



Arthropods:

Insects and their relatives

Arthropods: Insects and their relatives



- Characteristics of the phylum Arthropoda
- Five major classes
 1. Crustacea
 2. Arachnida
 3. Chilopoda
 4. Diplopoda
 5. Insecta
- Anatomy and development
- Arthropod diversity
- Roles in ecosystems and benefits for humans
- Bugs rule!



Characteristics of the phylum Arthropoda



1. Exoskeleton
2. Jointed appendages
3. Segmented body parts



not an arthropod

arthropod

Arthropod Anatomy



Head

- antennae
- mouthparts
- eyes: compound or simple

Thorax or cephalothorax

- legs and/or wings



Abdomen

- houses majority of reproductive, circulatory, respiratory, and digestive systems
- ovipositor (females)
- spinnerets (spiders)



Five major classes of arthropods



1) Arachnida

- four pairs of legs
- one or two body regions (cephalothorax and abdomen)
- no wings or antennae
- most live on land; some in freshwater
- 35,000+ species

Examples: spiders, harvestmen, scorpions, mites, ticks



Five major classes of arthropods



2) Crustacea

- five or more pairs of legs
- two body regions
- two pairs of antennae
- lack wings
- breathe with gills
- most are marine; some in freshwater; a few terrestrial
- 35,000+ species

Examples: crabs, crayfish, barnacles, sowbugs, shrimp, lobsters



Five major classes of arthropods



3) Diplopoda

- multi-segmented bodies
- two pairs of legs on most segments
- one pair of antennae
- lack wings
- terrestrial
- 8,000+ species



Millipedes

Five major classes of arthropods



4) