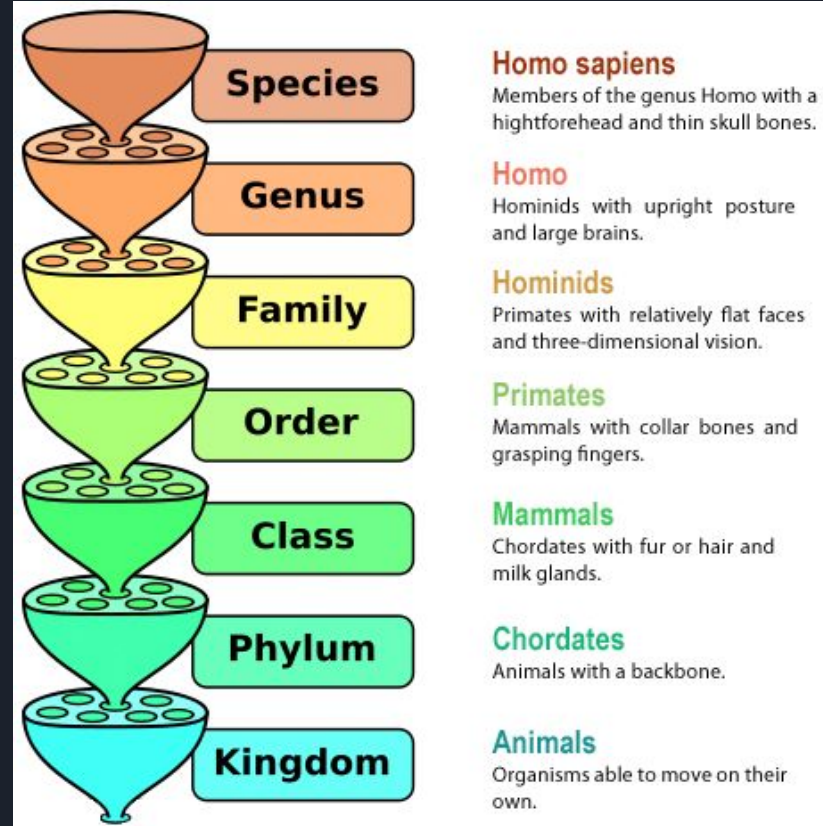
HOWEVER, unlike Spongebob, porifera are not square in shape.


## Animal Phylum

Porifera are very important and a **diverse** phylum within the animal kingdom.

These sponges are **living animals**.

It is the only phylum of the animal subkingdom Parazoa and represents the **least evolutionary advanced** group of the animal kingdom.





All adult sponges are **sessile** (permanently attached: not free to move about) and nearly all are **marine/aquatic animals** found in both fresh and saltwater, and in shallow or deep water.

There are **six families** of freshwater sponges.

Sponges are divided into **three classes**:

1. Class Calcarea (Calcareous Sponges)
2. Class Hexactinellida (Glass Sponges)
3. Class Demospongiae (Demosponges)

Each class will be discussed later on in the presentation.



*Aplysina fistularis*  
Yellow Tube Sponge

# Anatomy

Sponges **lack organ and tissue**, and all cells exhibit considerable independence.

The sponge is made up of **two single-cell deep layers and an intermediate mesohyl** (mobile cells plus extracellular matrix)

**The outer (sac) layer** consists of flattened polygonal cells called **pinacocytes**.

**The middle (mesohyl) layer** consists of **gelatinous protein/carbohydrate material**, a range of **mobile cells**, and a **skeleton of calcareous or siliceous spicules**, or of elastic proteinaceous fibers called **spongin fibers**.

**The inner layer** consists of **flagellated cells** called collar cells/**choanocytes**.



**Calcareous Sponges**



# Anatomy


The body has numerous **pores** called **ostia** that open into inhalant canals that lead to the feeding chambers, which are made up of choanocytes.

In the feeding chamber there are also large openings with **oscles**, fed by exhalant canals, that **carry the water current from the choanocyte chambers to the exterior**. The whipping action of the choanocyte flagella creates a current of water from ostia through the sponge body oscles.

**The choanocytes filter plankton and small bits of organic detritus from the water, and like the pinacocytes, absorb oxygen.**

Food is digested in ameboid archaeocytes that pick up food vacuoles from the choanocytes, which ingest the mainly particulate food.

Waste products are carried out through the osculum.



