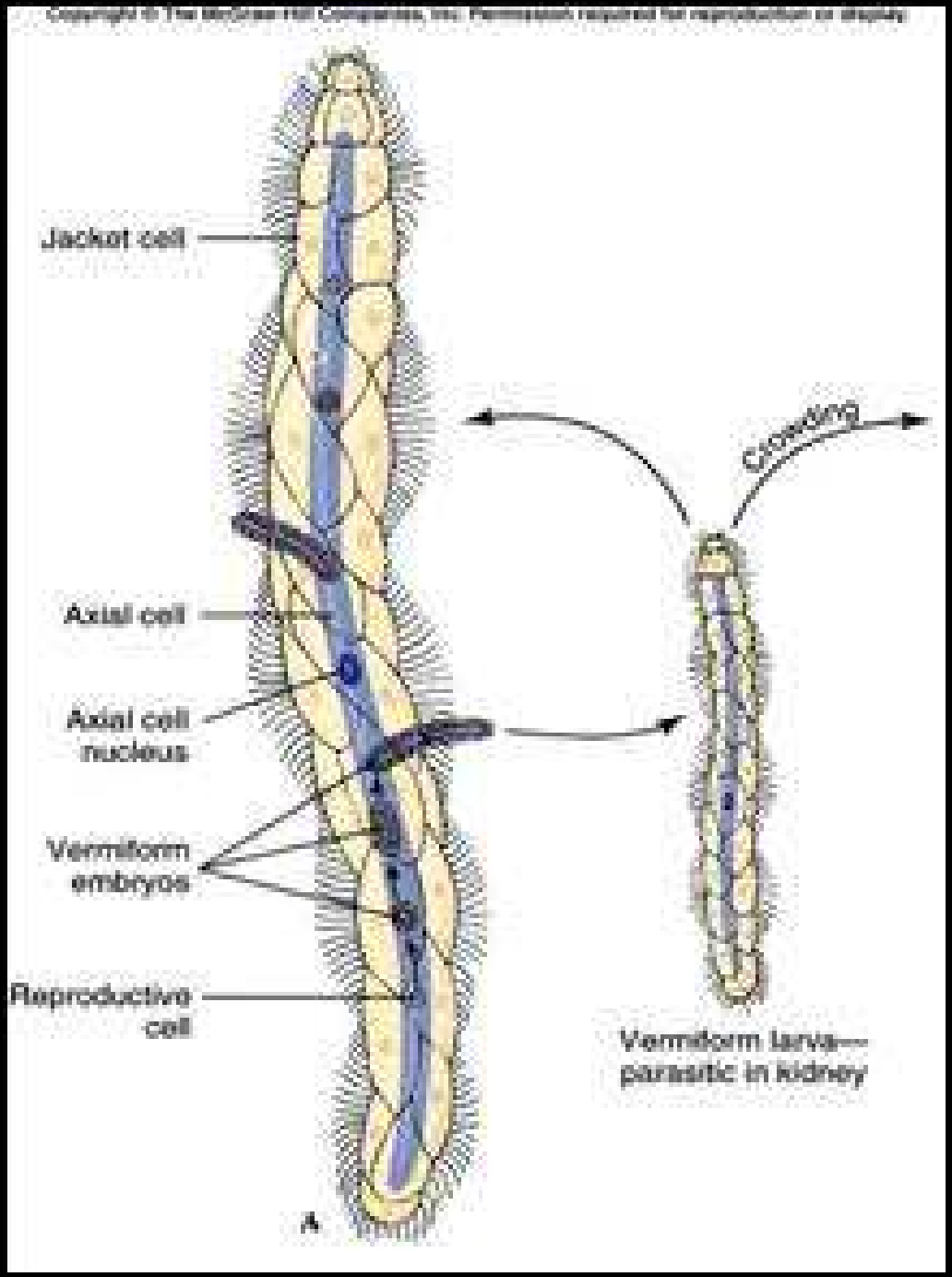

Mesozoa, Parazoa, and Metazoa

Chapter 12
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