

Introduction: * Named for the Latin word "Molluscus" meaning soft of Most are marine, but they can be both aquatic or

- ✤ Live in all areas:
 - arctic to tropical,
- valleys and deep oceans to mountainsides
- deserts
- hot vents

The shells were among the early forms of money. Water quality monitoring Mother of pearl (from bivalve shells) Pearls from oyster discomfort in the mantle Dyes Purple: Murex Sepia: Cuttlefish ink name from the cuttlefish species *Sepia officinalis* Red: Octopus ink



• The color of the ink (because of melanin) is red, More concentrated, darker, changing to brown and even to black.





- Bodies have more than two cell layers, tissues, organs
- Have soft bodies, and may possess dorsal and lateral shells made of protein and calcareous spicules.
- Bilaterally symmetrical bodies (most of the
- Normally reproduce sexually

Intro. Cont...

- Vary greatly in size from a millimeter to more than 62
- * Gut with a mouth and anus
- * Has a nervous system
- Open circulatory system
- * Ctenidial gills for gas exchange
- Pair of kidneys
- * Feed on various materials from detritus to protists, cnidarians, and small crustaceans.

Intro. Cont...

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- Intracellular digestion
- Mucus Glands
- No cuticle

Intro. Cont... Body is divided into the following main parts: · Head includes a mouth and sometimes eyes and tentacles • In various forms, muscular, covered cilia and mucus cells Visceral mass Non-muscular Contains internal organs Contains internal organs Mantle: (aka: pallium) Thin layer of tissue covering the body Secretes the shell Absent in snails and octopi · Made by glands in the mantle

What's where?

- Anterior:
 - Buccal cavity with radula
 - Radula is a ribbon of teeth supported by a muscular structure called an odontophore; used for feeding
 - 13 Ventral Foot: used for locomotion with muscular waves and mucous (sometimes cilia)
- Posterior:
 - Content one or more pair of gills (ctenidia)
 - Pair of sensory osphradia for smelling



Bivalvia

- ~10,000 species known
- * Live in marine, estuarine, freshwater habitats
- * Some are detritivores, most are suspension feeders

- Burrow in sediment and live on the ocean floor
- * Hermaphroditic or separate sexes
- Fertilization is usually external (egg and sperm mix in water) then go through trochophore and veriger stages before becoming an adult.
 Some others retain eggs and suck in sperm with the water

Body:

- Pair of dorsally hinged valves
- Pallial cavity surrounds the entire body
- Most bilaterally symmetrical (not scallops or oysters)
- Lack head, radula, and jaws
- - Some species have primitive receptors that allow them to sense variations of light.

- · AKA "Univalves" because they have only one valve (or shell)
- ≈ ~62,000 species
- Largest group of mollusks
- 80% of living mollusks
- * Found in virtually all habitats
- Grazers, browsers, suspension feeders, scavengers, detritovores, carnivores
- Most have separate sexes, but some are hermaphroditic
 - Thermaphroditic gastropods do not self-fertilize

- # Again they often have a single shell In some slugs, the shell is absent
- The shell is often coiled mostly dextrally (to the right) The body often undergoes torsion so the pallial cavity
- Have a well developed head Has a pair of cephalic tentacles
 - 77 A pair of eyes near the outer bases of the tentacles
- # Foot
 - Usually large
 - Used for crawling in most species
 - Has an operculum that seals the shell opening when the head-foot is retracted into the shell

Gastropoda

- Nervous and circulatory systems usually well developed
- * Externally they appear bilateral, but they are asymmetrical
 - They twist their organ systems into figure eights Develop and/or lose organs on either side of the



Class Cephalopoda

The eye

- Most sophisticated of all invertebrates
- As complex but not homolugousto the vertebrate eye
- Very large for their body size

- Focusing is done by moving the lens in and out
 Focusing is done by moving the lens in and out
 Contain iris, pupil, and lens, but not necessarily a comea
 Octopi are the only cephalopods with a completely closed and protected comea
 The Pupil is different in octopi, squid, and cuttlefish
- Octopi "slit shaped" ; rectangular
 Squid Round
- Cuttlefish "W-shaped"
 Nautilus eye is simpler
 - · Mounted on a stalk
 - Has no lens
 - 1-2 mm pupil
 It can narrow and widen in different brightnesses
 - Resolves images poorly so they can probably only detect light

Class Cephalopoda

- Arms and tentacles
- All cephalopods have arms, but not all cephalopods
- Octopuses, cuttlefish, and squid have eight non-retractable arms
- Only cuttlefish and squid have tentacles (two each)
- Arms usually have cirri (fleshy papillae/ palps), often suckers, and sometimes hooks (modified suckers) along their undersides used to adhere to substrates and catch prey.
- Tentacles are longer than arms, are retractable, and usually have a blade-shaped or flattened tip, called a club, which is covered in suckers.