Different types of amoebocyte spongiocytes and sclerocytes are responsible for secreting the skeletal material. **Archaeocytes**: give rise to egg cells and sperm derive from choanocytes. The body of most sponges is **irregular in form**, although some have an **almost radial symmetry**. Sponges are limited in size by the rate at which water can flow in and out of the spongocoel, bringing in food-bearing water and oxygen and removing waste products.

There are three types of sponge structure:

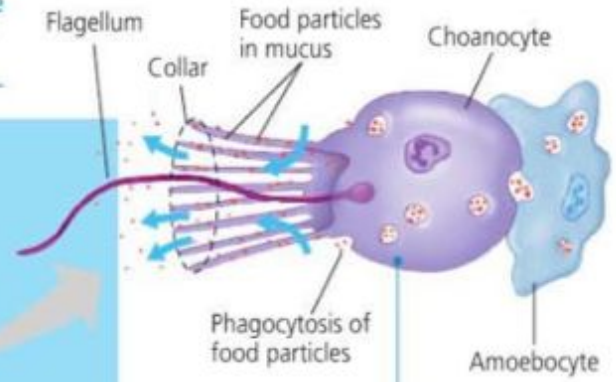
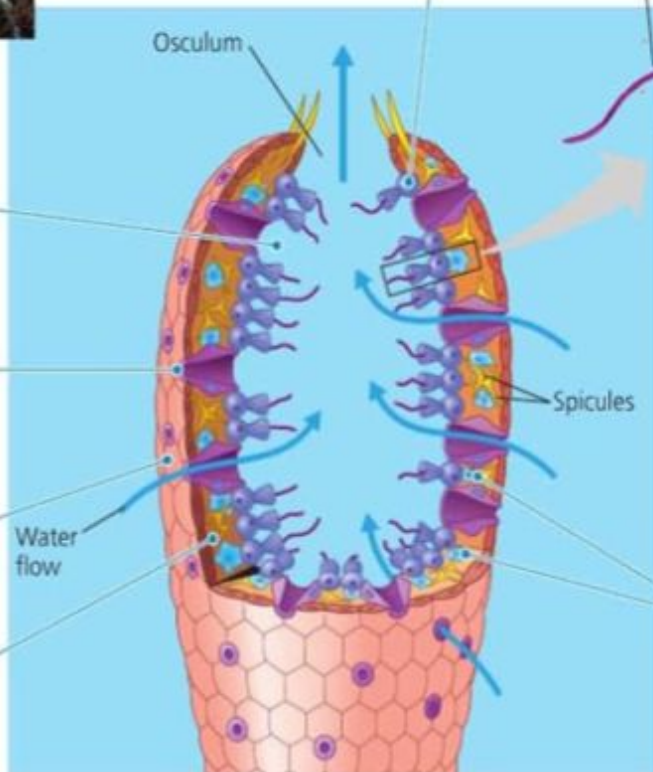
<b>Asconoid</b>	<b>Syconoid</b>	<b>Leuconoid</b>
Most primitive	More irregular structure	Highly irregular
Regular	Displays some degree of folding of the body wall	Displays the greatest degree of folding of the body wall
Tube-shaped	Basic radial symmetry	Lost radial symmetry
Radially symmetrical		Choanocytes line the pockets formed by the convoluted body wall
Smallest surface area → smaller size		Large surface area → some of the largest members of the phylum



Azure vase sponge (*Callyspongia plicifera*)

