**Chapter 10: Phylum Arthropoda Cont.**

**CLADE MANDIBULATA** (Subphyla Crustacea, Hexapoda, and Myriapoda)

**Subphylum Myriapoda** (“many foot”)

Characteristics:

1. One pair of antennae
2. Two tagmata (body regions) – **head, trunk**
3. **Uniramous** appendages - exopod is absent so all appendages formed by the endopod

**Class Chilopoda** ("lip foot" or "margin foot")

* Centipedes
* 1 pair of walking legs per somite (segment)
* Well-developed fangs, venomous
* Agile, fast-moving
* Dorsoventrally flattened body in cross-section

**Class Diplopoda** ("double foot")

* Millipedes
* 2 pairs of walking legs per somite
* No fangs, but some secrete toxins
* Slow-moving
* Circular body in cross-section

**CLADE PANCRUSTACEA** (Subphyla Crustacea and Hexapoda)

**Subphylum Hexapoda** (“six foot”)

Characteristics:

1. Three body regions (tagmata): **head, thorax, abdomen**
2. Three pairs of **uniramous** legs; one pair on each thoracic segment
3. Wings present in most species

**Class Entognatha** (“inside jaw”)

* Withdrawn (hidden) mouthparts
* No wings as ancestral trait

**Order Protura** (“first tail”)

* + No antennae, eyes, or pigmentation, <3mm

**Order Collembola** (“glue peg”): springtails

* + Caudal appendage (**furcula**) folded ventrally and used for jumping, ventral tubular appendance (**collophore**) used for sticking, <6mm

**Order Diplura** (“two tail”)

* + Mostly unpigmented, two caudal filaments, 3-5mm

Identification of Insects

Insecta comprises the most diverse animal class. In fact, there are more species within this class than all other classes combined. This class is also the most abundant, meaning it occurs in the largest numbers on the planet. Below is a subset of the groups of organisms that are members of this class.

**Class** **Insecta** ("to cut into")

* Ectognathus mouthparts
* 3 tagmata with associated appendages:
	+ - head (antennae, mouthparts)
		- thorax (prothorax, mesothorax, and metathorax - each bear one pair of walking legs for a total of 6 legs, may also bear wings)
		- abdomen (9-11 somites, last one bears cerci and genital organs *e.g*., ovipositor)

**Subclass Apterygota** (“without wings”)

* No wings ancestrally

**Order Thysanura** (“bristle tail”): silverfish

* + - * Three abdominal filaments
			* Body covered in fine scales
			* Wings absent

**Subclass Pterygota** (“wings”)

* Wings ancestrally

**Infraclass Paleoptera** (“old wings”)

* + - * **Order Ephemeroptera** (“lasting a day wings”): mayflies
				+ Wings held vertical above body
				+ Two or three threadlike tail filaments
			* **Order Odonata** (“tooth”): dragonflies and damselflies
				+ Wings held horizontal from body
				+ Large eyes

**Infraclass Neoptera** (“new wings”)

**Clade Orthopterodea** (Orthopteroid Insects)

* Biting/chewing mouthparts

**Order Phasmatodea** (“phantom”): stick & leaf insects

* + - * + Secondarily wingless
				+ Looks like a stick or leaf

**Order Mantodea** (“prophet form”): praying mantids

* + - * + Body elongated
				+ Raptorial front legs

**Order Blattodea** (“cockroach”): cockroaches

* + - * + Oval, flattened bodies
				+ Tarsi with five segments

**Order Isoptera** (“equal wings”): termites

* + - * + Eusocial
				+ Wings membranous and equal in size
				+ (Note: technically termites are now considered part of order Blattodea, but for now we will continue to learn them with their historical classification)

**Order Orthoptera** (“straight wings”): crickets, grasshoppers

* + - * + Large hind legs for jumping
				+ Auditory organs (*e.g.* tympanum) prominent

**Order Dermaptera** (“skin wings”): earwigs

* + - * + Two large pincer-like cerci

**Clade Hemipterodea** (Hemipteroid insects)

* Piercing/sucking mouthparts
* ≤ 4 Malpighian tubules
* Reduced wing venation

**Order Phthiraptera** (“louse wings”): lice

* + - * + Wingless ectoparasites

**Order Hemiptera** (“half wings”): true bugs

* + - * + Multisegmented piercing sucking mouths arising from the anterior portion of the head, held ventrally

**Clade Holometabola**

* Holometabolous (complete) metamorphosis
* All below with biting/chewing mouthparts except for those mentioned otherwise

**Order Neuroptera** (“vein wings”): lacewings,
antlions, dobsonflies

* + - * + Wings with a complex nerve-like vein pattern

**Order Coleoptera** (“covered wings”): beetles

* + - * + Front wings as hardened **elytra**

**Order Siphonaptera** (“siphon wingless”): fleas

* + - * + Secondarily wingless
				+ Laterally flattened
				+ Piercing/sucking mouthparts

**Order Diptera** (“two wings”): flies

* + - * + Back wings reduced to **halters**
				+ Many with lapping/sponging mouthparts

**Order Lepidoptera** (“scale wings”): butterflies, moths

* + - * + Body covered in scales
				+ Mouthparts as a coiled proboscis

**Order Hymenoptera** (“membrane wings”): ants, bees, wasps

* + - * + Abdomen and thorax narrowly joined
				+ Veins reduced in wings

Grasshopper taxonomy

Phylum Arthropoda

 CLADE MANDIBULATA

 CLADE PANCRUSTACEA

 Subphylum Hexapoda

 Class Insecta

 Subclass Pterygota

 Infraclass Neoptera

 Clade Orthopterodea

 Order Orthoptera

 Genus ***Romalea***

External anatomy of the grasshopper

 Refer to Figures 10.6 through 10.8 to identify the: **antennae, claws, compound eyes, coxa, femur, forewing, hindwing, labium with palps, labrum, mandibles (left and right), maxillae (left and right), mesothorax, metathorax, prothorax, spiracles, sternum, tarsus, tergum, tibia, trochanter,** and **tympanum**. In addition, be able to identify **males (cercus)** and **females (ovipositor)**.



**Figure 10.6.** Labeled diagram of the external anatomy of *Romalea*.

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**Figure 10.7.** Labeled micrograph of a grasshopper leg.



**Figure 10.8.** Labeled micrograph of isolated grasshopper mouthparts.