

## ZOOLOGY 101 SECTION 9 LECTURE NOTES

### Phylum Arthropoda:

The arthropods, largest phylum of animals in the world.

Includes: spiders, mites, scorpions, ticks, crustaceans, millipedes, centipedes and insects.

### Characteristics:

1. Bilateral symmetry, metamerism, some somites (segments) fused to form *tagmata*
2. Three body regions: head, thorax, abdomen
3. Appendages jointed and often specialized
4. Exoskeleton (cuticle) made chiefly of **chitin**; some proteins and lipids also
5. Muscular system complex, no cilia
6. Coelom reduced and filled with blood to form *hemocoel*
7. Complex digestive system
8. Open circulatory system
9. Respiration by gills, **trachea**, or **book-lungs**
10. Excretory system of **Malpighian tubules** in some; coxal, maxillary or antennal glands in others
11. Nervous system of annelid plan with highly developed sensory organs
12. Sexes usually separate, metamorphosis in some, internal fertilization, growth with **ecdysis** (molting)

### Reasons for Success:

1. A versatile exoskeleton
2. Segmentation and appendages for more efficient locomotion

3. Air piped directly to tissues
4. Highly developed sensory organs
5. Complex behavior
6. Reduced competition for resources through metamorphosis

### Metamorphosis

A change in body plan:

- *Direct development*: example humans
- *Indirect development*: the larval or juvenile stage does not resemble the adult

### Ecdysis

The molting of the cuticle to accommodate growth, generally occurs between developmental stages

### Exoskeleton

Cuticle (outer covering) secreted by epidermis, layered

- *Epicuticle*: outer, thin layer of protein and lipids
- *Procuticle*: inner, thicker layer of chitin and protein
  - exocuticle
  - endocuticle
- Tanning
- Laminated
- Ecdysis

### Subphylum Trilobita: trilobites

- Once numerous, now extinct

**Subphylum Chelicerata**: spiders, ticks, mites, scorpions, horseshoe crabs

- Six pairs of appendages
  - Pair of chelicerae
  - Pair of pedipalps
  - Four pairs of walking legs
- No mandibles
- No antennae

**Class Merostomata**: horseshoe crabs

- Unsegmented large carapace
- Broad abdomen
- Telson (spine-like tail)
- Book gills

**Class Arachnida**: spiders, ticks, mites and scorpions

**Order Araneae**: spiders

- Tagmata of cephalothorax and abdomen
- Tagmata joined by **pedicel**
- Chelicerae function as fangs and deliver poison
- Breathe by book lungs or trachea, with **spiracles**
- Unique excretory system of **malpighian** tubules
- Coxal glands (modified nephridia)
- Eight simple eyes
- Sensory setae (bristles) on body
- Silk glands and spinnerets

**Order Scorpionida**: scorpions

- Short cephalothorax and long segmented abdomen

- Abdomen divided into preabdomen (broad base) and postabdomen (tail-like with stinger)

Order Opiliones: harvestmen (daddy longlegs)

Order Acari: ticks and mites

**Subphylum Crustacea**: crayfish, lobsters, shrimp, crabs

1. Nearly all aquatic
2. Two pair antennae
3. Biramous appendages
  - a. protopodite = basal segment Y shaped
    - endopodite = medial ramus
    - exopodite = lateral ramus

**Class Malacostraca**: lobsters, crayfish, shrimp, krill, crabs, mysids, isopods, amphipods

Order Isopoda: “pillbugs”

Order Amphipoda

Order Decapoda: crabs, lobster, crayfish, shrimp

1. Largest
2. Typical ex. crayfish

Body Structure

- cephalothorax and abdomen
- carapace
- paired appendages
- antennae, mandibles, maxillae, maxillipeds, walking legs, swimmerets
- telson and uropods

3. 5 pairs of walking legs
4. Chelipeds
5. Herbivorous, carnivorous, scavenger
6. Serially homologous
7. Compound eyes

Class Branchiopoda: water fleas

1. Freshwater
2. Flattened

Class Cirripedia: barnacles

1. Sessile
2. Some parasitic

**Subphylum Uniramia: insects and myriapods**

1. Five classes
2. Over million species

Class Diplopoda: millipedes

Class Chilopoda: centipedes

Classes Pauropoda and Symphyla

Class Hexapoda: insects

1. Body Structure

- 3 body regions: head, thorax, abdomen
- Single pair antennae
- Compound eyes
- One or two pairs of wings
- 3 pairs walking legs

- Thorax has 3 fused segments
  - 1) Prothorax
  - 2) Mesothorax
  - 3) Metathorax
- Insect flight
  - 1) Synchronous flight
  - 2) Asynchronous flight
- Nutrition
  - 1) Labium
  - 2) Proboscis (modified maxilla)
- Circulation and temperature
  - 1) Open circulatory system
  - 2) Ectothermic
- Nervous system
  - 1) Odor
  - 2) Tactile (setae)
  - 3) Johnston's organs (statocysts)
  - 4) Tympanic organs (hearing)
  - 5) Compound eye and ommatidia
- Excretion: malpighian tubules
- Chemical regulation: pheromones
- Reproduction and development
  - 1) Metamorphosis = change
  - 2) Larval instars = immature forms
  - 3) Types of metamorphosis:
    - a-metabolous = only change in body size and maturity
    - paurometabolous = many molts, gradual change from larva into adult form (eggs>nymph>adult)

- hemi-metabolous = immatures are aquatic (naiads), adults are not
- holo-metabolous = immatures most different from adult, last stage before adult called pupa (eggs>larva>larva>pupa>adult)

4) Cocoon, chrysalis, puparium

- Insect behavior and social insects