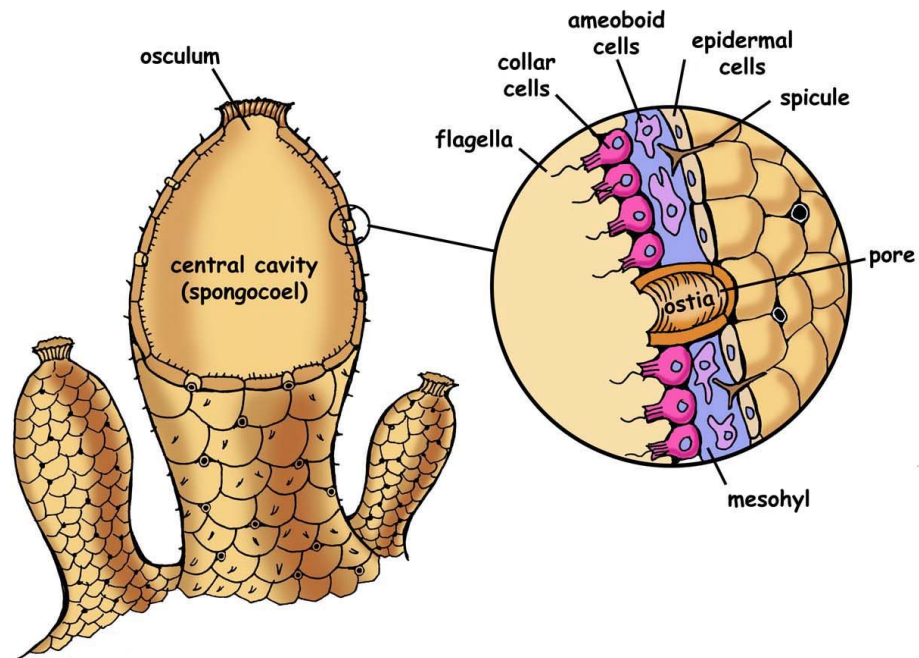
- 1 Mesohyl.** The wall of this sponge consists of two layers of cells separated by a gelatinous matrix, the mesohyl ("middle matter").
- 2 Epidermis.** The outer layer consists of tightly packed epidermal cells.
- 3 Pores.** Water enters the epidermis through pores formed by doughnut-shaped cells that span the body wall.
- 4 Spongocoel.** Water passing through pores enters a cavity called the spongocoel.

**5 Choanocytes.** The spongocoel is lined with flagellated cells called choanocytes. By beating flagella, the choanocytes create a current that draws water in through the pores and out through the osculum.



- 6** The movement of a choanocyte's flagellum also draws water through its collar of fingerlike projections. Food particles are trapped in the mucus coating the projections, engulfed by phagocytosis, and either digested or transferred to amoebocytes.
- 7 Amoebocytes.** These cells can transport nutrients to other cells of the sponge body, produce materials for skeletal fibers (spicules), or become any type of sponge cell as needed.

## Anatomy of a Sponge







# Reproduction

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

- **Asexual reproduction** occurs by budding or by fragmentation.
  - The buds may remain attached to the parent or separate from it, and each bud develops into a new individual.

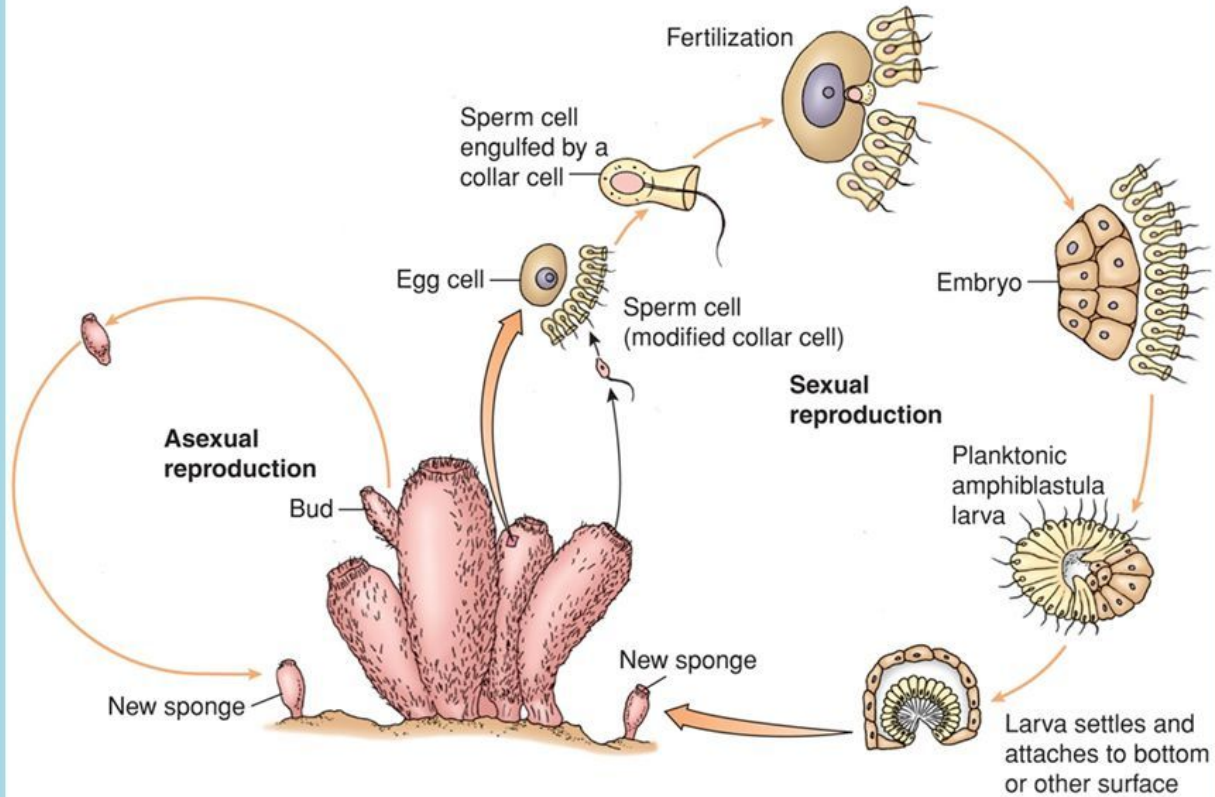
Freshwater sponges, as well as several marine species, form resistant structures called gemmules that can withstand adverse conditions such as drying or cold and later develop into new individuals.

