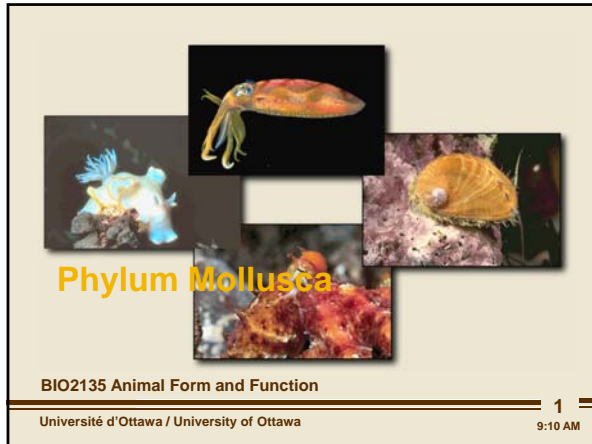


# Mollusca



second most abundant of all organism next to the arthropods

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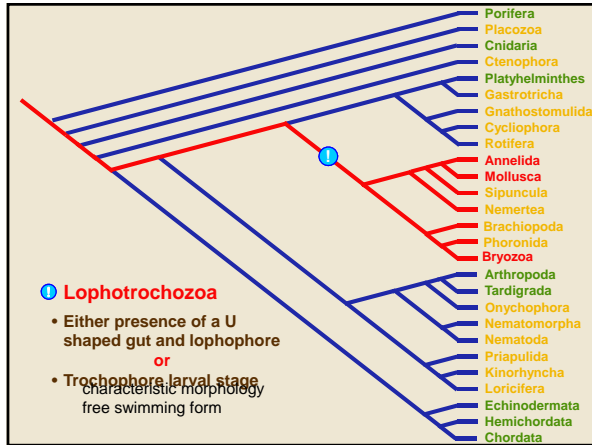
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group that is opposite to the lophotrochozoa

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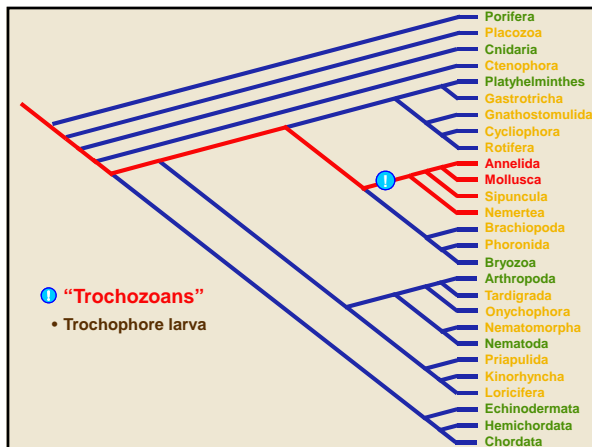
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group that has a trochophore larva in it's life cycle

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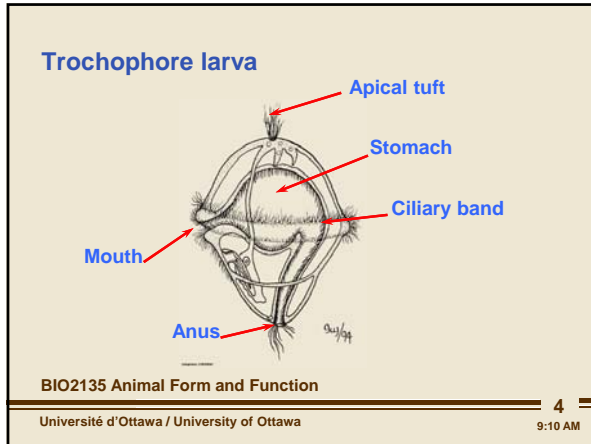


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# Mollusca



trochophore larva has a characteristic morphology  
 always has sit free swimming form  
 characteristics that define the larva: band of cilia that surrounds the middle beats water to propels the food  
 to the mouth which can then be passed to the stomach for nourish the larvae  
 also has 2 tufts of cilia at the top and bottom to stabilize itself  
 -similar to a spinning top with a band a cilia around the body that help with moving and propelling food into  
 it's digestive tract  
 -held in an upright position by the two sets of cilia at the top and the bottom

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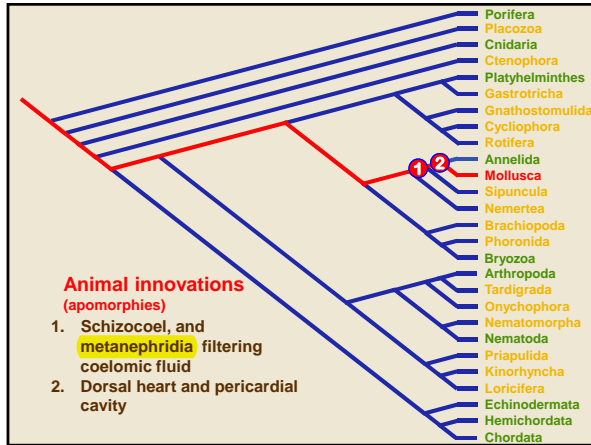
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main feature: the schizocoel  
 annelides and molluscs all have a coelom formed from a mesoderm filling the space between the ectoderm and endoderm  
now we also have the metanephridium  
 dorsal heart and pericardial cavity; for the group the heart is on the dorsal side of the organism and it sits inside a cavity

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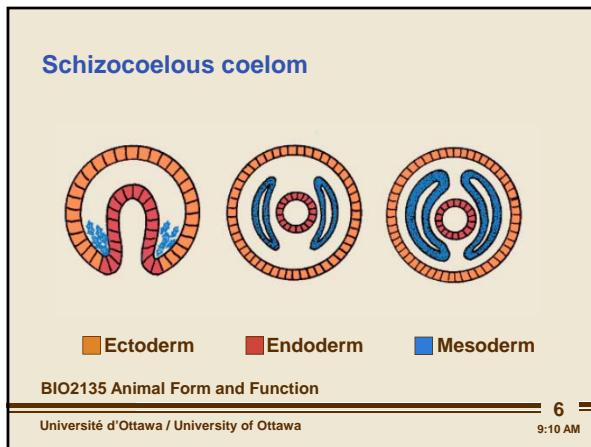
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after filling the space, the mesoderm then splits to make the body cavity

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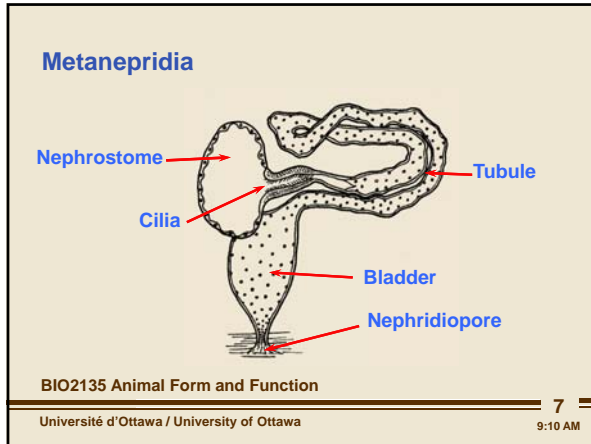
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# Mollusca



first time seeing the metanephridia

~~have a nephrostome - the funnel with cilia that line it, they force the water from the coelom into a tubule system~~

the blood and vascular system is closely associated with the tubules

~~-there is an exchange that occurs between them as a circulatory system reabsorbed material from it~~

-when all that is left is the metabolic waste or water, end up with a bladder that releases to the outside