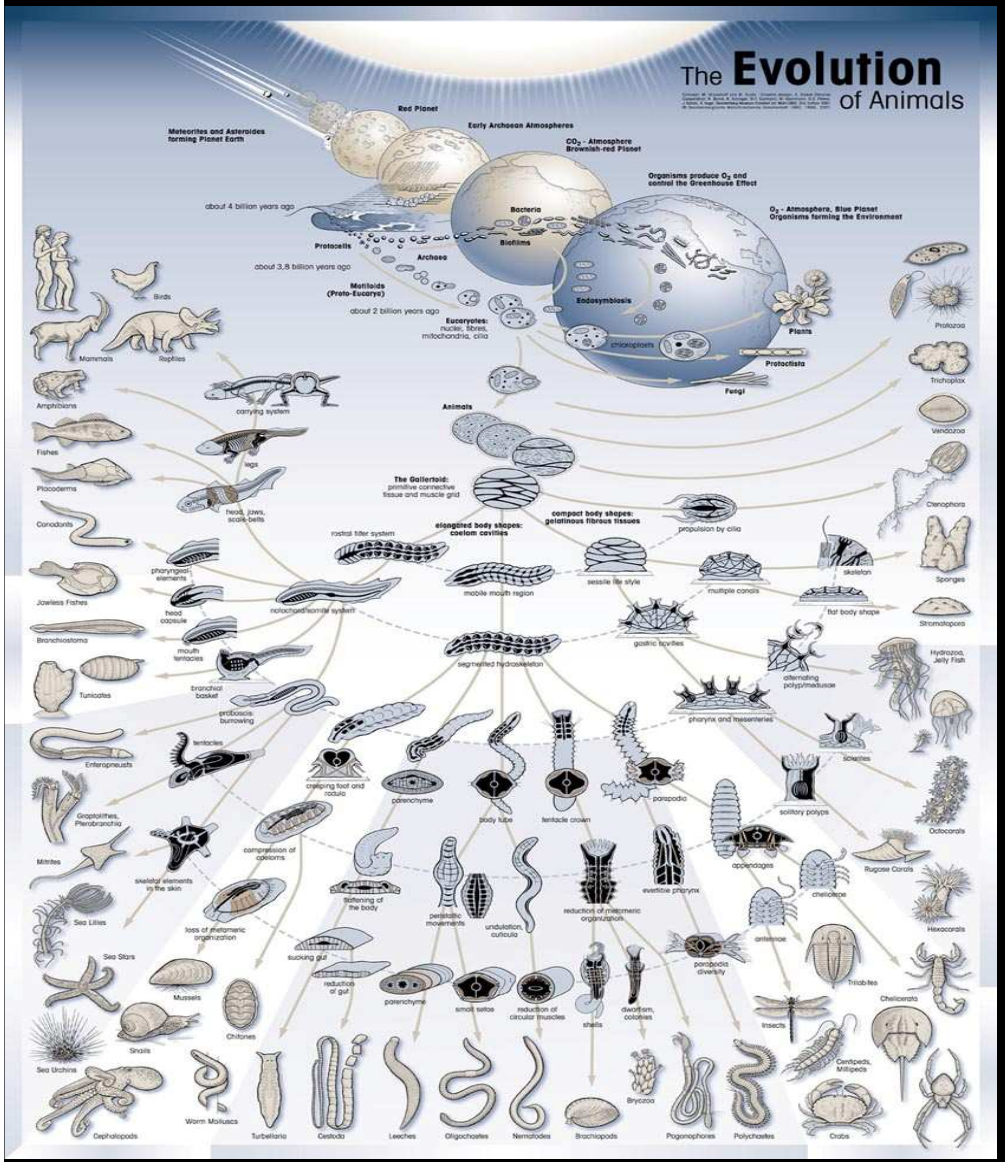
3 Multicellular Groups: Mesozoa, Parazoa, Eumetazoa