Gemmules are aggregates of sponge tissue and food, covered by a hard coating containing spicules or spongin fibers.

Sexual reproduction also occurs. **Most sponges are hermaphroditic, the same individual producing eggs and sperm, but in some species the sexes are separate.**

- The larvae are flagellated and swim about freely for a short time.
- After settling and attaching to a suitable substrate, the larvae develop into young sponges.

# Reproduction



# Class Calcarea (Calcareous Sponges)



Order: Homocoela  
Name: *Clathrina clathrus*



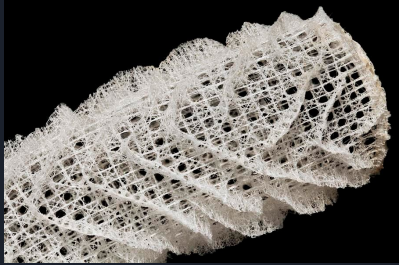
Order: Heterocoela  
Name: *Sycon*

## Chalk sponges

- Calcareous  $\text{CaCO}_3$  spicules
- Sponges in this class have skeletal spicules composed of calcium carbonate.
- The spicules often protrude through the epipinecodermal covering of the body wall, giving the organism a rough texture.
- Calcareous sponges are small (usually a few inches high) and are generally dull in appearance, although some species are brightly colored.
- Sponges in this class are among the **simplest sponge**, and all three morphological types - asconoid, syconoid, and leuconoid - are represented.
- Approximately 150 known species, exclusively marine and shallow-water dwellers.

# Class Hexactinellida (Glass Sponges)

Order: Amphidiscophora  
Name: *Hyalonema*



Order: Hexasterophora  
Name: *Euplectella*



Also known as Venus's-flower-basket (*Euplectella*)

- Deep-sea sponges,
- Lack epidermal covering,
- Their skeletons are composed of spicules of silica,
- The spicules, which often form a lattice work, have six points or some multiple thereof,
- The spongocoel is large,
- The osculum is covered by a grillwork of fused spicules.
- Silicious SiO<sub>2</sub> spicules
- The body is between a syconoid and leuconoid.
- When the living tissue is removed, the cylindrical skeletons often have the appearance of spun glass, hence the name.
- Supplies a home for certain shrimps that become trapped by the lattice of spicules.

# Class Demospongiae (Demosponges)



**Subclass:** Tetractinellida

**Top left:**

**Order:** Myxosporidia

**Name:** *Oscarella lobularis*

**Top right:**

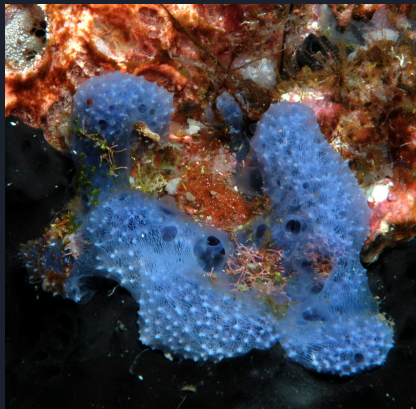
**Order:** Camosa or  
Microsclerophora

**Name:** *Plakina jamaicensis*

**Bottom right:**

**Order:** Choristida

**Name:** *Ancorina*



- Largest class, most sponges belong in this class
- Includes sponges with a skeleton made up of silicon-containing spicules or spongin fibers or both
- If they are made of spongin fibers then the spongin provides a matrix in which the spicules are embedded.
- These sponges vary in size, even going up to large irregular masses
- All are leuconoid, many are brightly colored.
- The freshwater sponges belong to this class → they are usually green because of the symbiotic algae that live in the amoebocytes
- The fibrous also belong to this class → include common bath sponges
  - *Hippospongia communis* and *Spongia officinalis*, and most other sponges are used commercially
- The boring spongers (Clionidae) have the ability to bore into calcareous rocks and mollusk shells
  - They begin giving birth to their larvae and spend their lives in the tunnels they form.
- Sulfur sponges (*Cliona* species) are bright yellow boring forms inhabiting shallow waters on the east and west coasts of the U.S.

