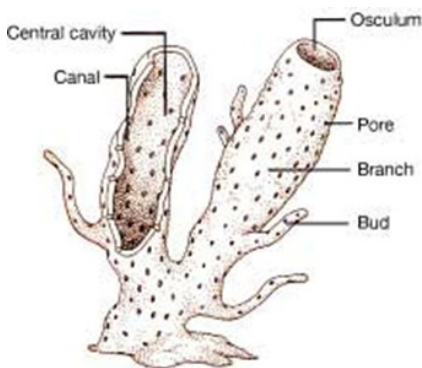


KINGDOM ANIMALIA

The Kingdom Animalia is the largest of the 5 Kingdoms in Domain Eukarya. Although the members of this kingdom are very diverse, all are **multicellular**, **eukaryotic** and **heterotrophic**. They are further characterized by having **specialized cells and tissues** for particular functions. All animals reproduce **sexually** with simpler members being capable of asexual reproduction as well. This kingdom is subdivided into 2 groups: Invertebrates and Vertebrates.

INVERTEBRATES - Animals Without Backbones

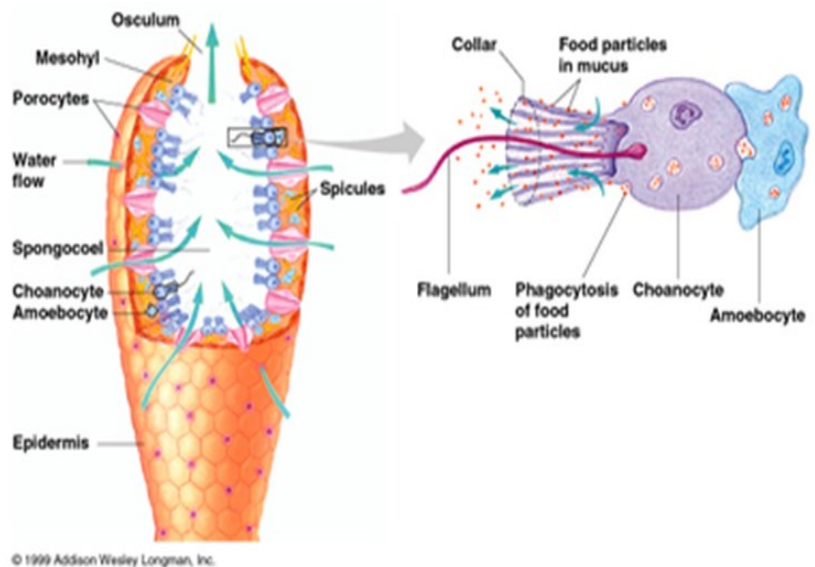
Animals that lack a backbone are called invertebrates. It is estimated that 97% of all species of animals are invertebrates. With the exception of insects, most invertebrates are marine.



Phylum PORIFERA Example: SPONGES

Sponges are called porifera or “pore bearers” because of the **pores** on the sides. They are among the simplest multicellular animals. They do not have any tissues or organs. They are animals that are a **complex bundle of specialized cells**. Nearly all sponges are **marine** and all are **sessile**, which means they live on the ocean bottom or attached to something and come in many shapes and sizes so are described as **asymmetrical**.

The outer surface of a sponge is covered with flat pore cells which allow water to enter. Water is pumped into a larger canal lined with **collar cells** (choanocytes). The cells have a flagellum that creates currents and a thin collar that traps food that is later ingested and passed to specialized cells (**amoebocytes**) for distribution. Water then leaves through the **osculum**, a large opening at the top of the sponge. Since the sponge actively filters material out of the water to eat they are known as **filter feeders**. As sponges grow larger they need support. **Spicules** are supporting structures.



Sponges can reproduce **asexually** when branches or **buds** break off and grow into larger sponges. Sponges can also reproduce **sexually** by producing egg or sperm. The sperm enters the sponge and fertilizes the egg. The gametes are released directly into the water.

