

Arthropods

Most diverse group of animals

- Over 1 million spp.

Single Phylum (Arthropoda)

3 large subphyla

- Chelicerata (spiders, scorpions, ticks)
- Crustacea (crabs, shrimp, lobsters)
- Hexapoda (insects)

See Figs. 13.3 and 13.4 in text

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Arthropods

Defining traits of Arthropoda

- Segments form groups (tagmata)
- Jointed appendages
- Exoskeleton (proteins, chitin)
- Complex muscles, rapid movement
- Reduced coelom (hemocoel)
- Respiration advanced with trachea or gills
- Advance sensory systems

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Arthropods

Subphylum Chelicerata

- Have six pairs of appendages
 - 4 pairs walking legs
 - 1 pair chelicerae
 - 1 pair pedipalps
- No mandibles or antennae
- Predigest food before consuming

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Arthropods

Subphylum Chelicerata

Class Merostomata

- extinct subclass of large aquatic scorpions (Eurypterida)
- living horseshoe crabs

Horseshoe crabs

- since Cambrian
- hard dorsal carapace and long telson
- opercular flaps on abdomen to cover book gills
- benthic feeder
- spring spawning aggregations

See Fig. 13.5 in text

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Arthropods

Subphylum Chelicerata

Class Arachnida

- Spiders, scorpions, ticks, and mites
- Dry climates
- Cephalothorax and abdomen
- Predatory with fangs, stingers, and poison glands

See Fig. 13.7 in text

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Arthropods

Subphylum Chelicerata

Spiders

- All carnivorous, using poison
- Most ambush or use web
- Predigest food, some with teeth
- Unique book lungs
- Excretory tubules (Malpighian) aid in water retention

See Fig. 13.7 in text

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Arthropods

Subphylum Chelicerata

Spiders

- Eight eyes sense movement
- Hairlike setae with sensory function
- Silk glands and spinnerets for web-building
- Liquid protein hardens, very strong
- Silk also for reproduction, prey storage, trip lines

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Arthropods

Subphylum Chelicerata

Scorpions

- Mostly tropical and secretive
- Short cephalothorax, preabdomen and postabdomen (tail) with stinger
- Pedipalps form large pincers
- Joint # varies among appendages
- Ventral surface organs = pectines

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Arthropods

Subphylum Chelicerata

Ticks and mites

- Maybe up to 1 million spp (only 30,000 known) **See Fig. 13.14 in text**
- Cephalothorax and abdomen fused
- Mouthparts (chelicerae, pedipalps) carried on capitulum
- Important effects on human food and health
 - Dust mites – allergies
 - Agricultural pests
 - Disease transmission by ticks

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Arthropods

Subphylum Crustacea

- Includes lobsters, shrimp, crabs, plus.....
- Mostly marine
- Cuticle exoskeleton high in calcium
- Possess mandibles
- Appendages not limited to cephalothorax

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Arthropods

See Figs. 13.17 and 13.19 in text

Defining traits of Crustacea

- Two pairs of antennae
- 5 pairs of appendages on head (2 pairs of antennae, 1 pair of mandibles, and 2 pairs of maxillae)
- Thorax and abdomen with 1 pair of appendages per segment
- Regional specialization
- Dorsal cuticle often forms hard carapace

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Arthropods

Crustaceans

- Internal cavity is hemocoel
- Open circulation
- Complex flexor and extender muscles
- Gills originate at base of appendages
- Antennal or maxillary glands for osmotic balance
- Tactile hairs for chemoreception

See Fig. 13.22 in text

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Arthropods

Crustacean reproduction and molting

- Mostly separate sexes
- Specialized egg brooding
- Indirect development in most (metamorphosis) **See Fig. 13.24 in text**
- Molting (ecdysis) required to grow
- Break down old cuticle layers and secrete new ones **See Figs. 13.20 and 13.21 in text**
- Take in water to swell body and split old cuticle
- Hormonal control

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Arthropods

Crustacean Taxa

Class Branchiopoda

- Brine shrimp and water fleas
- Important component of freshwater zooplankton

See Fig. 13.25 in text

Class Maxillopoda

- Copepods (subclass Copepoda)
 - > Large number of species
 - > Most abundant marine zooplankton (genus Calanus)

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Arthropods

Crustacean Taxa

Class Malacostraca is largest class

Includes several Orders:

- Isopoda
- Amphipoda
- Euphausiacea (krill)
- Decapoda (Crayfish, crabs, lobsters, true shrimp)

See Fig. 13.32 in text

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Arthropods

Subphylum Hexapoda

Class Insecta

- Most diverse and abundant arthropod
- Estimated 10 million spp.
- Economic importance

See Fig. 13.34 in text

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Arthropods

Class Insecta General Traits

- 3 tagmata = head, thorax, abdomen
- One pair of antennae and 3 pairs of walking legs
- Appendages uniramous
- Wings (0,1, or 2 pairs)
- Respiratory tracheae
- Scleroproteins in exoskeleton
- Specialized food habits

See Fig. 13.35 in text

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Arthropods

Insect Flight

- Wings composed of cuticle
- Most with 2 pairs
- Direct and Indirect flight muscles
- Synchronous or asynchronous control
- Various speeds and migratory distances

See Fig. 13.38 in text

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Arthropods

Insect Form and Function

Tracheal system

- Network of thin tubes
- Main trunks open to outside via spiracles **See Fig. 13.45 in text**
- Deliver oxygen directly to cells
- Gas exchange mainly by diffusion

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Arthropods

Insect Form and Function

- Complete digestive system with foregut, midgut, and hindgut **See Fig. 13.39 in text**
- Food habits vary widely
 - Herbivores
 - Scavengers
 - Carnivores
 - Parasites
 - Parasitoids **See Fig. 13.44 in text**
- Mouth part morphology tied to diet

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Insect Form and Function

- Malpighian tubules for excretion
- Well-developed sense organs
 - Mechanoreception with sensilla
 - Auditory reception
 - Chemoreception is critical
 - Vision with compound eyes

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Arthropods

Insect Form and Function

Reproduction

- Separate sexes in most
- Egg number and parental care vary
- Dramatic metamorphosis **See Figs. 13.47 and 13.48 in text**
 - Holometabolous
 - Hemimetabolous
- Seasonal dormancy called diapause

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