Chapter 31

Wednesday, January 14, 2026 08:18

Chapter 31: Sponges, Cnidarians, Ctenophores, and Protostomes
We will **not discuss** sponges (Porifera) or Ctenophores

At the end of this chapter a student will be able to name, describe, and compare and contrast members of Phylum Cnidaria. phyla within lophotrochozoa, and phyla within ecdysozoa.

Learning Objectives

Cnidarians

1. Describe the distinguishing features and structure of Phylum Cnidaria [Clade Radiata] including the structure of the cnidocyte. (remembering/understanding)

2. Name and describe the two body forms and four classes (with examples) of cnidarians. (remembering/understanding)

Lophotrochozoans

3. Describe the general characteristics of lophotrochozoans and name the associated phyla (with examples). (remembering/understanding)

4. Identify distinguishing characteristics of Phylum Platyhelminthes (flatworms) (remembering/understanding)

5. Name and give examples of the four classes (with examples) of Phylum Platyhelminthes. (also see lab materials) (remembering/understanding)

6. Name, describe features and characteristics of Phylum Mollusca and the three main classes (with examples). (remembering/understanding) (also see lab materials)

7. Name, describe features and characteristics of Phylum Annelida) and the three main classes (with examples) within the phylum. (remembering/understanding)

Ecdysozoans

8. Describe general characteristics of ecdysozoans and name the associated phyla (with examples) (remembering/understanding)

9. Describe distinguishing characteristics of Phylum Nematoda including sexual dimorphism (remembering/understanding)

10. Name, describe features and characteristics of Phylum Arthropoda and the associated subphyla and classes of arthropods (with examples). (remembering/understanding)

Some New Words
Annulus(i) surface rings seen on some organisms such as leeches or earthworms
Auricle an ear-like flap that is involved in chemical detection and not sound reception
Bivalve organisms that have two connected halves to the shell such as clams, each half is called a valve
Cephalic having a head
Cnidocyte a specialized cell found in cnidarians that is used in feeding and protection
Medusa one of two body forms of cnidarians (jellyfish form)

Nerve net a net-like formation of nerves that both conduct and send impulses
Polyp one of two body forms of cnidarians
Definitive host organism in which the parasite passes through sexual development, site of sexual reproduction
Dioecious having separate males and females
Eumetazoa animals that developed true tissues
Eyespot light sensing structure that lacks a lens
Gastrovascular cavity central cavity in which digestion occurs: has a mouth only, no anus
Hydrostatic skeleton fluid filled compartment upon which muscles contact and produce movement in animals
Intermediate host organism in which the parasite passes through the asexual stage of development, site of asexual reproduction
Mantle sheet of epithelial tissue that covers the visceral mass (internal organs) in mollusks
Monoecious having both male and female reproductive structures on the same organism
Platyhelminthes phylum containing the flat worms
Parazoa animals that did not develop true tissues - sponges
Proglottid individual body segment of cestodes, tapeworms
Protonephridia one types of osmoregulatory structure: it has flame cells with cilia on the internal end where the fluid is collected from the interstitium
Radula belt of teeth (chiton) in the mouth of some mollusks, used to scrape the substrate or make a hole in a shell
Scolex anterior end of a cestode (tapeworm) on which the holdfast structures used to attach to the host's intestine are located
Septum(a) a dividing "wall" such as the tissue dividing the individual segments of an earthworm
Seta(e) stiff hair-like structure, bristle, it can be found on the outside of the individual segments of an earthworm
Syncytium (syncytial epidermis) a multinucleated cell arising from the fusion of individual cells or the specialize connection via gap junctions as seen in the heart muscle for example
Visceral mass internal organs

You have a sample of cat emesis (vomit) and find worms in the sample.
The cylindrical worms are long and slender, pointed at each end, with no other distinguishing characteristics.
You conclude they are members of which phylum?

- A. Platyhelminthes
- B. Nematoda
- C. Cnidaria
- D. Annelida
- E. Nemertea

What specialized structure do crustaceans use to sense gravity ?