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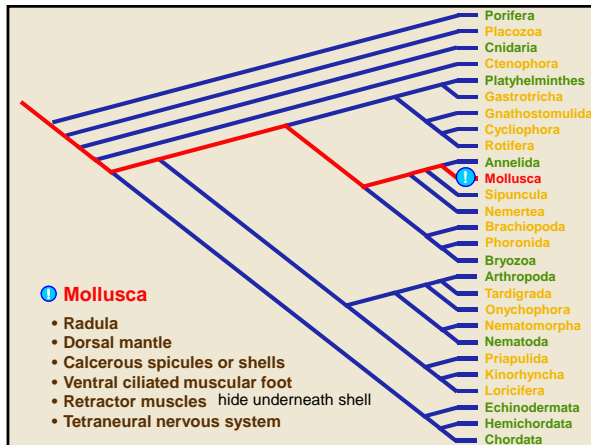
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on top of the trochophore larvae, the schizocoel, the metanephrium etc, the mollusc also have other autapomorphies:

mollusc feed with radula - special feeding structure

will also have mantle and epidermal layer that can create shell/calcareous secretions to protect the organism underneath

the body is going to be divided into 2 regions; ventral foot (creeping foot that uses muscular movement) with a dorsal mass with the viscera that controls all the functions of the organism

~~to protect itself it has retractor muscles that pull the shell down to protect the organism~~ underneath it - this organism can escape predation

has a strange nervous system

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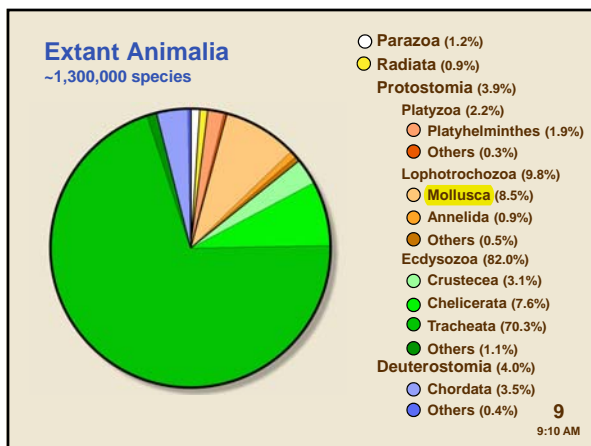
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huge in terms of its numbers - one of the groups that could come up on land (snails, slugs, gastropods)

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# Mollusca

**Mollusc diversity**  
(Adaptive radiation)



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10  
9:10 AM

escargot, reason for the success of mollusc on land  
figured out the terrestrial world

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**Mollusc diversity**  
(Adaptive radiation)



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11  
9:10 AM

nudibranch another mollusc that lives in the ocean - discarded its shell (doesn't use it for protection)  
-eat cnidarians and doesn't trigger the cnidocytes to fire  
-cnidocyte cells migrate through its body wall and line the outer surface so it  
can be protected  
-colouration displays that it is poisonous and toxic which it got from the cnidarians that it ate

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**Mollusc diversity**  
(Adaptive radiation)



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12  
9:10 AM

also have octopodes and squids - intelligent organisms  
mollusc that became prime predators in the oceans  
ex. squid that eat whales

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# Mollusca

**Mollusc diversity**  
(Adaptive radiation)



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13  
9:10 AM

clams and muscles - in bivalve group, become sedentary  
has strategy of burrowing itself into the ground and filter feeds on water

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**Mollusc diversity**  
(Adaptive radiation)



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14  
9:10 AM

chitin - mastered living in intertidal zone where there are trashing waves  
have an articulate bending shell that can cling to the rock and bend accordingly

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**Mollusc diversity**  
(Adaptive radiation)



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15  
9:10 AM

scallop - another bivalve that gives up its sedentary to swim around  
-big round muscle that opens and close the shell  
blue dot around the edges - eyes so they can see where they swim

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# Mollusca

**Mollusc diversity**  
(Adaptive radiation)



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16  
9:10 AM

ammonite shell - amollusc that used to be the prime predator in oceans at the beginning

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**Mollusc diversity**  
(Adaptive radiation)



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17  
9:10 AM

a relative that lives today- nautilus group is famous for adaptive radiation  
all the autapomorphies were adapted for this organism

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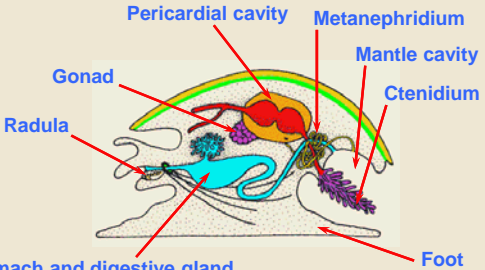
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**H.A.M.** Hypothetical aggregate ancestor



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18  
9:10 AM

take the general mollusc characters and aggregate them all in one place on an imaginary organism  
~~H.A.M. - hypothetical aggregate ancestor mollusc~~  
at the bottom - have the autapomorphy of the ventral muscular foot - main locomotory structure  
above the foot - another autapomorphy with dorsal mass that contains all the viscera  
have an organism that has all of it's living function on top of a mobile system

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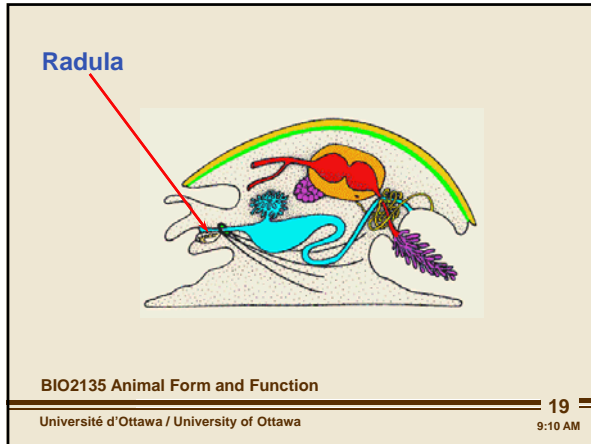
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# Mollusca



the radula - feeding structure

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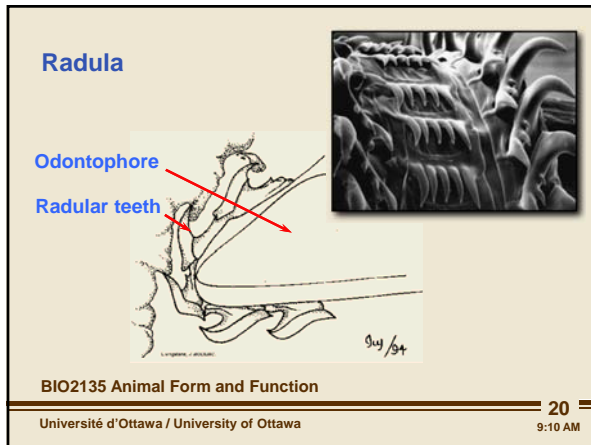
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huge innovation - the cambrian explosion is the explosion of invertebrate multicellular forms  
 one of the conditions - the bottom of the ocean was covered in algae bacterial matter that locked away the nutrients/organic materials  
 the burrowing forms of animals were the first to succeed in getting to the nutrients  
 the radula consists of a tongue - odontophore with the radular teeth that sit on top of it  
 odontophore and be stuck out and pulled back in

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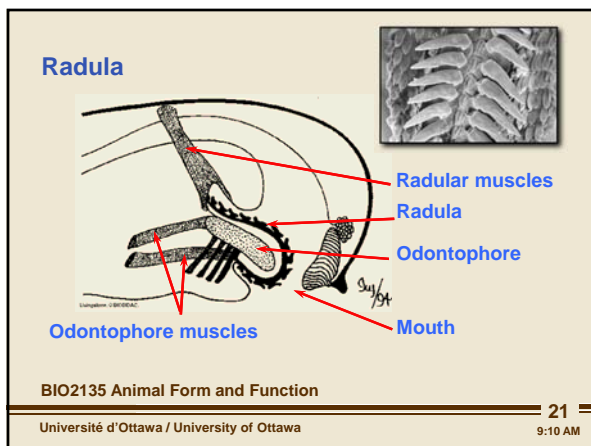
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the arrangement of the odontophore - musculature inside, pulls the tongue in and out but can also roll the teeth (on the surface of the tongue) back and forth to push against the substrate  
 -sanding organic materials into a fine particulate form that it can consume  
 -huge event for animals to get to the nutrients that were lock in unusable films

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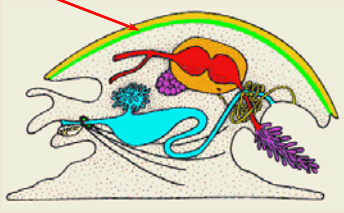
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# Mollusca

**Dorsal mantle covers the visceral mass**



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22  
9:10 AM

second characteristic was the dorsal mantle - layer of epithelium that covers the viscera underneath  
 layer of epithelium is-important because sequesters mineral calcium from the water and secreting it to make the shell  
 early models didnt make shells but made calcareous needles that covered the surface of the body to protect themselves  
 success to animals that were able to burrow or hide in their protective shell (protect themselves against predation -where retractor muscles are able to come in  
 -muscles run from dorsal to ventral to pull the shell down and hide the animal within it  
 called a mantle because at the posterior end it over hangs/there is a cavity in there  
 -end up seeing characteristic gills - used for respiration  
 -when shell gets clamped down, still have radula to continue feeding and have water that can flow through the cavity so it can still breath  
 -end up with an animal that has a new protective mechanism - all of which is sitting on the ventral foot

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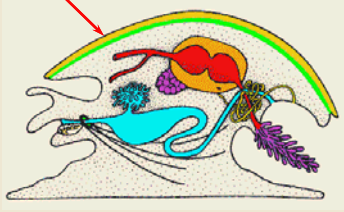


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**Secretes the shell**



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23  
9:10 AM

layer of epithelium is-important because sequesters mineral calcium from the water and secreting it to make the shell  
 early models didnt make shells but made calcareous needles that covered the surface of the body to protect themselves  
 success to animals that were able to burrow or hide in their protective shell (protect themselves against predation -where retractor muscles are able to come in  
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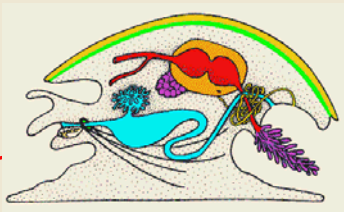


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**Ciliated ventral foot**



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24  
9:10 AM

ventral foot has cilia and musculature that propel it across the substrate

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# Mollusca

### Tetraneural nervous system

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25  
9:10 AM

characteristics are paired with a strange nervous system - tetraneural nervous system (everything else has a paired ventral nerve cord in the protostome line or paired dorsal nerve cord in deuterostome line) with the 2 divisions of the body with the dorsal mass and ventral foot - end up having a nerve ring around the esophagus, and a set of nerves that go down in the foot, and another set of nerves that go up into the visceral mass - like two organisms sitting on top of each other

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### Ctenidium (Respiration)

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26  
9:10 AM

the ctenidium - set of gills covered with cilia that makes a water current that moves through the mantle cavity, unidirectional (water comes in from the bottom and leaves through the top)

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### Complete digestive system

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27  
9:10 AM

complete digestive system dumps fecal waste in the excurrent flow from the mantle cavity and so does the metanephridia with the cilia on the ctenidia creating current that is going to be used to flush away the waste and airate the gills

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# Mollusca

**Open circulatory system with a pericardial cavity**

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28

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the circulatory system is opened

what is in closed circulatory that is missing in open ones? - capillaries

instead of having fine mesh tubules mixing with the tissues to pick up the nutrients

in an open circulatory system, blood (hemolymph) bathes the tissues

the cavity where the blood is sloshing around is called the hemoceol

still have blood vessels and a heart sitting inside the pericardial cavity

when the heart pumps, the blood vessels will distribute blood to different body regions where it is going to pour out of the blood vessels to bathe the tissues

-same region will have open ended veins where the heart is going to pull the blood back

only difference between open and closed circulatory systems are capillaries being the exchange surface vs the tissues being bathed in blood

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**Pericardial cavity**

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29

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pericardial cavity is important - give information on the function of the group

in organisms that have metanephridium and a coelom, the gonads usually develop on the walls of coelomic cavity have a metanephric funnel that leads to the outside

-a specialization starts to occur, instead of nephron being involved in filtering coelomic fluid, it is

the root that the gametes that for the gametes to be passed outside of the organism

when you have a coelom, the funnels can either be filtering systems for the coelomic fluid or be a passage for gametes to reach the outside environment

in the open circulatory system, the pericardial cavity is the small circle that contains the heart (all that is left of the true coelom), only one cavity - in cavity, see the original characteristics that are associated with the cavity

- there is a funnel that filters the coelomic fluid that is in it (picks up wastes that need to be exported

out)

the rest is the spongy hemoceol cavity

problem with having an open circulatory system

-blood vessel that brings blood to the heart and the waste needs to be filtered out from the heart

the metanephridia never touches the blood

in the pericardial cavity, there is a heart that has an atrium (a sac in front of it), where the blood pools before it moves into the heart

-atrium is very thin - any nitrogenous waste can diffuse into the pericardial cavity (which is the

remnants of the coelom where the funnel is sitting to pick up the coelomic fluid to filter and remove the metabolic waste

have open circulatory system that brings all of the blood through - passes it through the pericardial cavity, into the circulatory system, and the waste diffuse through the funnel to get to the outside

- the circulatory system works by taking the blood from the hemoceol, pulls it across the gills (ctenidia), to the heart and then sends it out to the rest of the body

-(follow it into the heart) system consists of blood sloshing around in the hemoceol, where there is a pipe every time the heart squirts out blood and the pipe fills up, forces blood through the system it is pulled across the gills to be aerated and then it is pulled into the atrium, where it pauses for a second to diffuse its wastes into the pericardial cavity and the heart squeezes it to the anterior and posterior end of the organism to refill the hemoceol

-heart opens = pull blood across ctenidia and since the funnel is sitting inside the other cavity, get diffusion of the waste from the blood into the coelomic fluid to the funnel and out

**Excretory and reproductive systems**

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30

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also the release point for the gonads, so the same tubing/plumbing is going to take the filtrate from the

coelomic fluid is going to receive the gametes and send them out to be fertilized

example of adaptive radiation - octopodes/squid are active predators, high metabolism

-is it a good system to have blood sloshing around as a predator? they change their systems

to closed circulatory system and will have 2 hearts to make sure they get the appropriate amount of oxygen to their tissues

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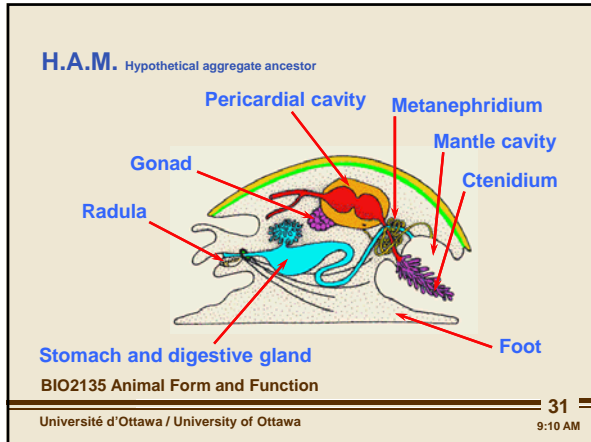


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# Mollusca



HAM - has radula, mantle cavity, etc  
one thing that is not in autapomorphies but should be

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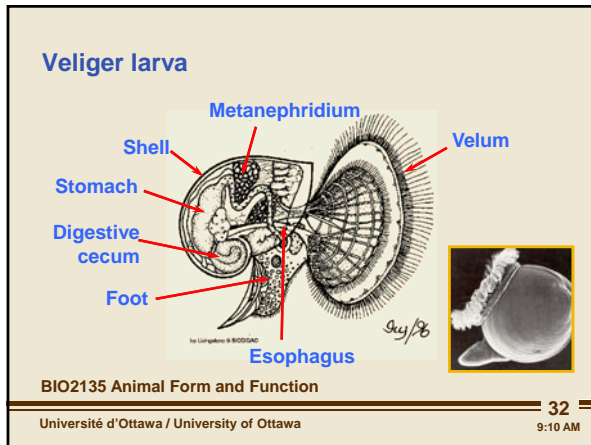
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in the development of this group, the trochophore larva also develops into a different larval stage - veliger larva, also at the ancestral base of the mollusc  
specialized organism that has a large velum flap that it uses to propel itself through the water  
-here have the beginning of the snail/clam

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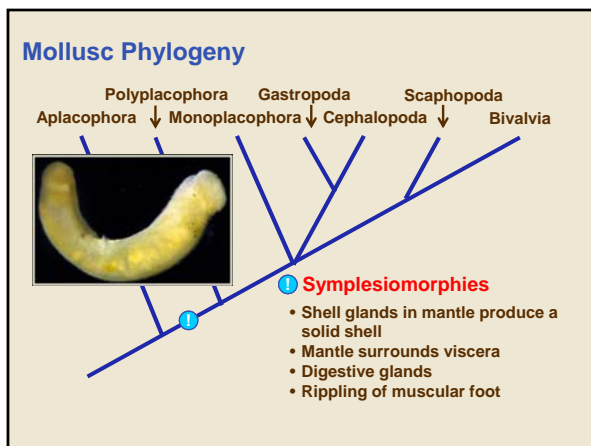
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first thing that you encounter, after the typical molluscan characteristics is the aplacophora- worm like mollusc that has a mantle that wraps around its body

- mantle has epithelial layer that makes calcareous spicules
- embedded inside calcareous needles that protect them

-afterwards mantle becomes a solid shell - mantle covers viscera mass completely - major event - allowed them to hide inside to protect themselves against predators and gives them a distinct advantage  
ventral foot is going to move with muscular contractions - rippling motion as to how they move on the substrate

inside the digestive tract - going to get a digestive gland  
mouth at one ends and anus at the other - and then a gland that comes off the side  
-where there will be absorption of nutrients

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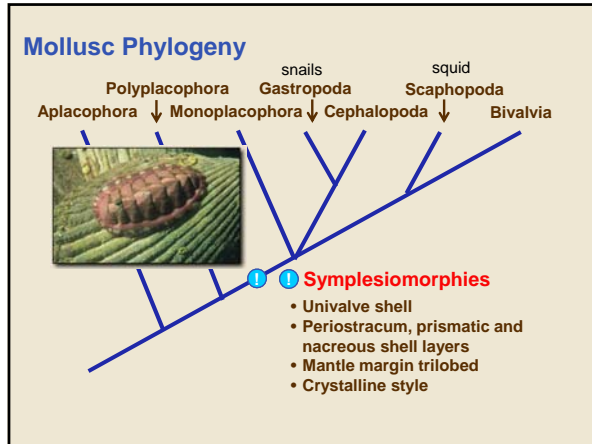
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# Mollusca



polyplacophora- the shell first appears as a series of valves (normally 8 shell plates), first appearance was jointed/hinged

-chitin- has shell with 8 components so they can bend and attach to the rock/substrate in the inter-tidal zones

-now going to be one shell that surrounds the organism

-calcareous shell has 3 components (periostracum, prismatic, nacreous) - architecture is inherited by the whole group

mantle is not going to be a simple structure that secretes the shell, will have 3 lobes - some muscular, sensory, and secretion

the digestive gland in the digestive tract is going to develop a crystalline style- unique solution to help digest particulate food

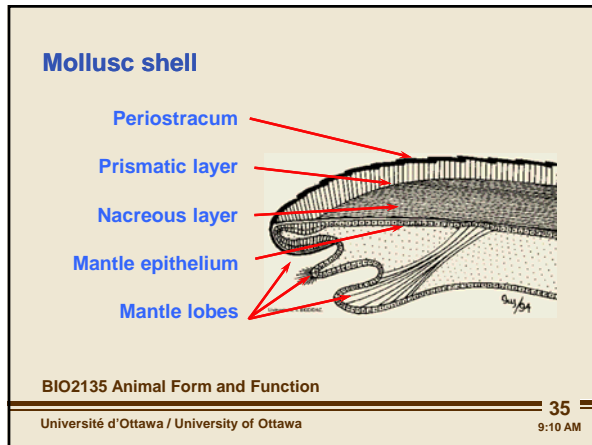
-two major groups branching form the same location (bad thing to happen in cladograms) group that contains the gastropoda, cephalopoda and monoplacophora - reason because dont know how it is supposed to be, where it is going to fit in

gastropoda and cephalopoda have similar feature that unite them

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-3 layers: outer periostracum which is the dark layer, prismatic- highly organized calcium salts (look like prisms)

-dissolve in acid conditions - because calcium is only out of solution in alkaline conditions, some areas are acidic and in order to protect the shell underneath - periostracum layer is a mix of calcium salts and proteins

-inner later nacreous- rubs against mantle epithelium, which is a thin layer just underneath - important in secreting cell layers at different times

-mantle is tri-lobed

-first lobe is where we build the new shells add more layers at the perimeter as it grows

-temperature affects how they grow (fast in hot, slow in cold) - can see growth rings on shell

-middle lobe- sensory - start to see optic units/eyes spot that detect light/sediments

-final lobe - muscular lobe to move the mantle relative to the body

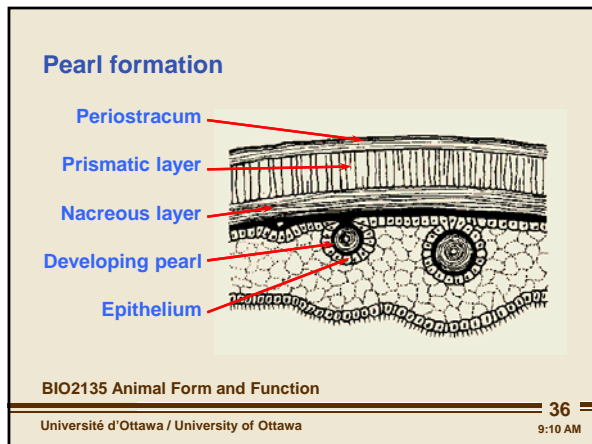
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if an irritant gets between the mantle and the nacreous layer,

(point of nacreous layer is to prevent and abrasion between the shell and the epithelium)

the epithelium will secrete nacre to surround the abrasive material to prevent the epithelium from ripping

-formation of a pearl

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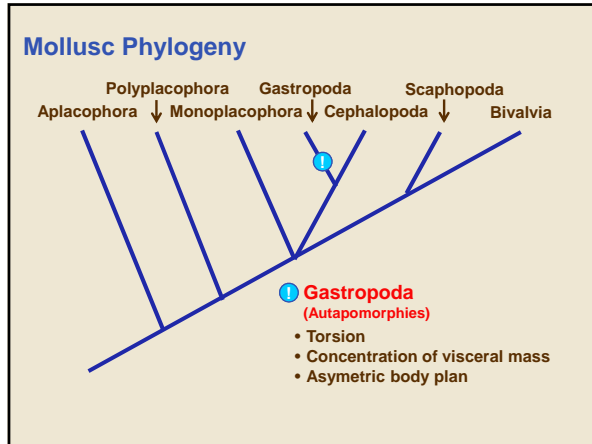
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# Mollusca



in gastropods, have a very unusual mechanism for concentrating the visceral mass  
 -apply the principle of torsion - get an asymmetric body plan

