

# Animal Diversity II: Ecdysozoa

## Objectives:

- Be able to identify specimens from the major groups of Ecdysozoa, including the Nematoda, Onychophora, Tardigrada, and Arthropoda.
- Be able to classify arthropods as Chelicerata, Myriapoda, Hexapoda, or Crustacea.
- Be able to describe the major body divisions of various Arthropoda.

## Ecdysozoa: animals that molt

The Ecdysozoa are a major monophyletic group of protostomes that share an important and complex synapomorphy: they shed their outer protective skin at least once in their lifetime, a process known as **molting** or **ecdysis**. Steroid hormones called **ecdysones** control this molting process. The Ecdysozoa are the most diverse group of organisms on the planet, especially because they contain the insects, and particularly the beetles, the largest and most diverse group of all organisms.

The Ecdysozoa includes many phyla, including the following:

**Kinorhyncha** (mud dragons)

**Priapulida** (penis worms)

**Nematoda** (roundworms)

**Nematomorpha** (horsehair worms)

**Tardigrada** (water bears)

**Onychophora** (velvet worms)

**Arthropoda** (joint-legged animals, the most species-rich phylum of all)

This laboratory will emphasize the Nematoda and Arthropoda, the two largest animal phyla.

## PHYLUM Nematoda (roundworms, including pinworms, heartworms, and many others)

Nematodes are small worms with tapered ends and a **pseudocoel** instead of a true coelom. Most nematodes are parasites inside the bodies of animals and plants, but *Caenorhabditis elegans* (often studied by developmental biologists and neurobiologists), lives freely in dung piles and other bacteria-rich habitats. Study the life cycle of at least one nematode, such as the vinegar worm *Ascaris*.

## PHYLUM Nematomorpha (horsehair worms)

These are long, thin worms that sometimes occur in drinking troughs provided to farm animals.

## PHYLUM Tardigrada (water bears)

These tiny animals, closely related to arthropods, are famous for their ability to survive in very harsh conditions, including extremes of cold, heat, acidity, and dehydration.

## PHYLUM Onychophora (velvet worms)

These tropical animals have a long fossil record going back to Cambrian times. They are closely related to arthropods, but their stubby legs do not have joints.

## **PHYLUM Arthropoda** (joint-legged animals)

All arthropods have a tough outer covering, the **exoskeleton**, which is further strengthened in many cases by the addition of calcium salts. Joints in this exoskeleton are made of soft, flexible bands that are spanned by muscles. Joints in the legs and mouthparts are the characteristic feature of arthropods.

Observe the great diversity among arthropods, paying special attention to their anatomy and the structural differences among the different arthropod groups.

### **SUBPHYLUM Trilobita**

They are an extinct, ancestral group that flourished in Paleozoic times. Their many paired appendages were nearly all alike.

### **SUBPHYLUM Crustacea**

These are nearly all aquatic and mostly marine.

**CLASS Branchiopoda** ("fairy shrimp" or "brine shrimp," important in marine food chains)

The freshwater genus *Daphnia* ("water flea") is also included here.

**CLASS Ostracoda** (tiny "seed shrimp" that resemble seeds in their small size and hard shells)

**CLASS Copepoda** (copepods, very abundant in plankton, important in marine food chains)

**CLASS Cirripedia** (barnacles)

**CLASS Malacostraca** (larger, more familiar crustaceans)

**ORDER Stomatopoda** (mantis shrimp)

**ORDER Isopoda** (terrestrial "pill-bugs," living in rotting logs and also in basements)

**ORDER Amphipoda** (amphipods or "scuds")

**ORDER Decapoda** (familiar lobsters, crayfish, crabs, and shrimp)

Examine and draw at least two decapods. How do you think they got this name?

### **SUBPHYLUM Chelicerata**

These arthropods have paired piercing structures (**chelicerae**) in their head regions, allowing them to inject poison into their prey. A second pair of modified appendages, called **pedipalps**, can hold the prey in place while the chelicerae inject the poison. Pay attention to how many pairs of legs each group has.

**CLASS Merostomata** (horseshoe crabs and their extinct relatives)

Examine *Limulus*, the horseshoe crab (Order Xiphosura).

**CLASS Pycnogonida** ("sea spiders")

**CLASS Arachnida** (spiders, scorpions, etc.), a group that became successful on land

**SUBCLASS Scorpiones** (true scorpions)

**SUBCLASS Pseudoscorpionida** (pseudoscorpions)

**SUBCLASS Opiliones** (harvestmen, also called "daddy long-legs")

**SUBCLASS Acari** (mites and ticks)

**SUBCLASS Araneae** (spiders)

## **SUBPHYLUM Myriapoda**

These are elongated arthropods with many legs. They all have **mandibles** (chewing mouthparts) and other structural similarities to insects.

### **CLASS Chilopoda** (centipedes)

These carnivorous arthropods often live in moist forest habitats (under logs, etc.) and are often found in basements. Each segment has one pair of legs.

### **CLASS Diplopoda** (millipedes)

These herbivores often roll themselves into a spiral for protection. Odd-numbered segments have a dorsal covering (tegumentum) that extends over the next even-numbered segment that lacks such a tegumentum. The result is a series of double segments, each with two pairs of legs.

## **SUBPHYLUM Hexapoda**

### **CLASS Insecta** (insects)

This is the largest and most diverse group of all, including about 3/4 of all the species in the entire animal kingdom! The body is divided into a **head, thorax, and abdomen**. The head always contains a pair of **antennae** and mouthparts that include a pair of **mandibles**.

**SUBCLASS Apterygota** (wingless insects: bristle-tails, silverfish, etc.)

**SUBCLASS Pterygota** (insects with two pairs of wings on the thorax)

**INFRACCLASS Paleoptera** (insects whose wings cannot be folded back)

**ORDER Odonata** (dragonflies and damselflies)

**INFRACCLASS Neoptera** (all other insects, whose wings can be folded back)

**EXOPTERYGOTA** (insects that undergo "incomplete metamorphosis," with nymph stages that develop adult characteristics gradually)

**ORDER Orthoptera** (grasshoppers, crickets, and others with chewing mouthparts)

**ORDER Dictyoptera:**

**SUBORDER Mantodea** (mantids, including the praying mantis)

**SUBORDER Blattaria** (cockroaches)

**SUBORDER Isoptera** (termites)

**SUBORDER Phasmida** ("walking sticks," with fantastic camouflage)

**ORDER Hemiptera** (true bugs, with piercing and sucking mouthparts; also includes cicadas and aphids)

**ORDER Siphonaptera** (fleas)

**ENDOPTERYGOTA** (insects that undergo "complete metamorphosis" in four well-defined stages: egg, larva, pupa, winged adult)

**ORDER Neuroptera** (lacewings, with netlike wing structure)

**ORDER Lepidoptera** (butterflies and moths, with scale-covered wings)

**ORDER Diptera** (flies and mosquitoes, with the second pair of wings reduced to vestigial "**halteres**" that are used for balance and steering)

**ORDER Coleoptera** (beetles, the largest group of all, with leathery front wings)

**ORDER Hymenoptera** (social insects: wasps, ants, and bees)