Class Cephalopoda

- Sex and reproduction
- Sexes are separate
- * Mating usually includes a courtship that often involves elaborate color changes
- Spermatophores (sperm packets) transfer to a female through her mantle opening.
- * The spermatophore is transferred by the male using either a penis or a modified arm called a hectocotylus.
- Juveniles hatch out directly without the swimming larval stage
- * Most males and females die shortly after spawning.

Class Cephalopoda

- A hectocotylis an arm of a male, modified to deliver a spermatophore (sperm-containing sac) to a female.
- In some taxa, part of this arm can detach from the male and remain inside the female.
- George Cuvier found this in 1829
 He thought it was a parasitic worm though

Class Cephalopoda

- Changing color: they have the ability to change color very rapidly by using numerous pigment-filled bags, called chromatophores
 - Chromatophores are found in the skin
 - Expand and contract to reveal or conceal small dots of color
 - C They can be so densely concentrated that 200 may be found in a patch of skin the size of a pencil eraser.
 - Color change is initiated by the eyes
 - Coloration reflects mood, white for fear, red for anger, brown is the usual color.



Class Cephalopoda

 Some squid possess an additional color-changing structure; the light organ.

- A pair of these light organs is located within the mantle cavity on the underside of the squid.
- Each contains a crypt and a lens.
- A crypt is a small sac that houses luminous bacteria
- The lens is a complex stack of tiny reflecting plates that controls the luminescence of this bacteria.
- Light from the bacteria projects downward and the squid can manipulate its intensity to match any light coming from above. This masks the squid's own silhouette, protecting it from potential predators.

Class Cephalopoda

- When threatened, the octopus will often try to escape by releasing a cloud of purple-black ink to confuse the enemy as it escapes.
- * Several blotches of ink can be released before the ink sac is empty.
- * The ink is toxic to the octopus who will become ill or perhaps die if released in a confined area where the octopus can't escape the ink.

Class Cephalopoda Intelligence Having a centralized brain (the largest of all invertebrates.) highly developed eyes and other sense organs, they are able to remember and learn by example or through trial and error. They have long term and short-term memories Cases have been documented where octopi have opened jars containing food to get the food so attached to Mr Potato Head that he turns aggressive when aquarium staff try to remove it from his tank

Class Cephalopoda

- * Three main clades
 - C Ammonoidea (an extinct and shelled clade)
 - C Nautiloidea (with only one living shelled genus, *Nautilus*)
 - Coleoidea (squids, cuttlefish, octopuses, the Ram's Horn Squid, the "paper nautilus," and an extinct clade, the belemnites)

Class Cephalopoda

- Nautilus
 Slow movin
 Coiled she
 - Restricted to deep water
- Coleoids
 - Most are squid species
 - Fast Moving
 - Thin flexible internal shell (called a pen)
 - Octopi have no shell: can mimic their environment:
 - can "walk" on two of their eight arms

Class Scaphopoda

- Means "shovel foot" or "boat footed"
- AKA "Tusk Shells"
- All are marine species
 - Phabitat ranges from shallow sub-littoral areas up to waters that are 4570 m deep
 - 13 most are found in waters greater than 6 m
- Shells are conical and slightly curved to the dorsal side
- Head lacks eyes and is used for burrowing
- Most distinctive feature is that both ends of the tubular shell are open
- Shells were once used to make necklaces and money (wampum)







Class Monoplacophora

⊛ Foot

Below head

Semi-circular

- Between the lateral sides of the foot and the ventral mantle edge are 5-6 pair of gills
 Less in smaller taxa
- Apex is usuall on the anterior end of the shell
 In some species the apex hangs over the anterior edge of the shell

Class Monoplacophora





Chitons:



Habitat of most is rocky intertidal zones and just below low tide level

🔲 Some live as deep as 7000 m

- Flattened, elongated, oval, overlapping dorsal valves which may be covered in spines, scales, or hairs
- Generally dioecious (having separate sexes)
- Develop trochophore larva and become a jovenile chiton; but no veliger stage
- Most chitons are small (0.5-5 cm)
 One species can reach over 30 cm in length

Chitons:

Have

☐ a heart and utilize an open circulatory system ☐ A pair of kidneys

Simple nervous system

- 2 pair of lateral nerve cords
- Aesthetes (minute sensory organs)

Some

🖾 Head

- No eyes
- No tentacles



Class Aplacophora

Sometimes broken into two classes
 Caudofoveata: (Chaetodermomorpha)

- Lack shells
- Lack foot
- Burrow in soft sediments
- Live in deep sea
- Solenogastres: (Neomeniomorpha)
 - Lack shells
 - Lack foot
 - Live epibenthically (on surface of bottom sediments)

Class Aplacophora

- ~320 species
- Deep Sea Marine
- Se Worm-like
- Carnivores
- Instead of a shell, the mantle secretes calcareous spicules
 Gives them a shine
- * There are no known fossils of aplacophorans

Class Aplacophora

- * In some taxa, spicules are modified into scales
- * Body plan is similar to chitons
- Differ from the polyplacophorans by having a dorsal gonad rather than a posterior gonad and types of spicules
- Have a simple nervous system
 Ladder-like cerebral ganglion