

Mollusca

1. Phylum Mollusca
2. Nearly 90,000 named species and 70,000 fossil species
3. Size:
 - a. Microscopic to gigantic
 - i. Giant squid 18m long (60 feet) and 1000 lbs. (largest invertebrate known)
 - ii. Giant clams 1.5m in length and ~500lbs
4. Molluscs originated early in earth's history (probably the Cambrian)
 - a. The first land animals were likely early molluscs
5. Economically molluscs are one of the most important animal groups globally
 - a. 450,687,000 metric tons were harvested just on the eastern seaboard of the US valuing nearly \$861 trillion.
6. All molluscs are dependent on **calcium**.
 - a. With a changing climate co2 levels are increasing. This increase creates a chemical reaction in the ocean causing it to become more acidic and thus, making calcium less biologically available.
7. 8 classes
 - a. All share a common ancestor with a shell however many species have lost the shell through time.
8. Class bivalvia
 - a. They have two shells
 - b. They almost always are sedentary **suspension feeders**
 - c. The two shells are held together by **adductor muscles** on the anterior and posterior regions.
 - d. Respiration
 - i. **Gills** are made up of very thin layers of tissue with close access to blood
 1. These thin layers allow for easy diffusion of oxygen into the **blood**
 2. The gills are heavily **ciliated** which creates a water current to suck water into the **incurrent siphon**
 - e. Circulatory system
 - i. Molluscs do not have blood like vertebrates have. They have a fluid called **hemolymph**.
 1. Hemolymph saturates the body allowing for similar actions to blood (oxygen transport, nutrient transport etc...) however it is not iron based like blood. Hemolymph has a copper base which turns it a blue color when oxygenated.
 - ii. **Hearts** are present and have an **auricle** to bring hemolymph in and a **ventricle** to pump hemolymph out through two **aorta's**
 - iii. Once hemolymph is pumped out it freely flows throughout the mantle and collects nutrients from the intestines and oxygen from the gills.

iv. This is a fairly inefficient method for circulating nutrients and oxygen because the highly oxygenated or high nutrient hemolymph mixes with the less and dilutes the overall nutrient and oxygen concentration.

1. However if you don't spend a lot of energy moving or doing anything but filter feeding there is less to worry about.

f. Feeding

i. The ciliated gills create a current that brings water and suspended particles into the bivalve

ii. Then it is brought across the body to the mouth in between the **labial palp**

iii. It is then brought into the stomach and passed through the intestine and out the anus.

iv. The lower part of the intestines joins the with the kidney

1. The kidney filters out metabolic waste.

v. All the waste and undigested food is then passed out the excurrent siphon to be eliminated from the body.

g. Locomotion

i. Blood is pumped into the muscular foot, that extends out between the valves and pushes the body along

ii. A few bivalves (scallops) use their shells for locomotion by clapping their shell together and propelling themselves.

h. Reproduction

i. Sexes are separate and fertilization is usually external.

ii. Larvae are free swimming and go through three distinct stages of development before becoming an adult bivalve

1. **Glochidia** are a free swimming form that hitchhike on fish gills to parasitize nutrients.

i. Examples

i. Freshwater muscles

ii. Zebra muscles

iii. Bay scallop

9. Gastropoda

a. Largest and most diverse of Mollusca classes

b. They are so diverse no general name can describe them.

i. These include snails, limpets, slugs, conchs, sea slugs, sea butterflies, sea hares etc...

c. Have some economical value with escargot (\$300 million dollar a year industry) and abalones (which sell for over \$2000 per pound in traditional Chinese medicine shops)

d. Respiration

i. Gastropods cover all habitats, they live in marine, freshwater, and on land.

ii. Their respiration varies, aquatic forms have a gills while terrestrial forms have a **pneumostome** leading to the lung

e. Circulation

- i. Gastropods share characteristics with bivalves in that they have an **open circulatory system**, where hemolymph saturates the body without distinct blood vessels.
 - ii. One main difference is the gill/lung structure has specialized pulmonary vessels to help create more surface area to absorb oxygen.
- f. Feeding
 - i. Feeding is incredible diverse based on the niche that the individual fills
 - ii. All gastropods have one-way guts with stomachs and intestines to aide in absorption of nutrients. They also have a single kidney to help rid the body of waste.
 - iii. Most gastropods are **herbivorous** (feeding on plants)
 - 1. Some scrap algae off substrates with a hardened tooth
 - 2. Some use this hardened tooth to tear plant material away
 - 3. While other (such as the sea hare) produce mucus nets to capture floating plankton.
 - iv. However there are a few predatory snails
 - 1. Oyster borers are a species of snail that use a proboscis to drill into bivalve shells and suck out the soft innards (oyster on a half shell anyone?)
 - 2. The cone snail of South America have one of the most deadly venoms known to man that is uses to kill fish and for the unsuspecting shell collector in Chile people... however its not all bad news a new class of powerful pain medication used during surgeries has come from this venom.
- g. Locomotion
 - i. All gastropods are mobile in one way or another
 - ii. Some crawl some swim by using “wing like” musculature that propels it along
- h. Reproduction
 - i. Some gastropods are hermaphroditic but most have different sexes.
 - ii. Many preform courtship ceremonies to attract mates
 - iii. Fertilization takes place externally where the female will lay a sting or mass of eggs to be fertilized by a male

10. Cephalopoda

- a. Includes squids, octopuses, nautiluses, and cuttlefishes.
- b. All are marine
- c. Ancestral cephalopods had shells to protect their soft bodies, however all species except one (the nautilus) has evolved to not have a shell.
- d. Feeding
 - i. Cephalopods all have large tentacles and arms to manipulate food into their mouths.
 - ii. They have a complete one way gut
 - iii. All are active predators

- e. Circulatory systems
 - i. are open and respiration takes place from a single gill
- f. Locomotion
 - i. The foot of the cephalopod forms a **funnel** under the mouth
 - ii. In this funnel it holds the anus, gills, and reproductive openings.
 - iii. It also constricts the funnel forcing water out causing a jet propulsion type of movements
- g. Reproduction
 - i. Sexes are separate
 - ii. Males package sperm in balls and pluck these balls out with one arm and insert it into the female funnel where it fertilizes the eggs
 - iii. Fertilized eggs are usually attached to a surface area to develop.
- h. Ink
 - i. All cephalopods except the nautilus have an ink sac that empties into the rectum
- i. Pigments
 - i. **Chromatophores** produce color changes by expanding and contracting in order to blend in with its environment.
- j. Eyes
 - i. Cephalopods have incredible complex and sophisticated eyes. They likely see only in greyscale but have shown in experiments to be able to distinguish great amount of details.