# Class Demospongiae (Demosponges)

**Subclass:** Monaxonida

**Top left:**

**Order:** Hadromerina or  
Astromonaxonellida

**Name:** *Cliona*

**Top right:**

**Order:** Halichondria

**Name:** *Halichondria panicea*

**Bottom left:**

**Order:** Poecilosclerida

**Name:** *Clathria (Microciona)*  
*echinata*

**Bottom right:**

**Order:** Haplosclerida

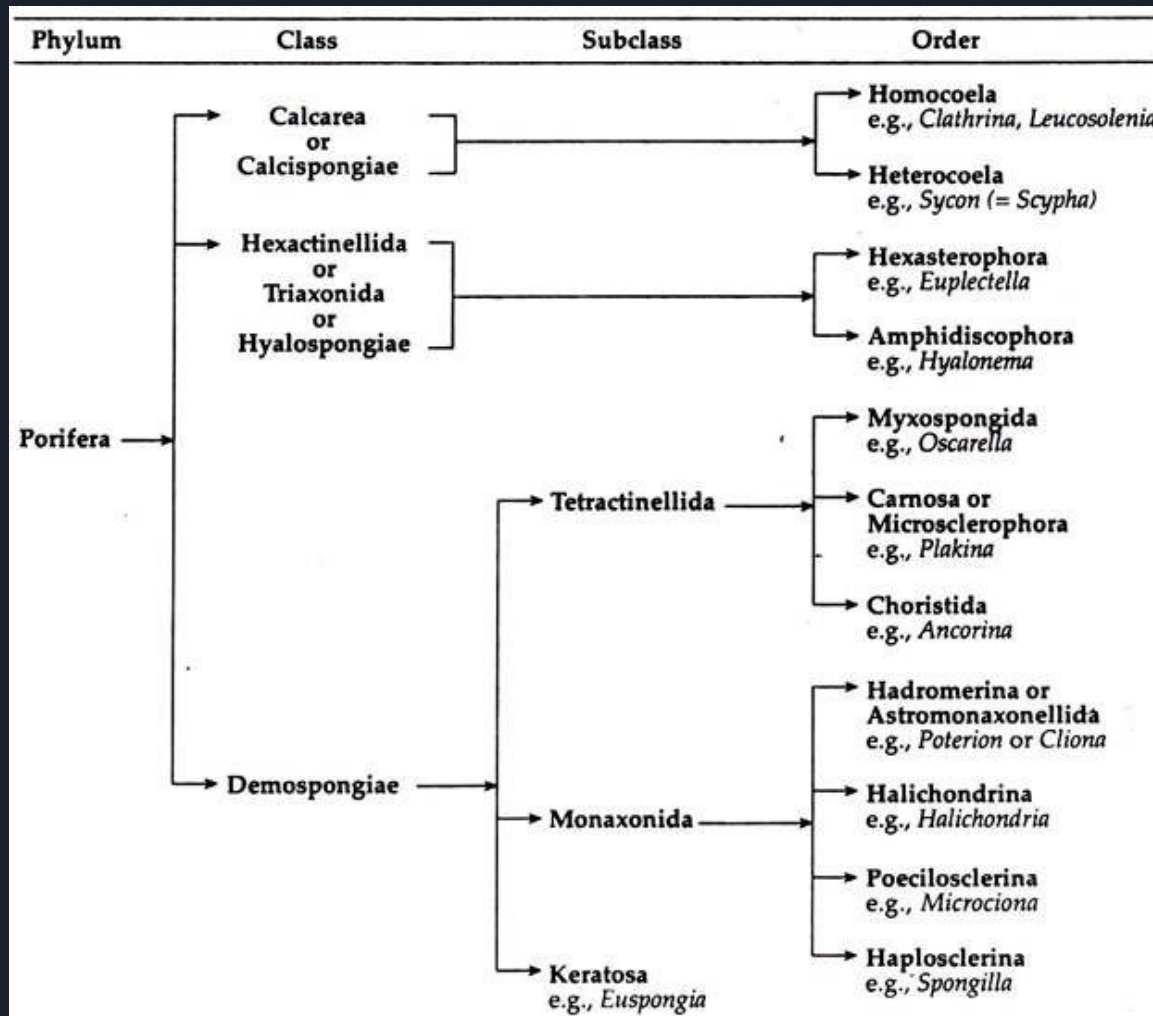
**Name:** *Spongilla*



**Subclass:** Keratosa

**Name:** *Euspongia*

<b>Class Calcarea (Calcareous Sponges)</b>	<b>Class Hexactinellida (Glass Sponges)</b>	<b>Class Demospongiae (Demosponges)</b>
Chalk sponges	Deep-sea sponges	Largest class, most sponges belong in this class
Spicules with CaCO <sub>3</sub>	Lack epidermal covering	Includes sponges with a skeleton made up of silicon-containing spicules or spongin fibers or both
Rough texture	Skeletons are composed of spicules of silica, often looking like spun glass	These sponges vary in size, even going up to large irregular masses
Simplest sponge with three morphological types: asconoid, syconoid, leuconoid	Spicules often form a lattice work and have six points of attachment	All are leuconoid, many are brightly colored.
Usually small and generally dull, but some are brightly colored	Silicious SiO <sub>2</sub> spicules	Freshwater sponges: usually green because of the symbiotic algae that live in the amoebocytes
