Phylum Mollusca

Polyplacophora
Gastropoda
Bivalvia
Scaphopoda
Cephalopoda
One of the largest of all phyla including between 50,000 and 120,000 living species
35,000 molluscan species
Have adapted to a wide variety of habitats: terrestrial, marine, benthic, accomplished swimmers.
80% of all Molluscs are under 5-cm. Range in size from snails less than 1 mm. To squid greater than 18 m.

Squid are the fastest of all aquatic invertebrates and octopuses have the greatest ability to learn
There is really no typically molluscs yet despite the external differences between snails, clams, and squids the body plan is similar and distinct from all other phyla

The Mollusca body plan includes:
- A large muscular foot
- A radula
- Mantle and mantle cavity
- Usually a small head
- Soft unsegmented body
- A hard non-living calcareous shell

Phylum Mollusca (soft bodied)
Defining characteristics

- Dorsal epithelium forming a mantle, which secretes calcareous spicules or one or more shells
- Cuticular band of teeth (radula) in the esophagus, used for feeding (lost in bivalves)
- Ventral body wall muscles develop into a locomotory or clinging foot
The foot is a powerful muscular feature used for locomotion and attachment
Adequately supplied with mucus glands
Rasp like, renewable teeth are located near the mouth = radula

- Firm ribbon composed of chitin and protein which has two rows of sharp chitinous teeth
- By moving in a rasp like fashion material is gathered, new teeth are continually being added
- Some have a rod of digestive enzymes (crystalline style) in the stomach which rotates creating a string of food and mucus which is digested in the stomach
The mantle is the body wall that enclose the body cavity where the gills and other organs are located.

This is where the gills and other internal organs are located.

The mantle in some species secretes the shell and is responsible for many sensory functions.

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Shells have a thin outer organic layer – periostracum.

A thin inner most calcareous layer – nacreous layer.

A thick calcareous middle layer – prismatic layer.

When a foreign particle becomes trapped between the mantle and the shells inner surface a pearl may form of a period of years (5-7).

Only 1 in 1000 oysters will harbor a valuable pearl, humans increase the probability by introducing pieces of shell or plastic spheres.
Mantle cavity
Houses the viscera and comb-like molluscan gills – ctenidia (G: comb)
Mantle cavity also is the site for most reproductive, excretory, and digestive systems
When a ctenidium is present it may be respiratory or may also function in sorting food particles
The molluscan coelom is very small being restricted to the area surrounding the heart and gonads
It is believed that the molluscs have descended from coelomate ancestors and the body cavity has been greatly reduced
Due to the soft body many are used for food by humans, more than any other phylum
Seven Classes in the Phylum representing 7 different ways to assemble the above components into a functional animal

Two Classes are not important in shallow water ecosystems and will not be discussed

Aplacophorans (worm-like)

- Only a few mm, without a true shell, found in all oceans mainly deep water
- No fossil record, 320 living species

Monoplacophora (mostly extinct limpet-like)

- Prior to 1952 only known in the fossil record found only in waters exceeding 2000 meters
- Have a single shell range in size from 1-37mm

Phylum Mollusca

Class Polyplacophora - chitons
Class Gastropoda – snails and slugs
    - Subclass Prosobranchia
    - Subclass Opisthobranchia
Class Bivalvia – clams, mussels, oysters, and shipworms
Class Scaphopoda – tooth and tusk shells
Class Cephalopoda – squid, octopus, cuttlefish, and chambered
Class Polyplacophora

Defining characteristics

1. Shell forms as a series of 7 to 8 separate plates
   Consists of the Chitons, bilaterally symmetrical, small ill-defined head without eyes
   800 species
   A chitons most distinctive feature is a series of overlapping and articulating plates usually 8 covering the dorsal surface
   Are embedded and secreted by the mantle
   Since the shell is multi-sectional it can bend to various underlying substrates

Elongate and oval, flattened with a creeping foot (mucus glands)
Typically 3 – 10 cm. and found close to shore mainly in the intertidal where they live on hard substrates

All are adapted to life on rocky turbulent coasts

Strong foot and low profile help from being swept away

Foot covers the entire ventral surface and movement is accomplished by pedal waves

The mantle cavity is dorsal of the foot and covers most of the visceral mass (mantle cavity)

Mantle cavity contains many gills on both side of the animal

Ctenidia = gills which are found in most Mollusca, consisting of a series of flat thin walled leaflets. Cilia on gills creates current for water to flow

Nervous system

Is a simple ladder system, which lacks ganglia, statocysts, tentacles, and eyes on the head

Do posses structures for light reception
Circulation
Heart contains few closed blood vessels and extensively branched open blood spaces and sinuses. Blood passes to all parts of the body
Excretory organs extract waste (nitrogenous) from blood and regulate ionic content
Osmoregulation - in marine Molluscs is usually poor
Usually have a higher concentration of salts in the tissue that is absorbed from the water
Digestion
Radula is used to scrape algae from the rocks (unique to Mollusca)

Use photo from book
Chitinous ribbon covered with many rows of hard-recurved teeth
Rasp like movement is effective in removing algae and encrusting animals
Mouth is anterior and anus is posterior linear digestive tract
Sugar glands release enzymes for digestion
Reproduction

- Reproduction
  - Sexes are separate with fertilization occurring in the water column
  - Trochophore larvae
    - Free swimming which settles and metamorphoses into an adult
Eastern Beaded Chiton (*Chaetopleura apiculata*)

Occurs subtidally on old shells

Due to the limited amount of rocky coasts in SE N.C. only on spp. is common in our area

Have a fossil record extending back 500 million years, their evolutionary relationship with other molluscan is unclear

They probably diverged from the main branch early on, meaning no others evolved from Chiton ancestors