- A. antenna
- B. statocyst
- C. radula
- D. parapodium
- E. scolex

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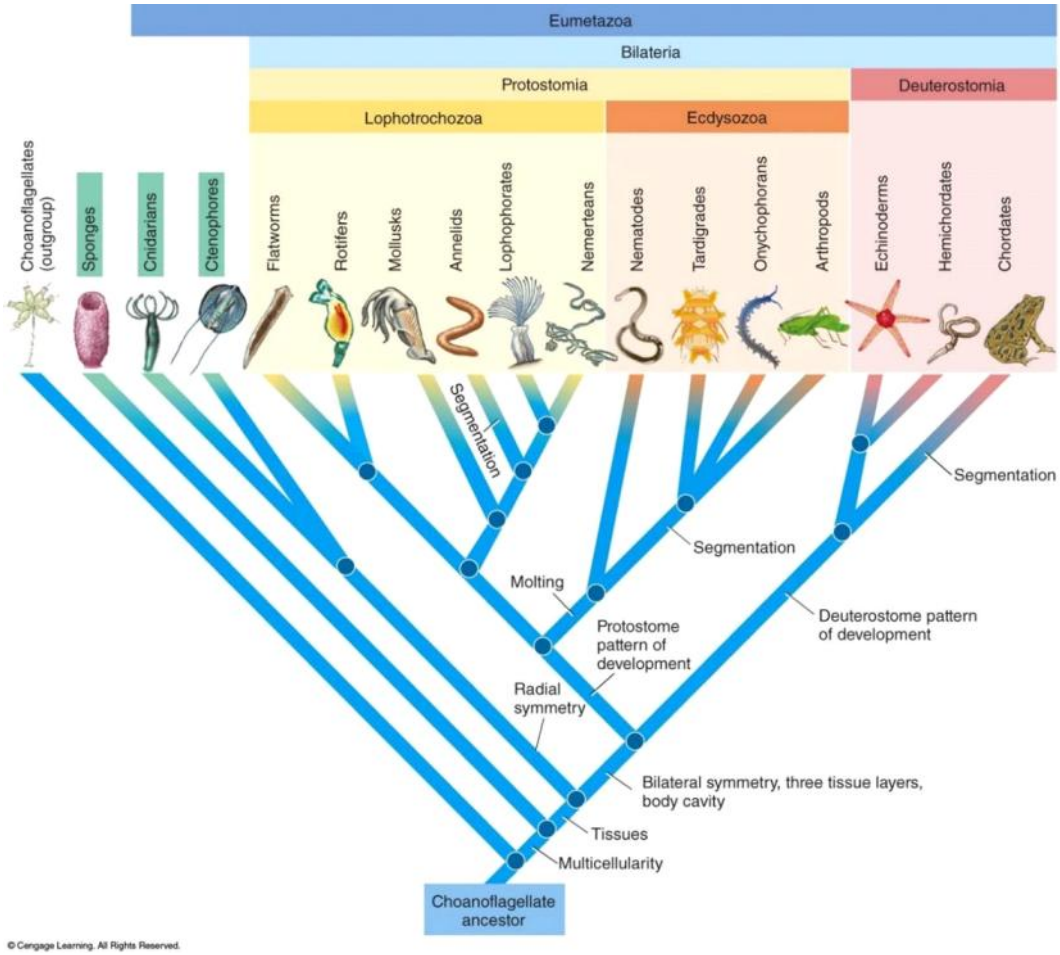
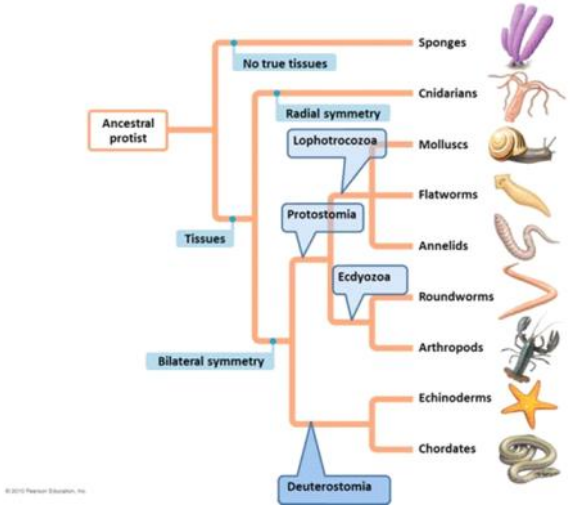
Evolutionary relationships between clades





Eumetazoans
Radiata

Objective 1: Describe the distinguishing features and structure of Phylum Cnidaria [Clade Radiata] including the structure of the cnidocyte. (remembering/understanding)

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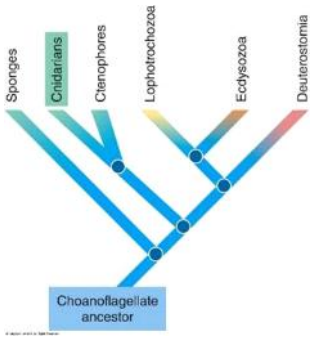
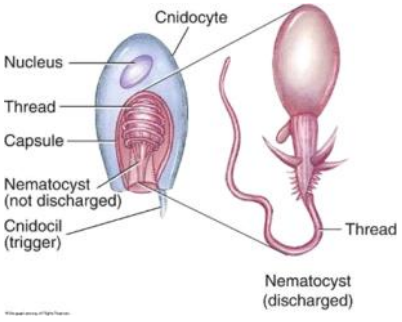