Approx. 150 known species	Body is between a syconoid and leuconoid	Include the fibrous sponges (including common bath sponges)
Exclusively marine and shallow-water dwellers	Spongocoel is large	The boring spongers (Clionidae) have the ability to bore into calcareous rocks and mollusk shells - spend their lives in tunnels that their larvae are born in
	Supplies a home for certain shrimps that become trapped by the lattice of spicules	Sulfur sponges (Cliona species) are bright yellow boring forms inhabiting shallow waters on the E. and W. coasts of the U.S.







# WORD SEARCH

ASCONOID

ASEXUAL

CALCAREA

CHOANOCYTES

DEMOSPONGES

HEXACTINELLIDA

LEUCONOID

MARINE

PINACOCYTES

PORE

PORIFERA

SESSILE

SPICULES

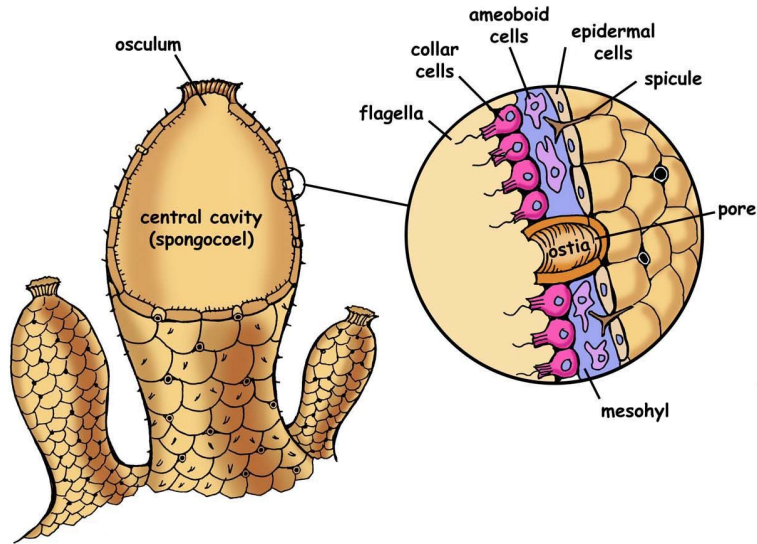
SPONGE

SPONGEBOB

SYCONOID

SYMMETRY

## Anatomy of a Sponge



ASCONOID  
SESSILE  
ASEXUAL  
SPICULES  
CALCAREA  
SPONGE  
CHOANOCYTES  
SPONGEBOB  
DEMOSPONGES  
SYCONOID  
HEXACTINELLIDA  
SYMMETRY  
LEUCONOID  
MARINE  
PINACOCYTES  
PORE  
PORIFERA



# Sources

"Porifera." The Columbia Encyclopedia, 6th ed.. Retrieved July 28, 2018 from Encyclopedia.com:  
<http://www.encyclopedia.com/reference/encyclopedias-almanacs-transcripts-and-maps/porifera>