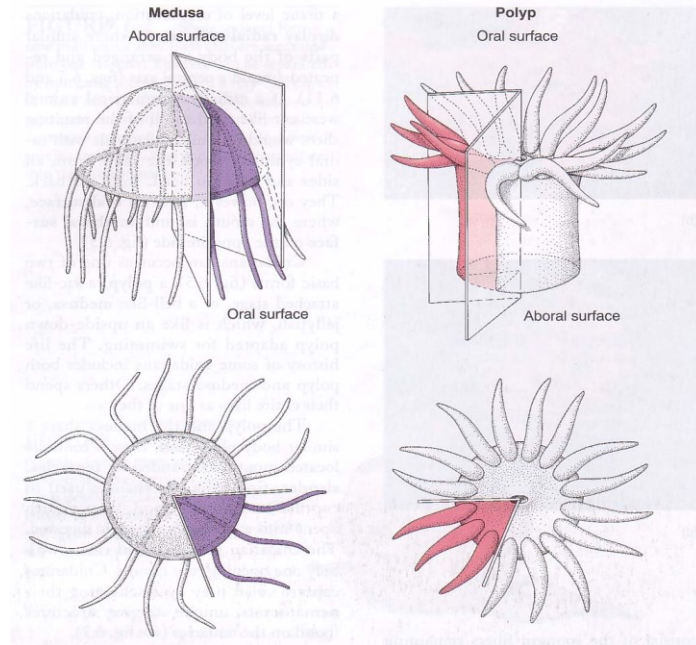
Sponge Feeding <https://www.youtube.com/watch?v=pTZ211eJX8&vI=en> (2 min)

Phylum CNIDARIA or COLENTRATES Example: Jelly Fish, Sea Anemone

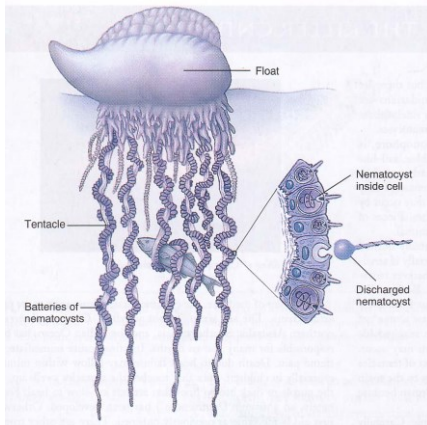
Sometimes called Coelenterates this phylum includes organisms that are mainly **marine**. Cnidarians are more complex than sponges. They have **tissues** specialized to perform specific functions. Unlike Sponges which have no symmetry, Cnidarians are radially symmetrical. **Radial Symmetry** means body parts are repeated around the central part of the body.

Cnidarians have 2 body forms: **polyp** -a sessile cylindrical sac-like body or a motile bell like **medusa** form. Both have a centrally located mouth surrounded by tentacles.

Almost all Cnidarians are **carnivores**. They usually use **nematocysts** (stinging structures) located on their tentacles to sting or even paralyze their prey. Food is pulled into the mouth which opens into a **blind gut** (sac like cavity) where it is digested. Due to their **acoelomate** (single opening) body plan wastes must leave through the mouth.



Swimming Anemone <https://www.youtube.com/watch?v=ys0mq71fcMk> (1:30)

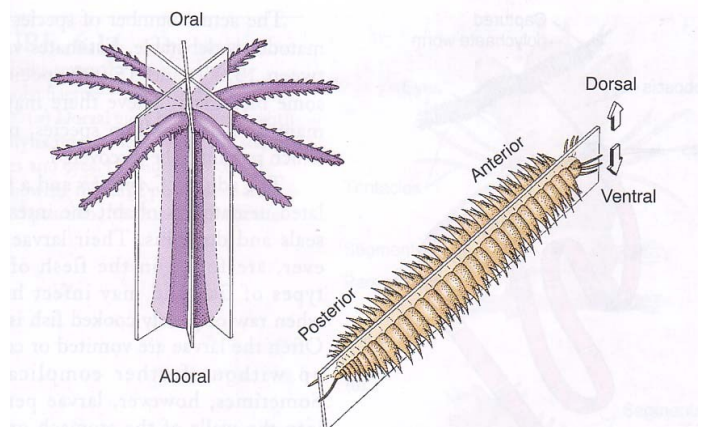


Like sponges Cnidarians are capable of both **asexual** and **sexual** reproduction with many medusae members beginning life as a polyp becoming free swimming as an adult.

Jellyfish 101: <https://www.youtube.com/watch?v=9z8ujpPgUjI> (3:50)

Phylum PLATYHELMINTHES, Phylum NEMATODA, Phylum ANNELIDA

Members of these 3 Phyla are commonly called worms. These organisms are all **bilaterally symmetrical** meaning only symmetrical in one direction with a front (**anterior**) end and a back (**posterior**) end. They also have a back (**dorsal**) surface and a belly (**ventral**) surface. All have evolved **organs** to perform life functions.

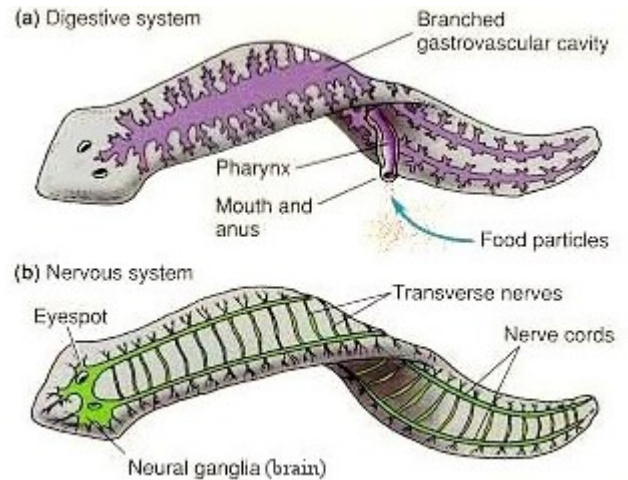


Platyhelminthes – Example: Planaria, Tapeworm

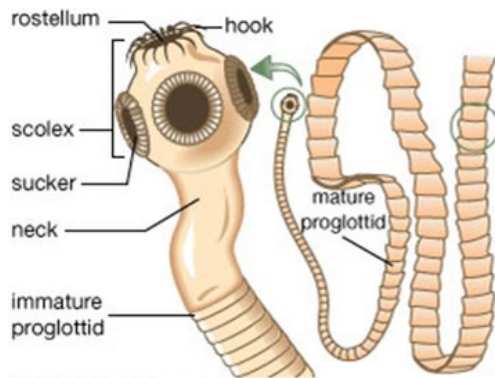
“Flatworms” are the simplest invertebrates that have organs and **organ systems**. They have a simple brain and nervous system that coordinates the movement of the muscular system. This concentration of nerves in the anterior end is called **Cephalization**.

Planaria are free-living carnivores. They have a **pharynx** used to take in food and digest it. Waste goes out the pharynx as well. They have **eyespot**s to detect light.

This is the first time we see some type of nervous system.



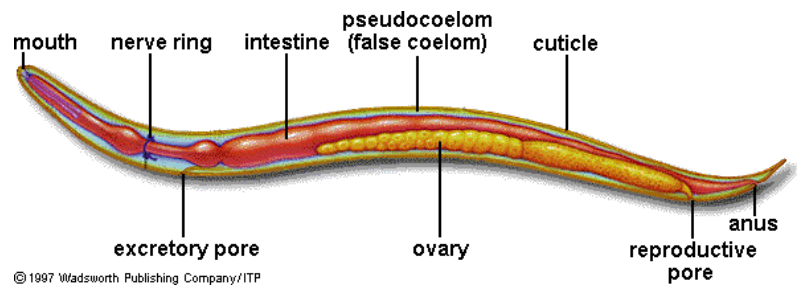
Planaria Regeneration <https://www.youtube.com/watch?v=w0QzSYQGsnA> (0:30)



Tapeworms attach themselves inside the intestines and absorb the nutrients the host takes in. Some can grow up to 50 feet in length. Tapeworms do not have a **digestive system** because they are **parasitic** and the organism they live in has already digested the food so they don't need one. This allows room for a well developed reproductive system in the form of **proglottids**. Each one contains both **male and female** reproductive structures.

Nematoda – example: Ascaris, Hook worm

“Roundworms” have a **tubular digestive system** running through the body with a separate mouth and anus. They get their cylindrical shape from a fluid-filled body cavity (**pseudocoel**) between the digestive tract and the body wall which acts as a hydrostatic skeleton. Most members are parasitic, covered with a tough **cuticle**. Nematodes reproduce sexually with separate sexes.



Parasitic hookworms <https://www.youtube.com/watch?v=44aq2A6NkUw> (2:07)

Annelida – Earthworm, Leach



Annelids are known as “Segmented Worms” and as such are the first invertebrates to show true segmentation & covering on their digestive tract (**peritoneum**). The space (**coelom**) created by the peritoneum allows for the development of organs. Segmentation

allows for specialization of body regions (development of **body systems**) & more efficient movement.

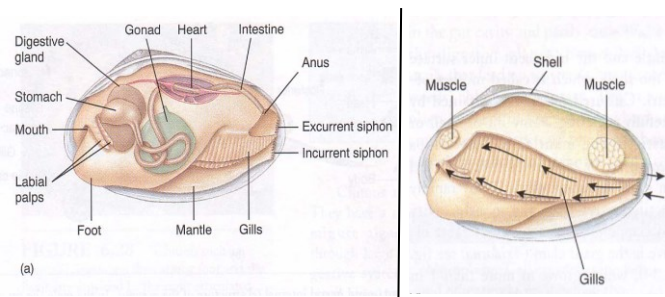
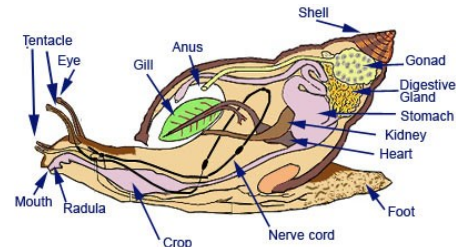
You will learn more about annelids in the [Earthworm Dissection](#).

Medicinal Leeches <https://www.youtube.com/watch?v=O-0SFWPLaII> (3:40)

Phylum MOLLUSCA Example: Snails, Clams and Octopuses

The name Mollusc comes from the Latin word “mollis,” which means “**soft**.” Molluscs have a soft body protected by a calcium carbonate **shell**. Some molluscs have an internal shell called a **pen** (squid). A thin layer of tissue called the **mantle** covers the unsegmented body and produces the shell. The body is usually **bilaterally symmetrical** with a ventral, **muscular foot** used for locomotion. Most Molluscs have a head that includes eyes and an **open circulatory system** (the heart pumps blood through tubes which **washes over** organs). Three common Classes of Molluscs are gastropods (snails), bivalves (clams, oysters) and cephalopods (squid and octopus).

Gastropods are typically a coiled body mass tucked into a shell. Some molluscs use a file-like tongue or **radula** to scrape algae off of rocks. Other molluscs are soft bottom feeders or even carnivores.

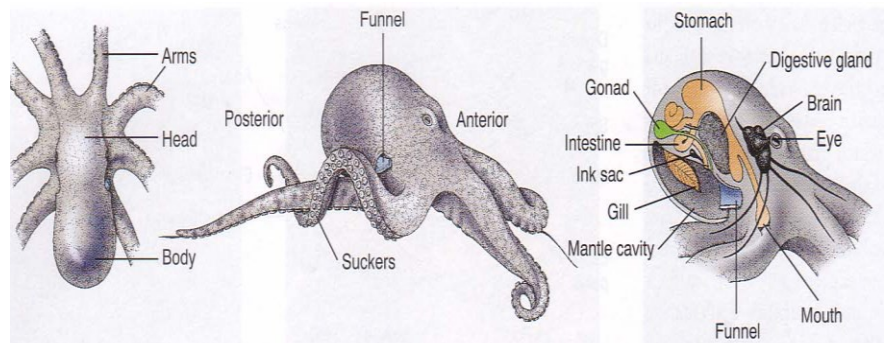


Bivalves are clams, mussels and oysters and other similar molluscs. They retain the body plan and are compressed in a two-valved shell. The inner part of the shell is lined with the mantle. There is no head or radula. **Siphons** pull water over the gills for **breathing**

as well as **filtering** small food particles. If a foreign particle becomes caught between the mantle and the body, the mantle will secrete calcium carbonate over top of it resulting in a **pearl**. Strong muscles are used to keep the shell closed. Clams will use their shovel shaped **foot** to move and to bury themselves in the bottom sediment.

Cephalopods include squid and octopus. They are agile swimming carnivores and have their foot divided into **arms** equipped with **suckers** to capture prey. They have a well-developed brain & excellent vision. Cephalopods use **jet propulsion** to move. The water enters through the open end of the mantle cavity and is forced out through a muscular tube called the **funnel**.

Octopuses have 8 long arms & lack a shell. They are efficient hunters & bite with a pair of **beak-like** jaws. If threatened, they can emit a dark ink produced by the **ink sac**, to distract predators.