Phylum Cnidaria
Cnidocyte gives phylum its name -specialized epithelial cell
- Specialized epithelial cells

Cnidocyte structure

Cell structure/part	function
Nematocyst	Fluid-filled organelle, thread extends when discharged
Operculum	Cover (lid)
Cnidocil	Trigger



Discharge process
-

multicellularity

tissues

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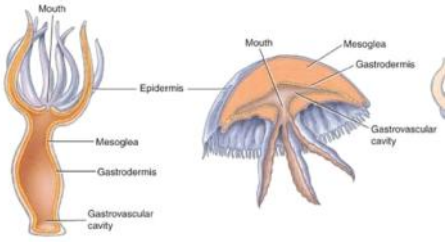
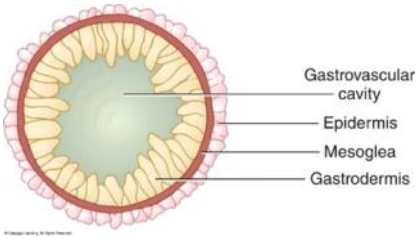
Cnidarians

Previously discussed
Diploblastic, radial symmetry, two body forms – poly and medusa

Polyp (hydra) Medusa (jellyfish)



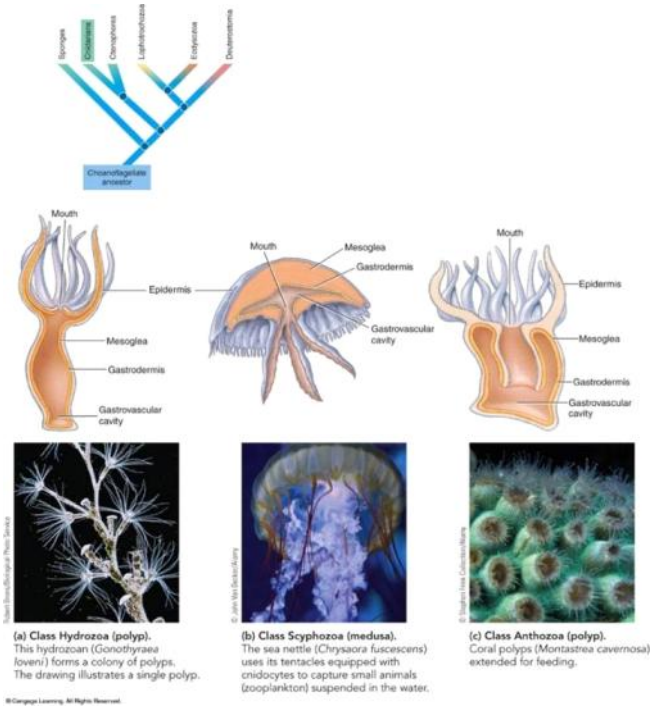


Feature	Function/characteristic
Gastrovascular cavity	digestive cavity (one opening)
Mesoglea (jelly-like layer)	Jelly-like layer between endoderm and ectoderm
Nerve net	Movement
Hydrostatic skeleton	Movement (fluid-filled G.C.)

Objective 2: Name and describe the two body forms and four classes (with examples) of cnidarians. (remembering/understanding)

Cnidarian classes

Hydrozoa – polyps
Scyphozoa - jellyfish
Anthozoa – flower animals (corals, anemones)
Cubozoa – box jellyfish



(a) Class Hydrozoa (polyp). This hydrozoan (*Gonothyraea loveni*) forms a colony of polyps. The drawing illustrates a single polyp.

(b) Class Scyphozoa (medusa). The sea nettle (*Chrysaora fuscescens*) uses its tentacles equipped with cnidocytes to capture small animals (zooplankton) suspended in the water.

(c) Class Anthozoa (polyp). Coral polyps (*Montastrea cavernosa*) extended for feeding.

Class Cubozoa (box jellyfish)

Protostomes
Bilateria
Lophotrochozoans

Objective 3: Describe the general characteristics of lophotrochozoans and name the associated phyla (with examples). (remembering/understanding)

