Ecdysozoans

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Learning Goals

- Describe the major clades of ecdysozoans
- Compare and contrast the traits of the four main classes of Arthropods

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Supergroup Ecdysozoa (process of ecdysis)

- Animals that molt
- Not Spiralia
- Exoskeleton (hard external skeleton)
  - Nematodes
  - Arthropods

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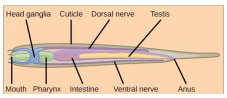
Phylum Nematoda

- Vinegar eels, eelworms, and other roundworms
- Found everywhere
  - Abundant and diverse
- Marine, freshwater, parasites, free-living
- Bilaterally symmetrical and unsegmented
- Covered by a flexible, thick cuticle that is molted as they grow

(a)



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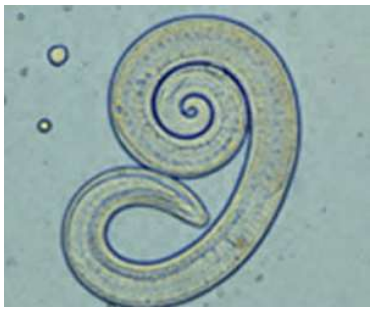
Human diseases caused by nemotodes

- Hookworms
- *Trichinella* causes trichinosis
  - Forms cysts in muscles
  - Infection from eating undercooked meat



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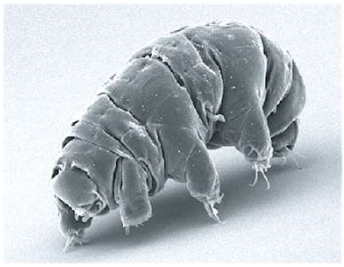
Phylum Tardigrada

- Water bears
- Microscopic, live in aquatic environments
- Famous for being able to go ingot cryptobiosis
  - Suspended animation
  - Resistant to
    - Dissecation
    - High temperatures
    - Vacuum
    - High pressure



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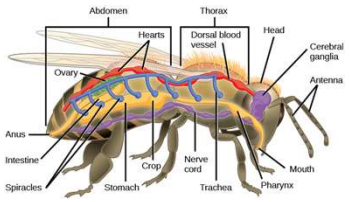
General arthropod morphology

- **Tagmata**: specialized functional groups of segments
  - Head, thorax, abdomen
  - Head and thorax may be fused into cephalothorax or prosoma
- **Exoskeleton**
  - Made of chitin and protein
  - Protects against water loss
  - Must undergo **ecdysis** (molting)
- **Open circulatory system**
- **Nervous system**
  - Double chain of segmented ganglia
  - Ventral ganglia control most activities
  - Many have compound eyes



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Compound eye

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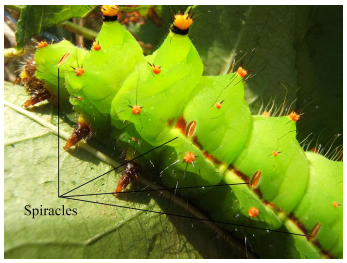
Arthropod respiratory system

- Marine arthropods have gills
- Terrestrial arthropods use tracheae
- Branch into tracheoles in direct contact with cells
- Connected to the exterior by spiracles
- Valves control water loss



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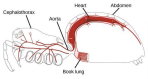
Subphylum Chelicerata (spiders and their kin)

- Spiders, ticks, mites, scorpions, daddy long-legs, horseshoe crabs, sea spiders
- Anterior appendages called **chelicerae**
  - May function as fangs or pincers
- Body divided into 2 tagmata:
  - Anterior **prosoma** bearing all appendages
  - **Pedipalps** and 4 pairs of walking legs
- Posterior **opisthosoma** contains reproductive organs



(a)

(b)

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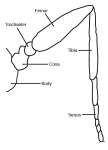
Subphylum Crustacea