Octopus Opens a Jar <https://www.youtube.com/watch?v=9kuAiuXezIU> (2:50)

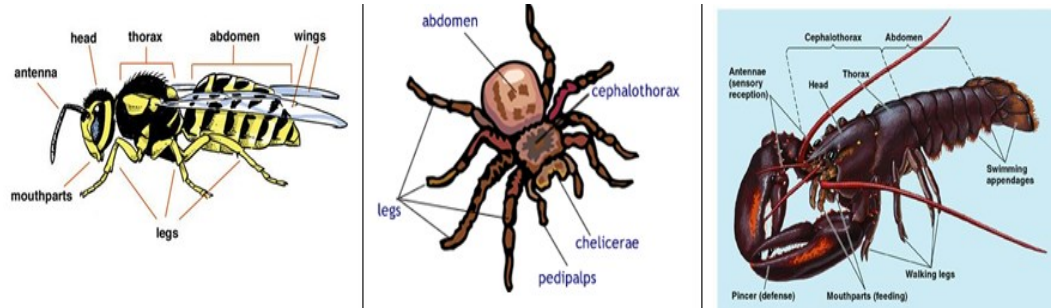
Phylum ARTHROPODA Example: Lobster, Spider, Dragonfly

Arthropods make up the largest phylum of animals with over 1 million species occupying all habitats on Earth. The arthropod body is **bilaterally symmetrical**, segmented & covered by a tough nonliving chitinous **exoskeleton**. The exoskeleton provides protection for well-developed body systems but must be shed (**molted**) thus limiting their size. Muscles are attached to **jointed appendages** like legs and mouth parts which are

adapted for a particular lifestyle allowing for walking, flying or swimming.

Arthropods have an **open** circulatory system and

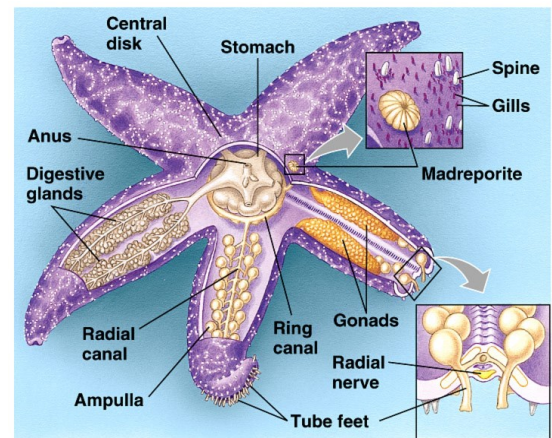
cephalization (a concentration of sensory organs in the head region) Most arthropod species have separate sexes. Many species have larvae that look nothing like the adult & go through **metamorphosis**. This contributes to the success of the Phyla as the young do not compete with adults for food. Familiar Classes of Arthropods are **Insects** (Bee), **Arachnids** (spiders) & **Crustaceans** (lobster).



Arthropod Adaptations <https://www.youtube.com/watch?v=bz4ODmqbnQA> (3:40)

Phylum ECHINODERMS Example: starfish, sea urchins & sand dollars

Echinodermata means “spiny-skinned”. Although sometimes the spikes look external they are part of an **endoskeleton** (internal) & are really covered with a thin layer of ciliated tissue. Not all echinoderms have spines (ie. Sand dollars). Adults are **radially** symmetrical while larvae are bilateral making them our closest invertebrate relative. Their radial symmetry is based on five repeating pieces as they lack a **head** (anterior) region. The two sides of an echinoderm are the **oral side** (containing the mouth) & the **aboral side** (with the anus). Echinoderms have an **evertable**



stomach so feed by extending the stomach outward secreting digestive enzymes to begin digestion externally. Nutrients are then absorbed & the stomach is pulled back into the body.

Echinoderms have a **water vascular system** of canals attached to muscular **tube feet**. These water-filled channels create hydrostatic pressure within the tube feet for movement and adhesion. The nervous system is a simple **nerve net** that coordinates the movement of the tube feet and spines with the absence of a brain. The sexes are separate in most echinoderms. Asexual reproduction is through **regeneration**. An arm can produce a new organism if a piece of the central disk is intact or present.

Starfish walking & feeding <https://www.shapeoflife.org/video/echinoderm-animation-sea-star-body-plan> (3:50)