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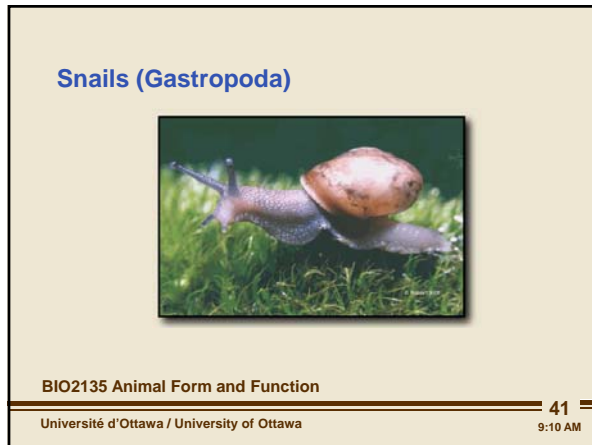
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the snails rep a muscular foot, a coiled visceral mass - where torsion has occurred

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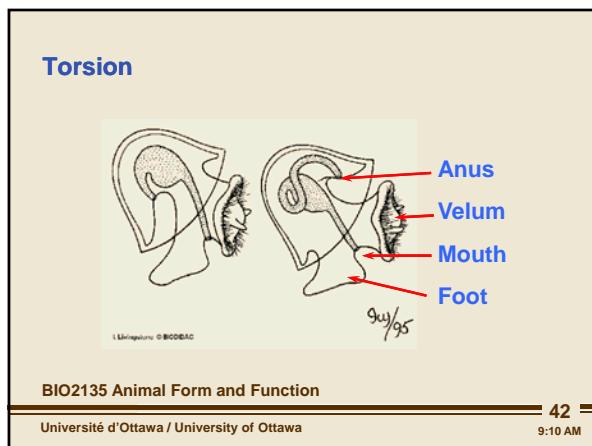
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torsion - early in embryo logical development the way the retractor muscles pulled the shell down, they rotated it  
 -visceral mass has down 180 turn on the foot - now have anus sitting on top of the head  
 -no oral - aboral axis so there is no symmetry - reason for asymmetry in molluscan class  
 why? - at veliger larvae- prior to torsion, retractor muscles were parallel to each other and now they are crossing each other  
 to protect itself, without torsion, muscles would pull the body in first, then the head would be the last to get pulled in  
 with torsion - head and posterior end get pulled in first and then the middle gets pulled in last

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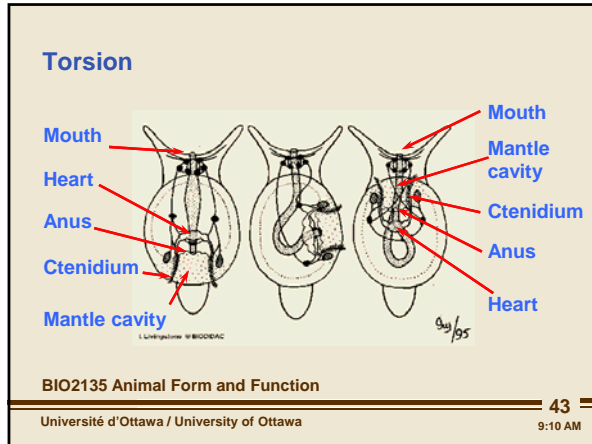
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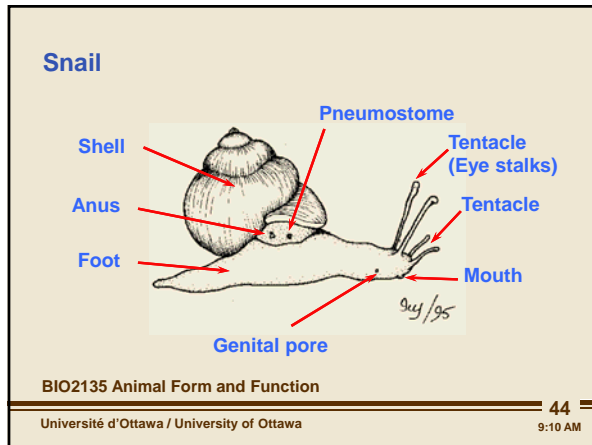
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# Mollusca



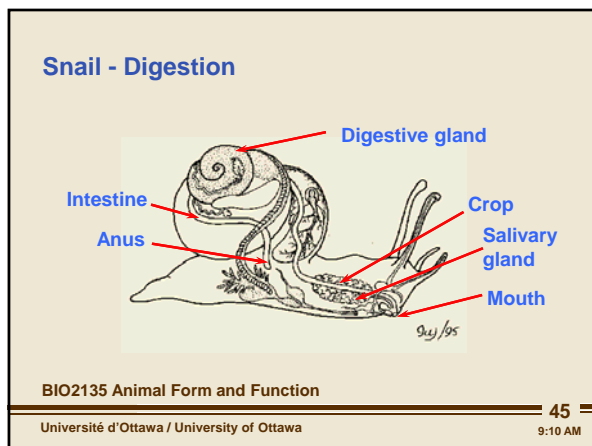
consequence for the adult, not good for fecal waste to be put of the head  
 to deal with this some molluscs de-twist or twist more and have the anus positioned on the side  
 some make the water flow up and through the shell out the top  
 -this was a bad advantage, must be something else

-molluscs taste water quality by the ospharadia - located in mantle cavity  
 before it went through torsion its water quality sensors were sitting in the posterior end of the mantle cavity,  
 doesnt have visual systems or other was to detect the things around it  
 -animals found out where they have been and not where they are going  
 -cephalization cause sensory elements move it to the anterior end - so moved the opharadia to the front  
 -although you are bringing the anus to the front, you were able to bring information of the water  
 quality (include chemical signals etc) into the direction you were moving  
 --when the ancestor was moving across the substrate, movement would cause turbulence - debris in the  
 water that was pumped into the mantle cavity and back out - might get caught on the gills and block the  
 opharadia - another reason why it would have moved to the front  
 gastropods - have a compact visceral mass, when it moved to the inside, paired structures found on the  
 outside (ex. metanephridium, atria, ovary) one got tuck inside the fold  
 reason for assymetry-all paired structures disappeared and became single so not paired structures that could  
 be lined up anymore - no oral and aboral end



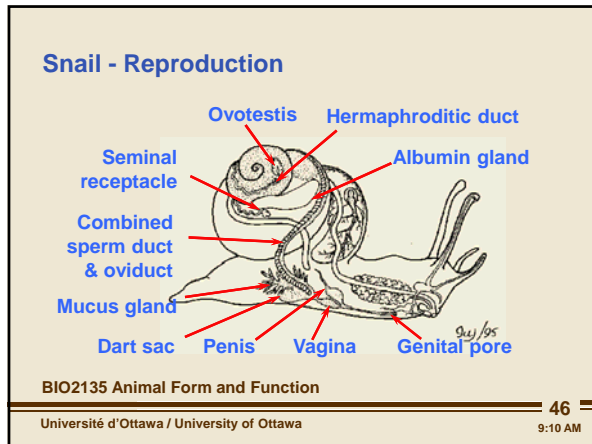
end up with a snail-moving up on land was one of the success for the mollusc and the gastropods give that  
 to us

-they are able to completely retract into their shell and lock themselves inside - by doing so  
 they resist water dessication  
 in terrestrial forms can see air breathing and there is a structure that is on the side that brings in the air in to  
 the mantle cavity called the pneumostome  
 -and at the anterior end, can see cephalization



internally everything is meshed together  
 architecture that had digestive gland- all bent on itself - all inside spiral shell  
 -gonads/reproductive structures are inside  
 muscular foot extends outside

# Mollusca



another group that is hermaphrodite

system is very complex and compact - only have one gland - ovotestis, located at the end of the shell, near the digestive tract so it gets a lot of the nutrients

-both sperm and egg travel down this hermaphrodite duct- pass in front of albumin gland to provide nutrients

-hermaphrodite duct attached to the oviduct gets split into a sperm and ova duct that are tied together - right before the split there is the albumin gland

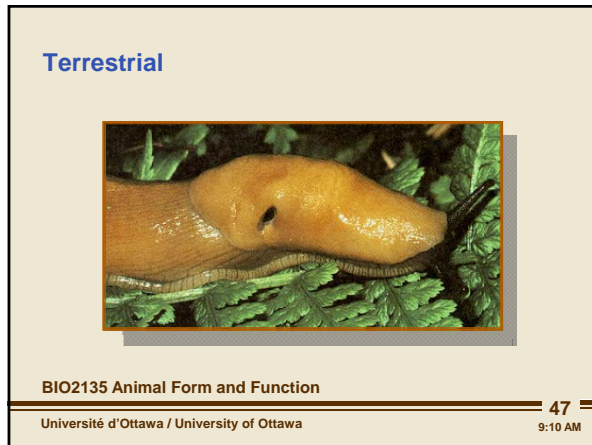
-when animal produces sperm from the oviduct, it goes through the hermaphrodite duct and then moves to the sperm duct and gets to a seminal vesicle where sperm is stored

when snail mate, it everts a penis to pass sperm to the other individual receiving individual will receive sperm place it up in the seminal receptacle at the top of the coil where all the nutrients are

when you make an egg, it will roll down from the ovotestis, down the hermaphrodite duct, stop in front of the albumin gland to pick up nutrients, then travels down the ova duct until it find the opening to the seminal receptacle, to be fertilized and then it gets past to the outside

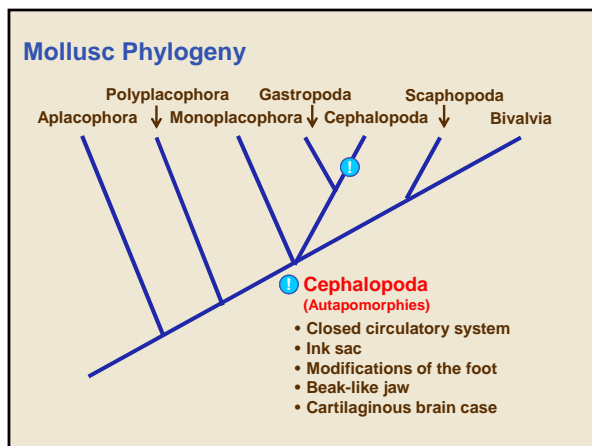
-dart sac - in mating - rigid structure that they try to jab into the other partner (possible stimulus for reproductive behavior) - contains chemical signals

-one that is more penetrated by the dart sac - enlarges the opening to the seminal receptacle to receive sperm - makes it more female-like (makes it more monoecious)



some other ones that dont have shells, slugs

to be able to function they need to keep themselves moist



-cephalopods (sister group) - visceral mass that coil in a different way - takes on an active predatory life

-adaptive radiation to predatory life

-circulatory system is different - end up having 3 hearts, now have a closed circulatory system and addition of capillaries

-production of ink to escape predators - all cephalopods when startled will release ink to

escape from predator - ex shark will think that ink shadow is the prey they are after

biggest modification is the foot - cephalopods increase their visceral mass and decrease their foot -

tentacles are suspended from the body

another modification of the funnel when they want to propel themselves through the water

as predator, they no longer rely on filter feeding, end up with chitinous beak like structure - have a jaw that

rips and tears - when it wants to capture it's prey it will shoot out the two arms, pull the food in, grab it with

the tentacles and push it into the face

-sensory system - now have visual systems - processes a lot of information

tetraneural system - had two nerve cords and two ganglia, all ganglia move to anterior end to be


cephalized - fused together and send out nerve tracks - now concentrated together (consolidated forward)

wrapped in a cartilaginous brain case to protect it

animal that took snail characteristics, adapted it to become a better predator

# Mollusca

**Cephalopoda**



BIO3334 Invertebrate Zoology

49

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-squids fairly common - short lived but produce many offspring

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**Adaptations as predators**



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same for octopods as well

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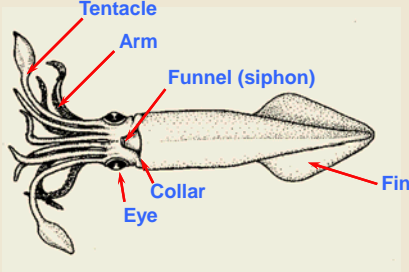
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**Squid**



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in squid can see the changes that occurred in this group - lose coil structure

-surviving molluscs in permean extinction

-in permean when we lose diversity of organism in ocean, most of the early fishes disappear

-when fish come back - they come back from the fresh water systems - when they move back into the ocean they are much more agile/maneuverable predator

-shell cephalopod are in danger because they are slower - have adaptive radiation and loses the shell to become more agile - had selection pressure for smaller and smaller shells (as shells diminished in size, agility went up)

the mantle that was laying down the shell, no longer a rigid structure

-extracted into a cone shape, make a cone of visceral mass, a mantle with muscle, head with

the beak and whatever is left of the foot dangling underneath

the muscles in the mantle can expand and contract it

- expand the mantle to fill it with water or contract to squirt water out

collar attaches the mantle to the visceral mass that is inside - collar can lock down tight so that when the mantle contracts and squirts the water out, there is only one way for the water to come out - through the funnel - propels the organism forward

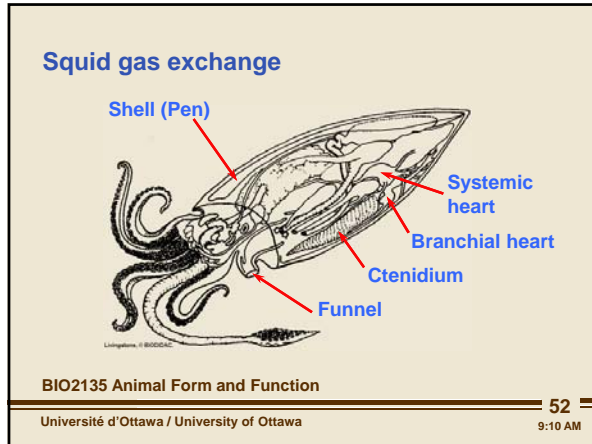
-gills are suspended in there - get better aeration

-flits its dorsal end and make that like its anterior end to move forward (still have anterior, posterior, ventral and dorsal parts) just gets mixed up

-squid look backwards as it swims forward

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# Mollusca



internally, end up with 2 hearts

- extra branchial heart that pumps blood into the gills  
 instead of having a pool of blood - have a series of capillaries that provide gas exchange with all of the organ structures

have a powerful heart that squeezes blood across the ctenidia, that are well aerated by the muscles of the mantle cavity to send the blood to the heart to be squeezed again and distributed through the entire body, ensures a unidirectional closed circulatory system

as the mantle squeezes, inside is the soft viscera - small piece of shell that is left over - pen - made of chitin (rigid rod with wings that extends and provides protection to the internal organ system when the mantle squeezes - all that is left of the original shell

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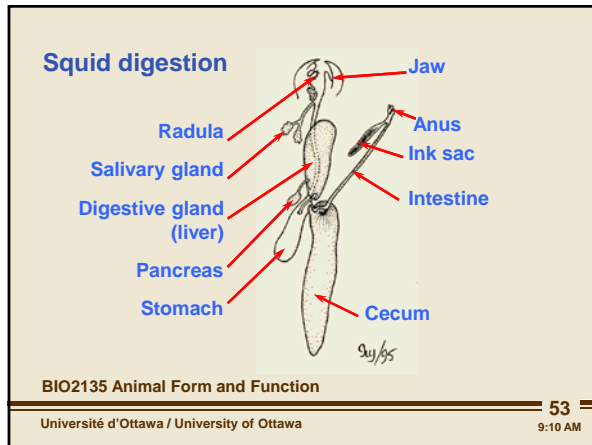
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digestion - high energy organism that needs to process/digest large amounts of food  
 digestive system consists of a tube with a digestive gland and a digestive tract that bends back on itself  
 digestive gland has two functions

- secret digestive enzymes to break down food that entered the stomach
- absorb the nutrients

-broken down the gland into two lobes for the digestive gland

- larger lobe - cecum -

- smaller lobe- liver/digestive gland, has another smaller lobe attached called the pancreas

squid swallows food and stores it in the stomach, receives tons of digestive enzymes from the digestive gland  
 secretory lobe is separated from the absorptive lobe

- get lots of digestive enzymes from the liver and pancreas gland

-stomach will churn and make it into a liquid mush

- then get sent to the absorptive area the cecum via the ciliary sorting field, smaller particles will

be sent to the cecum where it can be absorbed

- undigested food will be past to the intestine and out the anus to the outside

- opening located so that nothing in mantle is affected

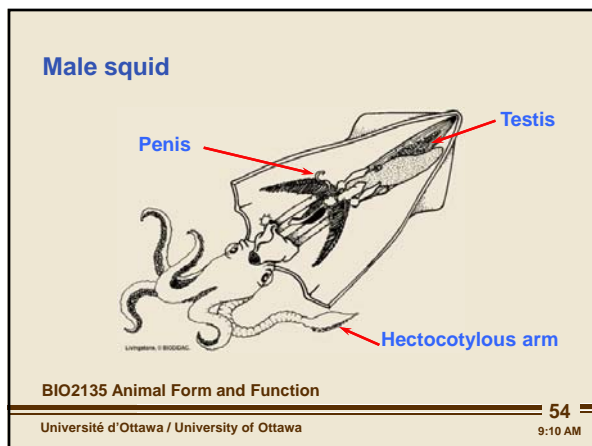
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mating becomes a problem - because the reproductive area of the female is inside

males will produce a spermatophore - sperm package, have a hectocotylous arm

-grabs packages of spermatophore and then reaches inside the female mantle cavity and sticks them inside

- eventually they will break open and the female will collect them in the seminal

receptacle to fertilize the eggs and bring them to the outside

-egg have unique casing

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# Mollusca

**Female squid**

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female has to produce the eggs and provide nutrients to them via the oviducal gland, also needs to place them into a capsule before placing them on the substrate

- special set of glands to make the capsule - nidamental

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**Colour production**

- Elastic capsule chromatophores
- Iridiocytes
- Bioluminescence

[Squid camouflage1](#)

[Squid camouflage2](#)

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vision is big for this group

-have the ability to create different colours in the skin

colours in the skin are called elastic capsules - when muscles of the capsule expands, it enlarges dramatically - under nervous control can expand it to any size it wants - there are mixes of colours

all of this is lined over top of layer cells - iridocytes cells - and when light come in, and gets reflected, if the capsules are open then colour will show

-blue, red, green chromatophores - light reflects back and depending on what was opened it will show different colors

-mimic anything and can camouflage into the ground

squids that live in the deep oceans, where it is completely dark are able to flash different spectra of light

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**Squid eye**

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images are reflected in their eye

lens camera eye - visually isolated box that has a pinhole camera - inverts the image

also has a lens to refine the image

optic nerves go off the back of the retina

-human eye, optic nerve goes to the front of the retina and accumulate and penetrate through the blind spot

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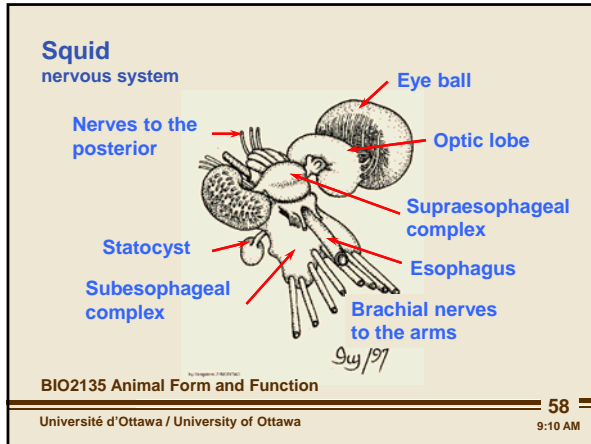


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# Mollusca



have a complex brain- optic lobe of the brain that processes the image from the eye ganglia fuse together in one large brain to make a large nerve that run out to the body  
 -took distributed ganglion and accumulated them in one place, can process information more efficiently  
 have cartilaginous brain case is wrap around it to protect it  
 -eat mantle of the squid

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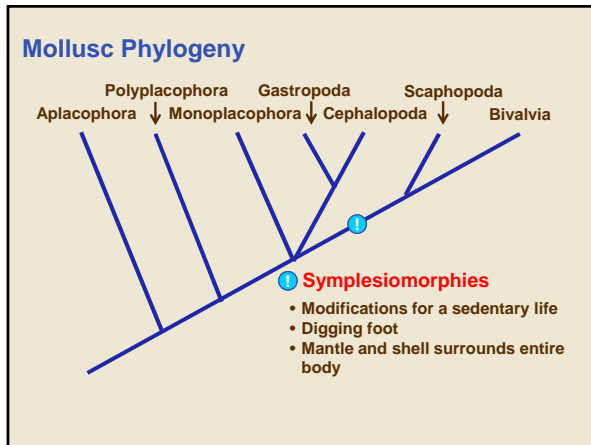
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-bivalves- clams - mollusc that have sedentary life  
 -just filter water - going to dig themselves in the substrate so they can hide from predators, end up with a digging foot  
 -have a body that is completely covered by the shell - just an opening big enough to allow water into the mantle cavity to aerate the gills and feed

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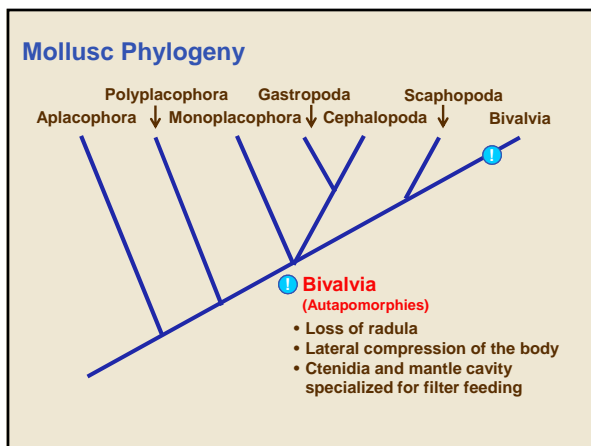
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in bivalves, they lose their radula, no cephalization  
 -dont really need them  
 -ancestor with the head at the back, now laterally compress the body, shell has folded where the animal hides inside  
 -muscular foot- with the visceral mass got pushed into the foot  
 -ctenidia are specialized for filter feeding, reason for why they are so big they dont need a lot of oxygen

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# Mollusca

**Clams (Bivalvia)**



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exception is a scallops - only bivalve group that isnt sessile

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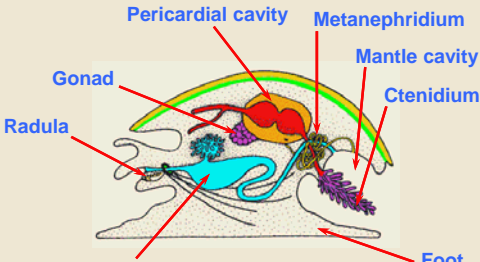
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**H.A.M.** Hypothetical aggregate ancestor



Pericardial cavity Metanephridium  
Gonad Mantle cavity  
Radula Ctenidium  
Stomach and digestive gland  
Foot

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after lateral compression...