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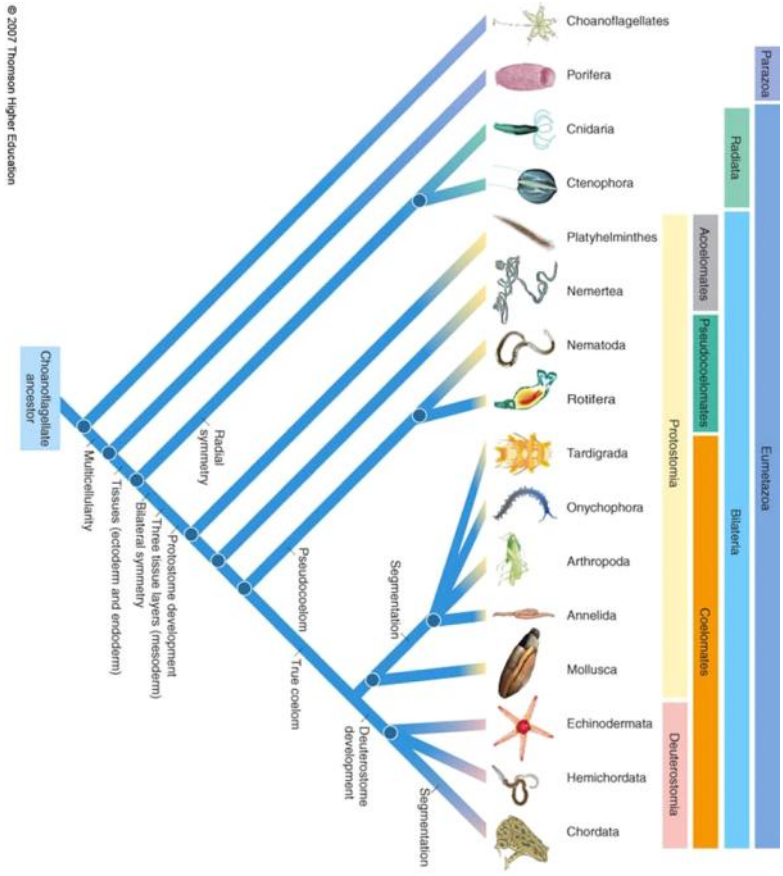

Ancestral featurs
- Multicellularity
- Tissues (three tissue layers) [ectoderm, mesoderm, endoderm]
- Triploblastic
- Bilateral symmetry
- Protostomic development
- Other features vary with class

The Phyla <u>Platyhelminthes, Mollusca, and Annelida all have these features</u>

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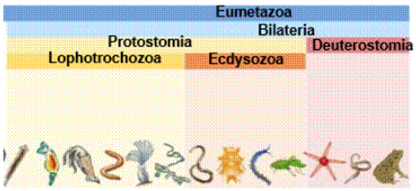
Clades within Bilateria and Protostomia



Protostomes divided into two clades [previously]

Lophotrochozoa

Lophophore

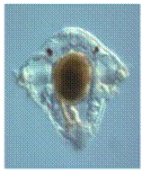
Ciliated ring around the mouth

http://www.teara.govt.nz/files/p5863doc.jpg

Or

Trochophore

Ciliated larva



http://scaa.usask.ca/gallery/lacalli/catpage4.shtml

Examples: flatworms, mollusks, and annelids

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Objective 4: Identify distinguishing characteristics of Phylum Platyhelminthes (flatworms) (remembering/understanding)

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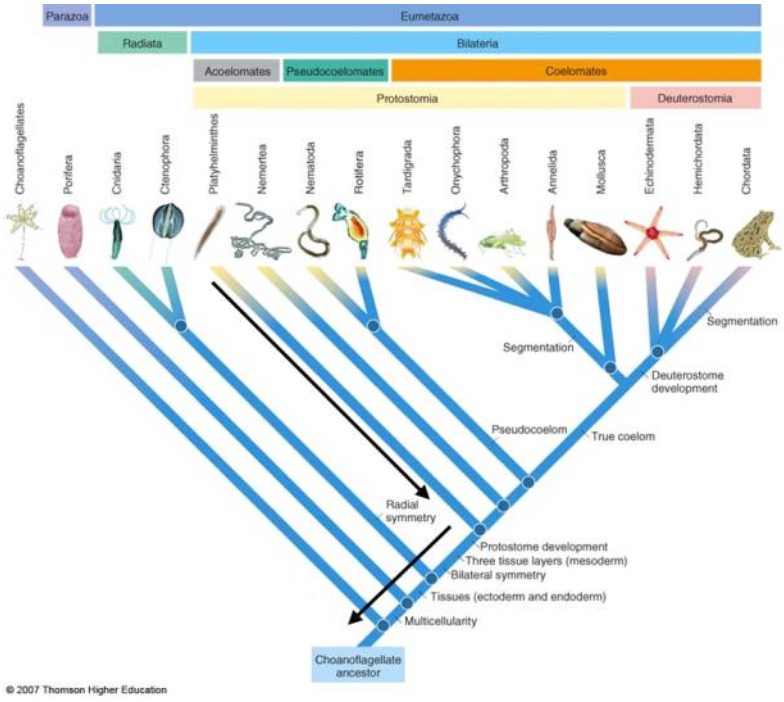
Phylum Platyhelminthes [Class Turbellaria seen in lab]

Acoleomate, unsegmented flatworms (also see lab materials) [Cetodes however are segmented]

Organ level [No organs for circulation or gas exchange.]
- Tubellarian have sense organs

Simple nervous system
- Brain and nerve cords

Gastrovascular cavity (digestion)
- Same as cnidarians.



Objective 5: Name and give examples of the four classes (with examples) of Phylum Platyhelminthes. (also see lab materials) (remembering/understanding)

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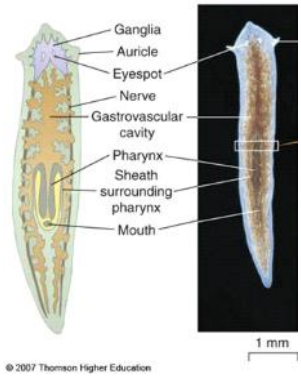
Four classes of Phylum Platyhelminthes

Free living flatworms

Class Turbellaria (only free-living flatworms) - planarian observed in lab



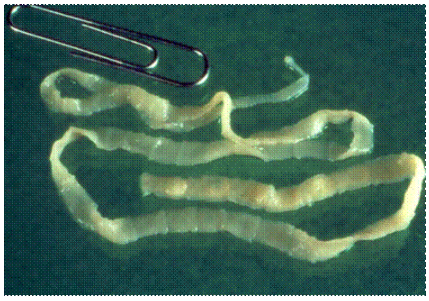
Parasitic flatworms

Class Trematoda (flukes)

Class Monogenea (flukes)

Class Cestoda (tapeworms) [observed as slides in lab]
NOTE: This class is referred to as the segmented flat worms.

Anterior end modified into hold fast
Long digestive cavity
Lost sense organs



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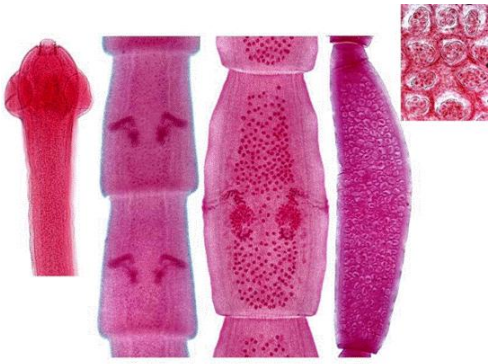

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Remaining two classes not discussed are both types of flukes

- Trematoda -
- Monogenea - parasites at only need one host

Class Turbellaria (also see lab materials)
Acoelomate
Unsegmented flat worms

Organ level (no organs for gas exchange or circulation)
-
Simple nervous system
-
Gastrovascular cavity
-

Slide

Class Cestoda

Parasitic flatworms, segmented flatworms
Internal parasites of vertebrates
Segmented flat worms
Additional characteristics (also see lab materials)

_____
_____

Remaining two classes not discussed are both types of flukes

Trematoda
Monogenea

Objective 6: Name, describe features and characteristics of Phylum Mollusca and the three main classes (with examples). (remembering/understanding) (also see lab materials)

No slide

General molluscan features [body plan]

A. Soft body with visceral mass
B. Head [gastropods and cephalopods]
C. Foot [solid in bivalves and gastropods; tentacles in cephalopods]
D. Mantle [sheet of epithelial tissue; very visible in bivalves
E. Coelom - coelomates
F. Circulation
    a. Open [bivalves and gastropods]
    b. Closed [cephalopods]
G. Radula [tongue-like structure with chitinous teeth; has poisonous barbs in cone snails]
H. Respiration
    1. Pulmonate - Having lungs [land dwelling snails]
    2. Gills - Fresh water and marine snails, bivalves, and cephalopods
I. Movement
    1. Muscular foot in Bivalves and snails
    2. Modified foot - Tentacles in some cephalopods – the octopus
2. Water expelled through siphon
Cephalopods and some bivalves
J. Digestive system
    Complete

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The three classes in Phylum Mollusca
Gastropoda, Bivalvia, Cephalopoda

- Generically called head-foot animals

Class Gastropoda includes snails, slugs, conchs, sea slugs, and their relatives

Habitat [freshwater, marine, terrestrial]