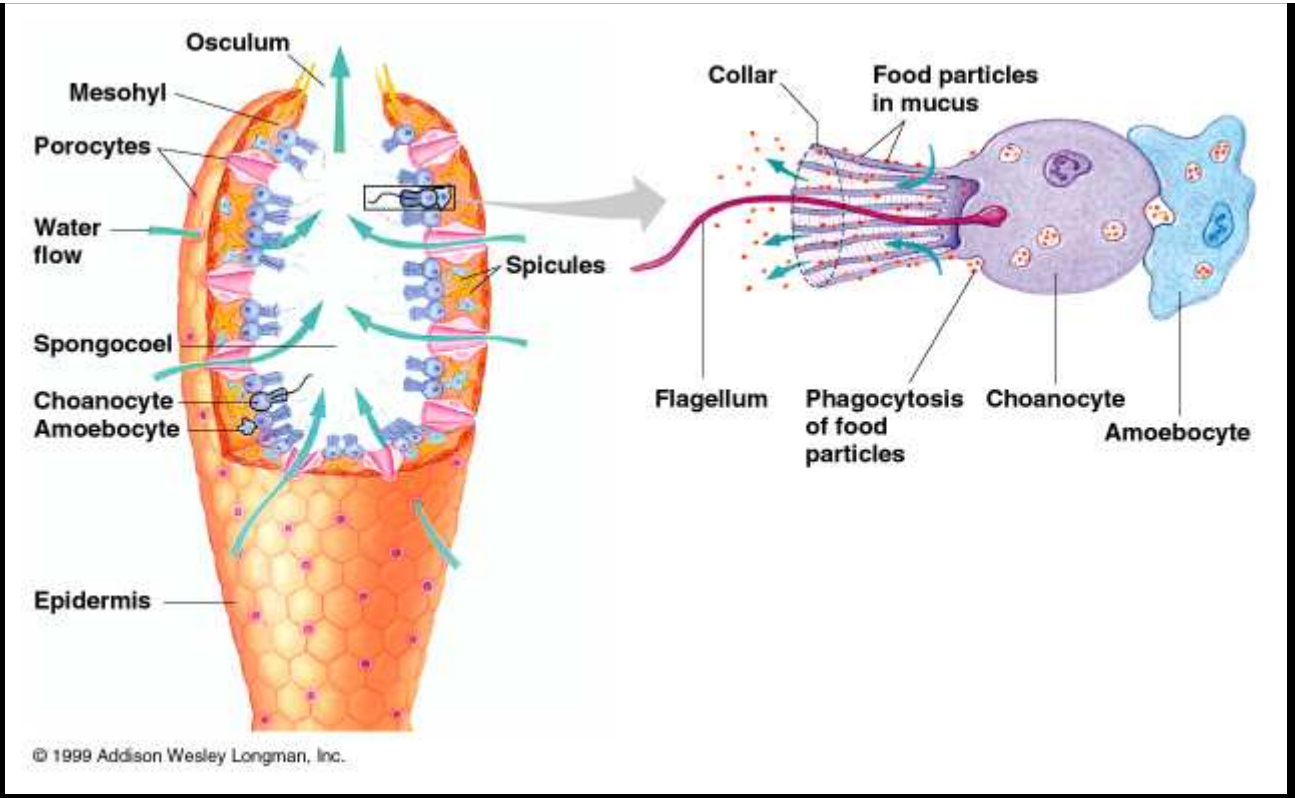
- Multicellular organisms are divided into three groups:
  - **Mesozoa**,
  - **Parazoa** (phylum **Porifera**, phylum **Placozoa**) and
  - **Eumetazoa** (all other animal phyla).

  – Mesozoa and Parazoa are multicellular but lack germ layers of Eumetazoa. They have a cellular level of organization.
  – Mesozoans are entirely parasitic but have a complex reproductive cycle.

Where did animals come from?



- Some propose that metazoans arose from **syncytial** (multinucleate) **ciliated forms** and cell boundaries evolved later. The body form resembled modern ciliates with a tendency toward bilateral symmetry.
- This would resemble flatworms, but their embryology fails to show cellularization, and flatworms have flagellated sperm.
- This would mean that radial cnidarians had a bilateral ancestor.
  - http://plynn.net/evolution-of-animals.jpeg