- Crabs, shrimps, lobsters, barnacles, crayfish, copepods, pill bugs, sand fleas
- Have three tagmata
  - **Cephalon** and thorax fused to form a **cephalothorax**
- Two pairs of antennae, three pairs of appendages for chewing, and various pairs of legs
- Most appendages are **biramous**
- Gas exchange through gills or across cuticle

(a) Biramous appendage (crayfish leg)



(b) Uniramous appendage (insect leg)

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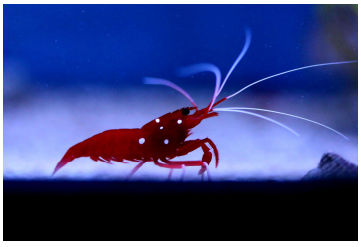
Order Decapoda

- Shrimps, lobsters, crabs, and crayfish
- Have 10 feet: 5 pairs of thoracic appendages
- Exoskeleton usually enforced with $CaCO_3$
- Cephalothorax covered by carapace
- Lobsters and crayfish
  - Swimmerets used in reproduction and swimming
  - Uropods paddle on either side of telson
- Crab has small abdomen held under carapace



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Subphylum Hexapoda

- Three body regions
  - Head
  - Thorax has three segments, each with a pair of legs:
    - May have one or two pairs of wings
  - Abdomen
- Most insects have compound eyes
- Sensory **setae** are hair-like structures that detect chemical and mechanical signals
  - Some have a **tympanum**: a thin membrane associated with tracheal air sacs that detect sound
  - Many communicate with **pheromones** used for communication (mating signals, trail markers)

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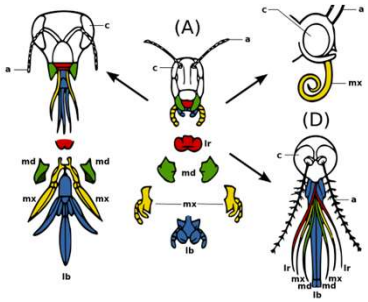
Insect feeding adaptations



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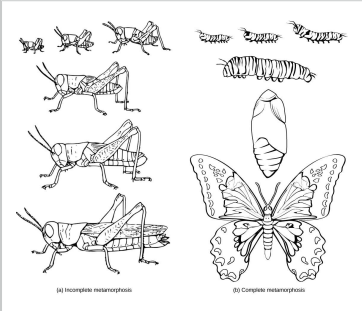
Hexapod life cycle

- Most insects undergo metamorphosis
  - **Incomplete metamorphosis** (grasshoppers): immature stages similar to adults
  - **Complete metamorphosis** (butterflies): immature larva are wormlike and have a pupa or chrysalis that precedes the final molt into adult form



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Subphylum Myriapoda

- **Centipedes (Class Chilopda)**
  - One pair of appendages per segment
  - Carnivorous with poison fangs
- **Millipedes (Class Diplopoda)**
  - Two pairs of appendages per segment
  - Each segment is a tagma of 2 segments
  - Herbivores

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Phylum Arthropoda (for your reference)

- Body is **segmented**
  - Opportunity for specialization of body regions
  - Differ in shape, muscles, or the appendages they bear
- Hard **exoskeleton**, composed of **chitin** and protein, covers the entire body and appendages
  - Protects against predators
  - Prevent excessive loss of moisture • Supports the underlying soft tissues.
  - Distinct muscles attach to the inner surface of the exoskeleton and operate the joints of the body and appendages
- Paired, **jointed appendages** (arthropod means "jointed foot")
  - Modified for many functions
  - Swimming paddles, walking legs, mouthparts for capturing and manipulating food, sensory structures, or organs for transferring sperm
- Nervous system of "brain" (**cerebral ganglia**) and **ventral nerve cord**
  - Variety of very effective sense organs
  - Organs of hearing and antennae that sense taste and touch.
  - **Compound eyes** composed of many light-sensitive units called **ommatidia**
  - Especially adapted for detecting movement

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Understanding check

What is ecdysis and why do ecdysozoans need to go through it?

What is metamorphosis, do all ecdysozoans go through metamorphosis?

How would you distinguish an arachnid from an insect?

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