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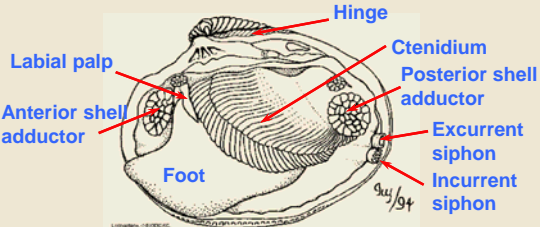
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**Bivalve structures**



Labial palp  
Anterior shell adductor  
Foot  
Hinge  
Ctenidium  
Posterior shell adductor  
Excurrent siphon  
Incurrent siphon

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when you open up the clam and remove the shell - large gills (ctenidia)

- muscular foot for burrowing
- muscle scar and tissues that attach one side of the shell to the other side of the animal - control open and close shell - adductor muscle
- pull the shell together, when muscles contract and hold the shell together - important for keeping the clam shut
- dont eat the ones that are close - because they are dead
- to open the shell, the hinge has an elastic element to pop open

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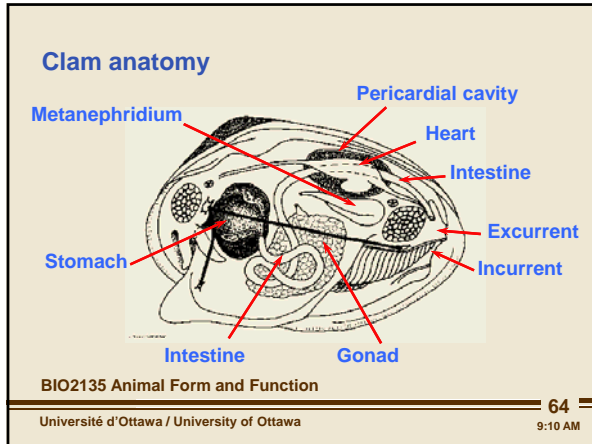
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# Mollusca



things are spread around in a lot of different location

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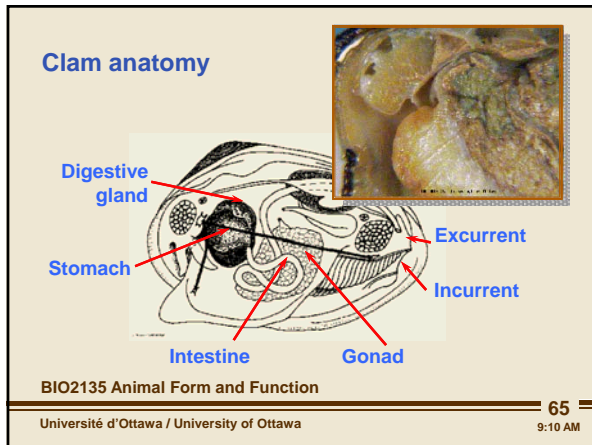
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there is no cephalization. there is a mouth between the labial palps

have esophagus that leads to the stomach where there is the crystalline style, right adjacent to it there is the digestive gland

where everything has been pushed down into the foot

all of the tissue is spongy and is bathed in hemolymph (because of open circulatory system with hemoceol)  
-intestines weaves its way through the pericardial cavity and dumps out in the excurrent flow

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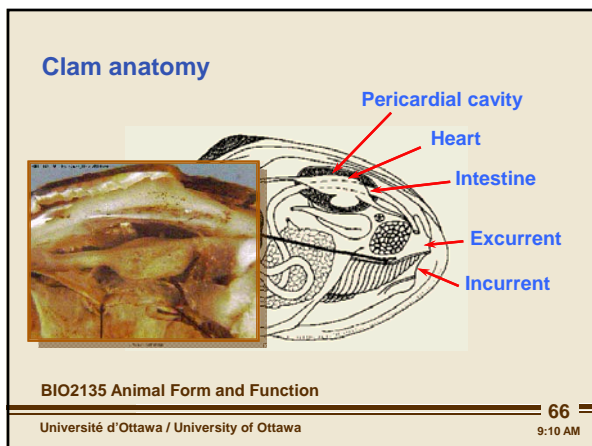
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-can see the heart inside with the intestine running through

-heart has an atrium with the blood supply coming through

-metanephridia is filtering the coelomic space/ pericardial cavity

-the blood is passing by in closed tubes

metabolic waste diffuses out to the pericardial cavity and the metanephridia is right beside it so it can filter the coelomic fluid

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# Mollusca

### Clam anatomy

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67  
 9:10 AM

-constantly bringing in large amounts of food  
 huge amount of water that is being pumped through the respiratory system  
 water goes through the gills where there is the ciliary sorting field and then the water then leaves through the  
 excurrent flow at the other side of the gills

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### Circulatory system

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all the way through, their blood leading from the blood vessel supply nutrients to the tissues

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### Clam ctenidia

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modified ctenidium- folded on itself  
 the surface is covered in cilia  
 -set of cilia that create the water current that pulls water in and out  
 -set of cilia that collect particulate food that get trapped on the surface of the gill - they are  
 going to get passed down the edge and then up to the mouth and into the digestive tract  
 everything happening inside the clam shell

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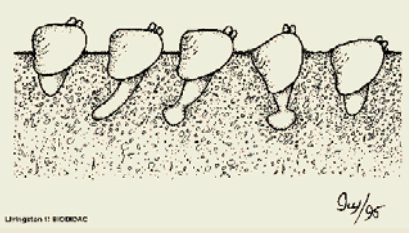
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# Mollusca

**Locomotion**



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- burrow into sediment and pump water from protected position
- to burrow, it sits and takes its foot, relaxes retractor muscles, forces hemolymph to elongate the foot and push it into the substrate
- once its pushed in a little, can expand base of foot to create an anchor
- shell being pulled down to foot
- shell flutters to help
- when it finally reaches the tip of the foot, the adductor muscles relax and the shell pops open to be wedged in substrate
- when elongating foot again, the foot will push deeper into sediment
- stops when siphon at surface (inflow of water)

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**Freshwater clam  
Glochidia**



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- unusual life cycle
- veliger larva from trochophore larva
- glochidia larva that are going to be released into water column and attach to gill surface where it will be protected
- filter water through gill to pick up nutrients and food and slowly start to grow until they are large enough to survive on their own

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**Zebra mussel**  
*Dreissena polymorpha*

- Highly efficient and prolific filter feeder
- Competes with local species



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- one of the first fresh water pest species
- effective filter feeder
- so much more effective than clams and other bivalves that it is dominating
- pulls algae out of water column very efficiently, to the point where the sun can hit all the way down
- sun penetrated to the bottom
- large plants can now root to the bottom and grow to the surface
- lake eerie (one of our shallowest lakes) now has sunlight passing down to the very bottom which changes the ecosystem

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