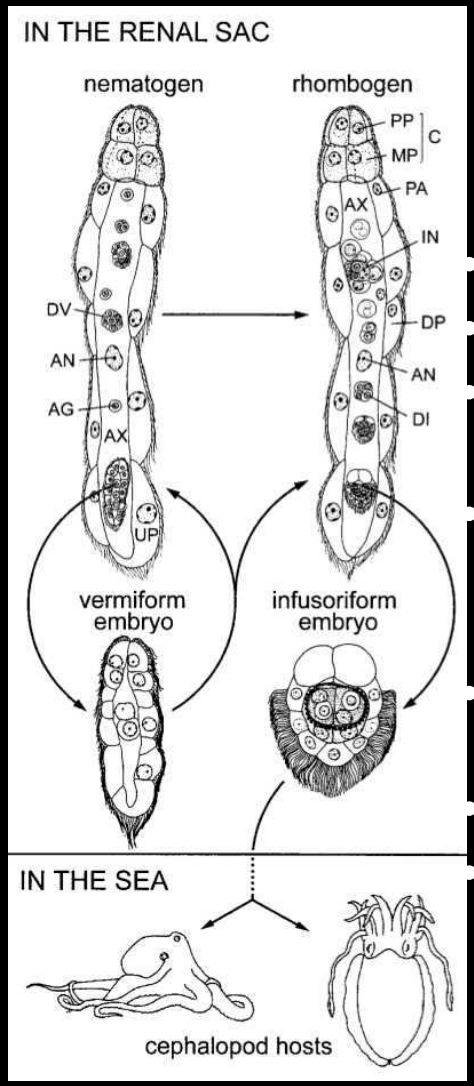


Others suggest that metazoans arose from a **colonial flagellated form (ie. Sponges!)** and cells gradually became specialized. Haeckel first proposed this in 1874.

– As cells in a colony became more specialized, the colony became dependent on them.
  - The colonial ancestral form was at first radially symmetrical, and reminiscent of a blastula stage of development.
– This hypothetical ancestor was called a **blastea**.
– Bilateral symmetry would have evolved when the larvae adapted to crawling on the floor.

Why multicellular?

- Nature’s experiments with larger organisms without cellular differentiation are limited.
  - Increasing the size of a cell causes problems of exchange; multicellularity avoids surface-to-mass problems.
  - Cell assemblages in sponges are distinct from other metazoans; molecular evidence shows common ancestry.



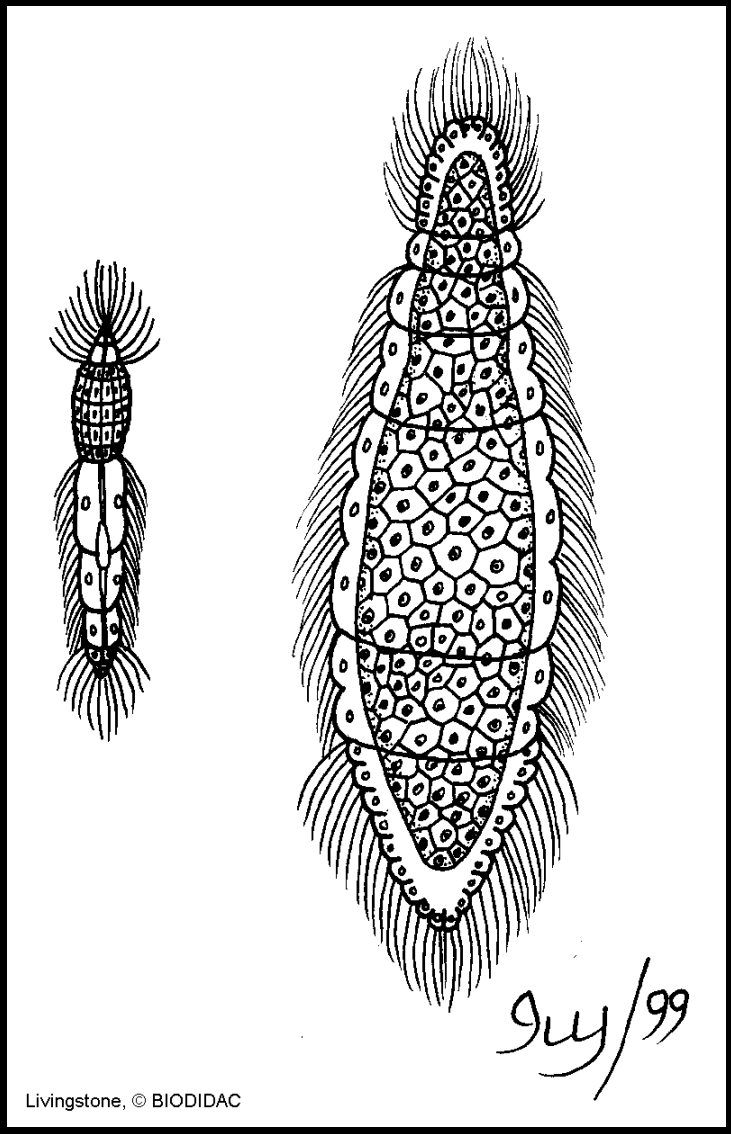
Mesozoa

- small phylum
- small and poorly understood animals
- simple bodies
  - consisting of less than 50 cells
- All known species are internal parasites of marine invertebrates.

- Named by van Beneden in 1876; he believed mesozoa was a link between protozoa and metazoa.
- All are parasites in marine invertebrates.
- They are small, made of 20–30 cells in two layers but these are not germ layers.
  - Class Rhombozoa
    - Rhombozoas live in the kidneys of benthic cephalopods.
  - Class Orthonectida

Characteristics of Mesozoa:

1)Bilaterally symmetrical.
2)Has no organs or tissues.
3)Body contains no internal cavity.
4)Body possesses no digestive tract (gut).
5)Body only two cell layers in most places.
6)Has no nervous system.
7)Has some cells develop inside other cells.
8)Reproduction quite complex involving both sexual and asexual aspects.
9)All are endoparasites on other marine invertebrates.



Rhombozoans

- Live in kidneys of benthic cephalopods (octopuses, cuttlefishes, and squids)
- Vermiforms (adults) are long and slender

Orthonectids

- Parasitize a variety of invertebrates, such as brittle stars, bivalve molluscs, polychaetes, and nemerteans.

Parazoa =

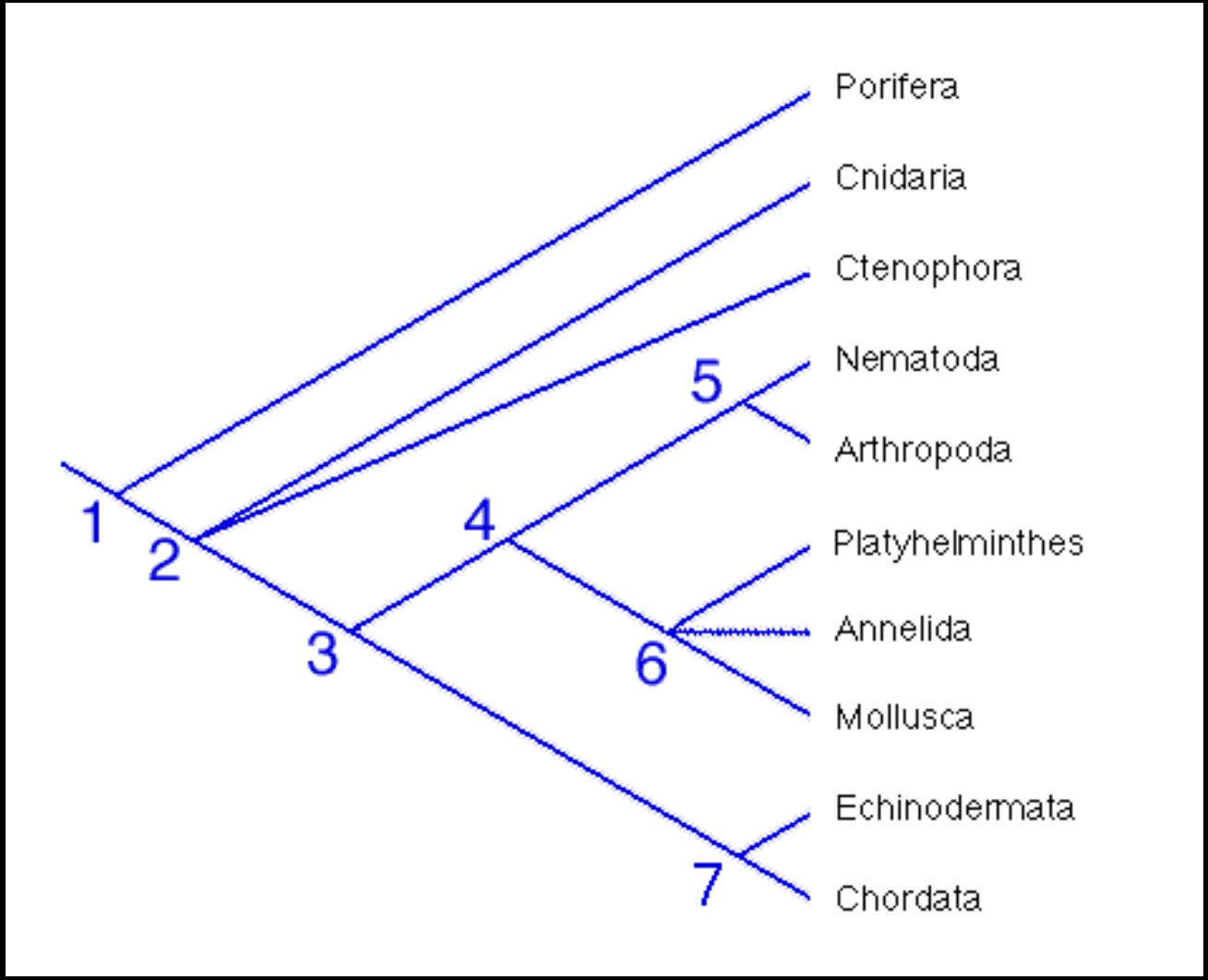
- Multicellular organisms having less-specialized cells than in the Metazoa
  - comprises the single phylum Porifera

Note: Metazoa are multicellular organisms that have cells organized into tissues and organs

Parazoa

- A name proposed for a subkingdom of animals which includes the sponges.
- An early branching event in the history of animals separated the sponges from the Metazoans, which were the ancestors of all other animals.
  - Thereafter, sponges evolved independently, and since the Precambrian, they have been conspicuous members of many fossil communities.

How have animals branched off from a common ancestor?



Phylum Porifera

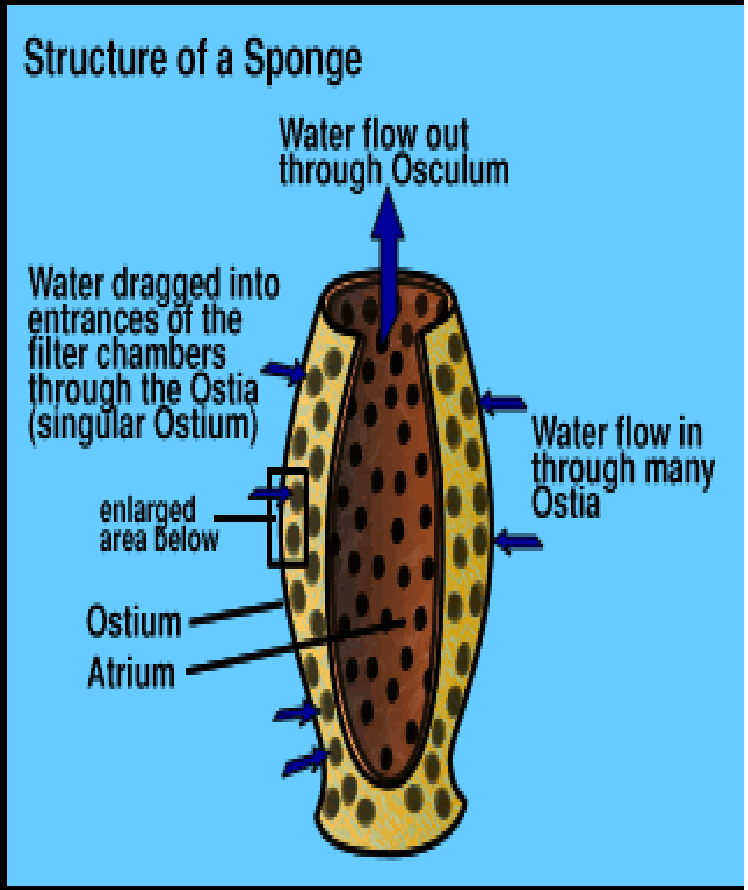
- "**Sponge**" is the common name for the Poriferan
  - It is named for the pores with which every sponge is covered, 'porifera' meaning 'pore bearer'.
- Sponges come in an incredible variety of colors and an amazing array of shapes.
- Between 5 000 and 10 000 species live today
- They are the simplest form of the multicellular organisms and all are aquatic, benthic organisms.
- Most are **marine**,
  - only 150 fresh water species known today.
  - They are known to be present in all seas and in several lakes.

Morphology

- Surface of a sponge's body is covered by a skin, one cell thick.
- Sponges lack symmetry (asymmetrical)
- Unlike all other marine invertebrates, they have no true tissues or organs.
  - They do NOT have nerve or muscle cells.

- Body is hollow, and it is composed of a simple aggregation of cells, between which there is little nervous coordination.
  - these cells perform a variety of bodily functions and appear to be more independent of each other than are the cells of other animals.

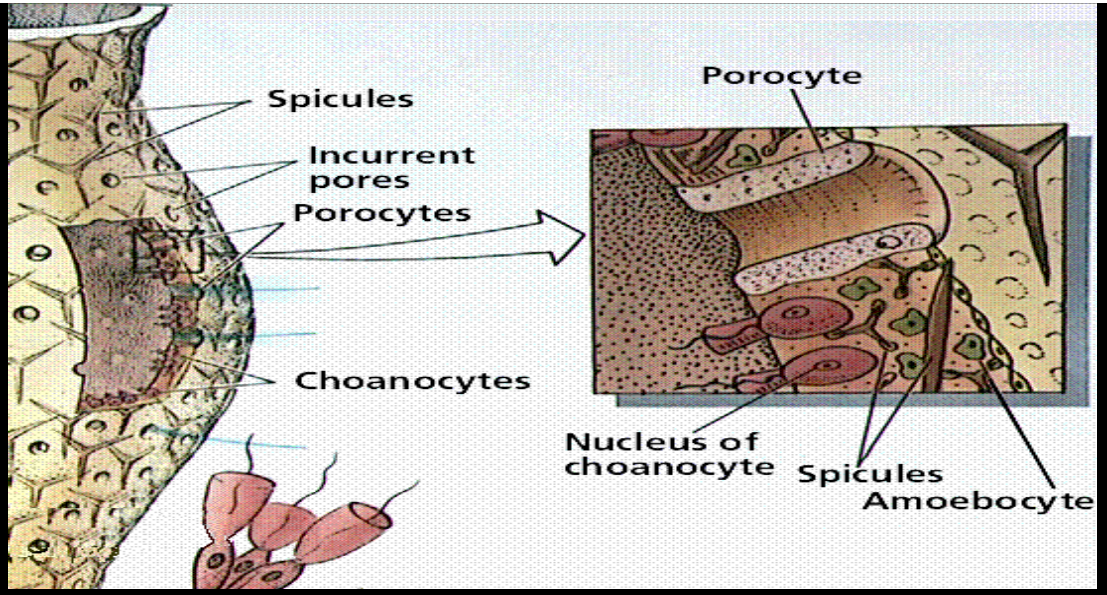
- This gelatinous matrix is supported by an internal skeleton of spicules of silica, calcium carbonate, or fibrous protein known as 'spongin'.
- The sponge's body encloses a vast network of chambers and canals that connect to the open pores on their surface.



Water Circulation

- The open pores on the surface of the sponge come in two types.
  - “entry” cells are known as ostia
  - exit cells, which are bigger, are the oscula, often termed 'excurrent'.
- Specialized cells, the choanocytes, allow water into the ostia.
- Water flows through the body of the sponge, entering at the ostia, circulating around the canals and chambers, then leaving from the oscula.
- The flow of water through the sponge is unidirectional, driven by the beating of flagella which line the surface of the chambers.
- The volume of water passing through a sponge can be enormous, up to 20 000 times its volume in a single 24-hour period.

In this photograph, the pumping action of a sponge is illustrated. A non-toxic yellow dye has been squirted around the base of a purple tube sponge in the Caribbean. Shortly thereafter, the dye is pumped out through the osculum at the top of the sponge.



Feeding

- Sponges feed by drawing a current of seawater in through their entry pores, the oscia, filtering out food particles, then ejecting the water out through their exit pores, the oscula.
  - This flowing water provides both food and oxygen, as well as being a means for waste removal.
- In general, sponges feed by filtering bacteria from the water that passes through them.
  - Some sponges trap about 90% of all bacteria in the water they filter, but others appear to be less efficient at capturing bacteria.
  - Some sponges harbor symbiotic unicellular algae such as green algae, dinoflagellates, or cyanobacteria, which supply them with food and allow salt accumulation for the skeleton.
- Poriferans do not have mouths.
- Cells in the sponge walls filter food from the water as it is pumped through the body.
- The canals are lined with special net-like collar cells, which absorb the nutrients and oxygen from the water whilst expelling carbon dioxide and waste products into it.