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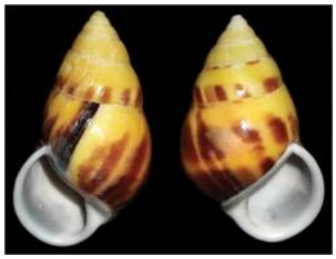
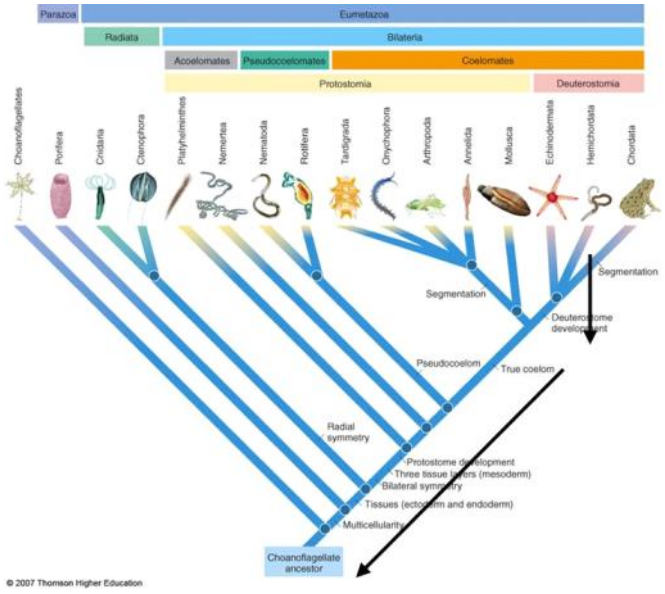
Phylum Mollusca, Class Gastropoda

Characteristic	Function
Shell (most)	Protection; spiral coil, flat, or absent; coils left or right.
Body - torsion	Twisting (independed of shell coiling)
Body - cephalic	Head well developed
Body - tentacles	One set with eyes, one set is sensory
Radula – many species	Belt of chitinous teeth [kinda works as a drill]
Radula - adaptation	Posionous barbs (cone snail)
Respiration - gills	Specialized epithelium - water
Respiration - pulmonate	Epithelium (mantle) functions as lungs - air

Pneumostome





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Phylum Mollusca, Class Bivalvia
includes clams, oysters, mussels, scallops and their relatives
(also see lab materials)

Habitat - freshwater and marine

Characteristic	Function
Shell structure	Two halves (values) connceted by flexible higne
Body – lateral compression	Side to siedd flattened
Body – acephalic	No head
Body – foot	Solid, muscular (for digging)
Respiration – siphons	Incurrent and excurrent (water and food)
Respiration – gills	Specialized epithelium
Circulation – open	Fluid flows out

Circulation - heart	Three chambers in coelom
Coelom	Ventral at hinge, encloses heart and part of intestine

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Phylum Mollusca
Class Cephalopoda includes octopus, squid, nautilus, cuttlefish

Habitat – marine

https://conorbofin.files.wordpress.com/2012/03/squid-quill.jpg

http://www.greenfacts.org/glossary/images/cephalopod.jpg

Feature	Function/characteristic
Shell	Octopus no Nautilus yes Squid reduced (pen)
Body-head	all cephalic
Body – eyes	well developed (direct - photoreceptors are facing forward [humans are indirect])
Brain	well developed (significant learning in octopus)
Foot	Divided into tentacle surround mouth
Radula and beak	not in nautilus
Respiration	Gills in mantle cavity
Movement	Funnel-like siphon (water in for respiration)
Buoyancy control	Nautilus secretes gas into shell chambers
Protection	Pigment cells

Chromatophores	color changes (nervous control)
Iridophores	Reflex light (irridecent)

Objective 7: Name, describe features and characteristics of Phylum Annelida) and the three main classes (with examples) within the phylum. (remembering/understanding)

Phylum Annelida (ringed) (segmented roundworms) (lab)

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I. General features
- A. Segmentation
  - Segmented round worms
- B. Septa
  - Internal membranous partitions
- C. Annuli
  - Surface rings indicating where the septa are located
  - Leeches have only surface annuli and not septa
- D. Setae
  - External bristles of epithelial origin
  - Not found in leeches.
- E. Nervous system
- F. Circulatory system
  - Closed system
- G. Digestive system
  - Complete
- H. Respiration
  - Across body surface
- I. Excretory system
- J. Reproduction
  - Monoecious – both male and female reproductive structures on same organism
- K. Coelomates

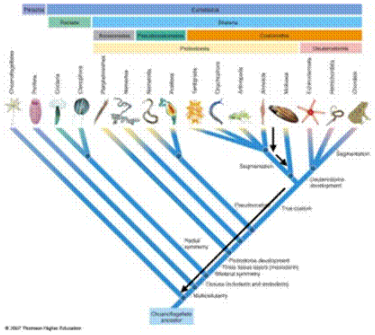
Phylum Annelida

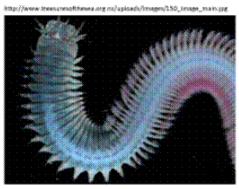
Segmented roundworms

Classes: Polychaeta, Oligochaeta and Hirudinea [leeches]

Aquatic invertebrates

Annelids, mollusks, cnidarians, echinoderms





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Phylum Annelida
Class Polychaeta
- Fibrous, collagen and mucus

Class Oligochaeta
- Proteins, lipids, mucus [moisture]

Aquatic invertebrates include annelids, mollusks, cnidarians, echinoderms

Phylum Annelida

Chaeta - cilia, hairs, bristles

Feature	Class Polychaeta	Class Oligochaeta
Habitat	Marine	freshwater, marine, terrestrial
Statocysts (both) Orientation to gravity	yes	yes
Cuticle (both)	fibrous, collagen and mucus	proteins, lipids, mucus [moisture]
Cephalic	yes	acephalic
Setae	multiple on parapodia	
Jaws with pedipalps	yes	no
Feeding	some active predators some filter feeders	some substrate feeders some predators (some aquatic species) some parasitic (rare – fish and frogs) some omnivores
Eyes	yes	no
Antennae	yes	no
Sensory tentacles	yes	no
Parapodia	yes	no
Clitellum	no	

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Phylum Annelida, Class Hirudinea - the leeches
Hirudin is secreted anticoagulant

Habitat: freshwater, marine, and moist land environments

Parasites - blood sucking parasites

Medicinal use - remove accumulated fluid and blood after injury, disease, or surgery

Body

Annuli - surface rings [also in earthworms]
Setae - none
Appendages - none
Suckers - muscular structures at both ends

Ecdysozoa
Polyphyletic group
Nematoda and Arthropoda

Objective 8: Describe general characteristics of ecdysozoans and name the associated phyla (with examples) (remembering/understanding)

Ecdysozoa

Grouping is polyphyletic

Groups molt surface covering

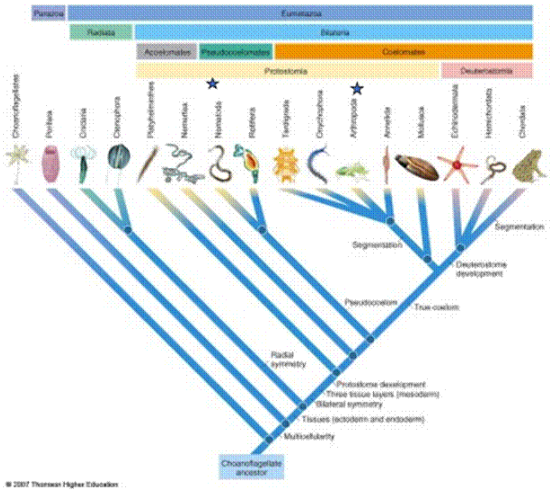
Ancestral features

Multicellularity
Tissues (three tissue layers)
Triploblastic
Bilateral symmetry
Protostomic development

Phyla
Nematoda and Arthropoda

Other features vary with phylum and class

Arthropods are segmented with jointed appendages



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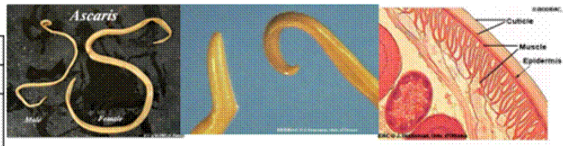
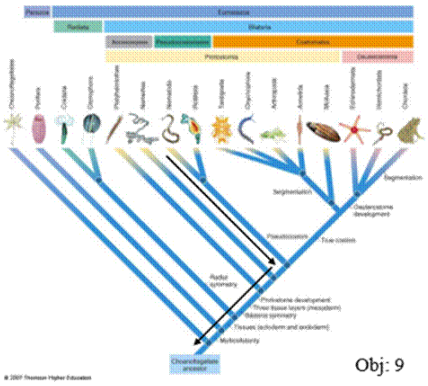
Objective 9: Describe distinguishing characteristics of Phylum Nematoda including sexual dimorphism (remembering/understanding)

Clade Ecdysozoa, Phylum Nematoda [elongated round worms] (Also see lab materials.)
Additional features other than with cladogram above.

Ecdysozoa: Phylum Nematoda

Feature	Function/characteristic
Shape	elongated and round
Pseudocoelomate	no internal septa (seen in Oligochaeta for example)
Smooth surface covering	no annuli, no setae
Skeleton	hydrostatic (fluid filled pseudocoelom)
Eutely	fixed number of cells (body and organs)
Reproduction	
Dioecious	separate sexes
Sexually dimorphic	males physically different from females
Muscle	longitudinal
Digestive tract	complete





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Ascaris (lab)
common intestinal parasite
Hookworms
intestinal parasite, sucks blood
Pinworms
commonly found in children
Trichina worm
internal parasite of animals; humans infected by eating undercooked, infected meat

Objective 10: Name, describe features and characteristics of Phylum Arthropoda and the associated subphyla and classes of arthropods (with examples).
(remembering/understanding)

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Clade Ecdysozoa, Phylum Arthropoda

- Ecdysis: molting/shedding

Most successful group, > 80% of known animals - includes insects
Habitat: freshwater, marine, terrestrial

Feature	Characteristic/function
Coelomate	cavity lined with mesoderm

Segmented	seen in annelids, arthropods, and chordates repetition of body parts
Appendages	paired, jointed, multiple different functions
Exoskeleton	
Outer layer protein	contains waxes to protect against moisture loss
Inner layer chitin and protein	hardened structure helps protect against predators
Senses	many sense organs including antennae and compound eyes
Respiration	
Gills	truly aquatic arthropods
Tracheal tubes	terrestrial arthropods and some aquatic species
Book lungs	some terrestrial species

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Other arthropod systems
1. Circulatory – open with hemolymph
2. Digestive - complete [similar to earthworms]
3. Reproductive - sexual, some hermophroditic

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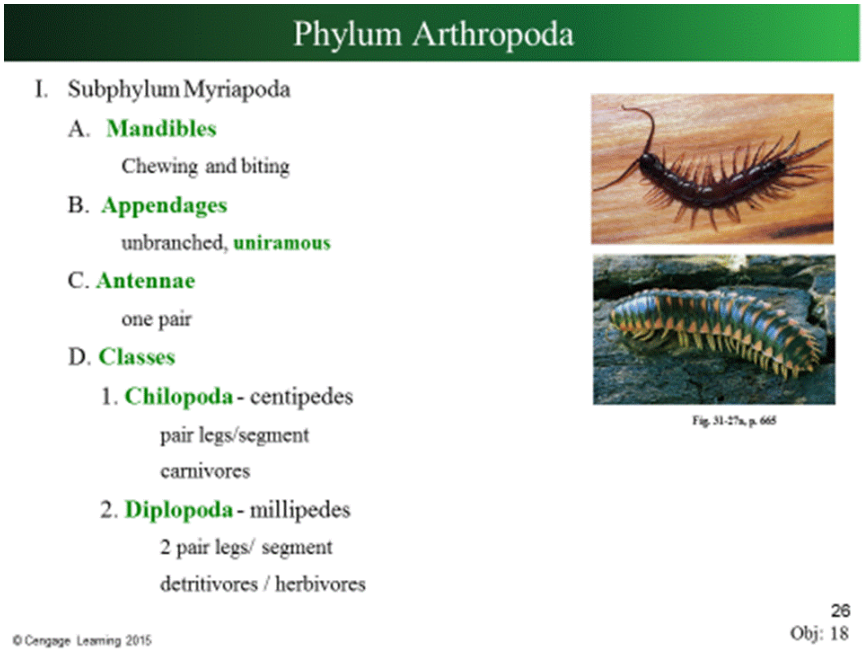

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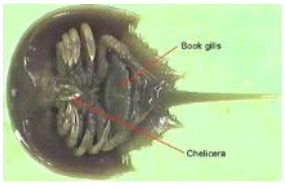
Phylum Arthropoda, Subphylum Chelicerata

Feature	Characteristic/function
Mandible or	none

Maxillae (chewing)	
Chelicerae First pair of appendages	adapted as fangs or pinchers [defining feature of the group]
Pedipalps Second pair of appendages	used like “arms” to manipulate food
Antennae	none [only arthropods without them]
Body	cephalothorax and abdomen
Classes Merostoma Arachnida	Horseshoe crabs only living group in this class spiders [lab], scorpions, ticks, harvestmen (daddy longlegs), mites appendages -four pair of jointed legs food source – most are carnivores



No Slide

Ticks a group of arachnids
- parasites
- transmit bacteria causing Rocky Mountain spotted fever and Lyme disease

Slide

Phylum Arthropoda, Subphylum Crustacea – include crayfish observed in lab, lobsters, crabs, shrimp, barnacles

Feature	Characteristic/function
Mandibles and maxillae	yes, can manipulate and chew food
Appendage structure	
Uniramous	unbranched [antennae]
Biramous	branched [antennules and swimmerets]
Antennae	2 pairs [antennae and antennules] used in taste and touch

Body	cephalothorax and abdomen
Reproduction	dioecious and sexually dimorphic
Senses	compound eyes and statocysts
Excretion Antennal glands	regulate salt balance

Slide

Phylum Arthropoda, Subphylum Hexapoda

Class Insecta

Feature	Characteristic/function
Body regions Thorax	head, thorax, abdomen three regions with 2 legs attached to each one
Uniramous appendages	
Wings	many have one or two pairs
Antennae	one pair
Eyes	simple (ocelli) compound
Mandibles and maxillae	all insects have same basic mouthparts that can be used for chewing, piercing, lapping [species dependent] have labial palps