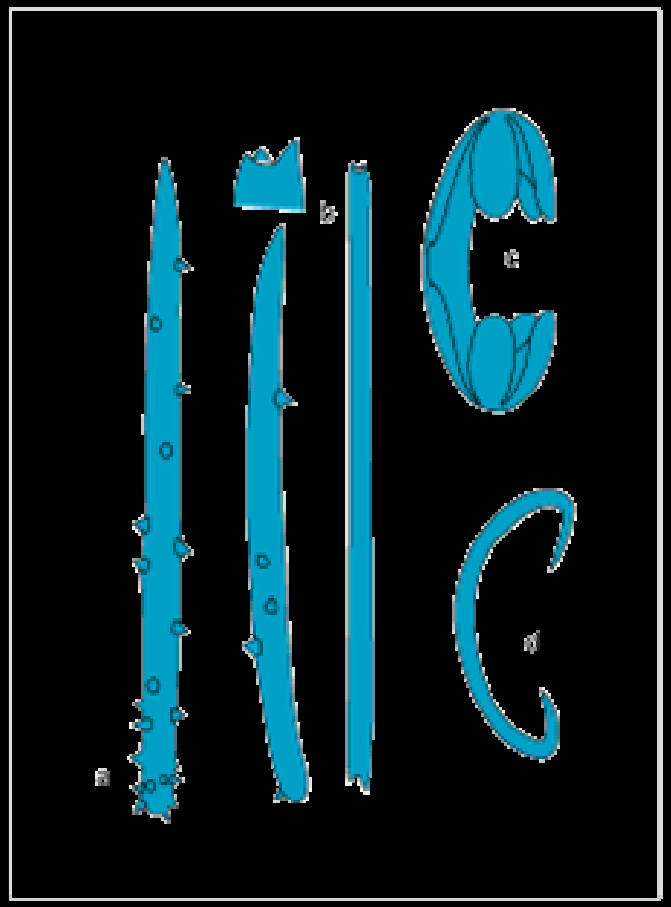
- Inside the sponge, the water flows through canals to a spacious chamber called a spongocoe.
- Deprived of its nutrients, the water is then expelled through the oscula.

The Carnivorous exception

- Sponges of the family Cladorhizidae are unusual in that they typically feed by capturing and digesting whole animals.
- They capture small crustaceans with their spicules, which 'hook onto' and attach to crustacean exoskeletons which they may come in contact with the. Sponge cells then migrate around the helpless prey, and digestion takes place outside the cells - or 'extracellularly'

Skeletal framework:

- Spicules: calcareous or siliceous support structures
  - Used to identify sponge
- Spongin: form of collagen, in matrix of sponges



Reproduction

- In the Porifera, reproduction is both sexual, and asexual.

Sexual Reproduction

- hermaphroditic, so the same individual releases both sperm and eggs.
  - They are released at different times to avoid self-fertilization.
- Sperm are released
- Sperm are carried by the water current towards another sponge.

- There, they are captured by the female cells, the choanocytes.
- Fertilization occurs, and the resulting [zygotes] [fertilized eggs] develop into [ciliated] larvae.

Asexual Reproduction

- Sponges that reproduce asexually produce either buds or, more often, gemmules, which are packets of several cells of various types inside a protective covering.

- Fresh water sponges of the Spongillidae often produce gemmules prior to winter. The development of these gemmules into adult sponges begins the following spring.
  Some buds are resistant to drought, and can develop on their return to water.

Sponges are divided into three distinct groups, as follows:

- **Hexactinellida**, or glass sponges.
  - These are characterized by siliceous spicules consisting of six rays intersecting at right angles.

- **Demospongia**. This is by far the most diverse sponge group, although they are not well represented in the fossil record, as they do not possess skeletons that would easily fossilize. Demosponge skeletons are composed of 'spongin' fibres and/or siliceous spicules. Demosponges take on a variety of growth forms from encrusting sheets living beneath stones to branching stalks upright in the water column. They tend to be large and only exhibit the more complex 'leucon' grade of organization.

- **Calcarea**. Members of the group Calcarea, the calcareous sponges, are the only sponges that possess spicules composed of calcium carbonate.

Phylogeny

- Ancient group
- Sponges originated before the Cambrian period
- Radiated because of their elaboration of water circulation and filter feeding

Sponge Commensalisms

- Many animals live in symbiosis with the sponge
  - Some crabs attach pieces of sponge to their carapace for camouflage and protection
  - Some reef fish eat sponge
  - Sponge is home/shelter to many

Summary:

- Asymmetrical
- Organized as an assemblage of different kinds of specialized cells, e.g., collar cells
- No tissues
- Skeleton lacking or made of spicules

- http://www.bbm.me.uk/portsdown/PH_321_Sponge.htm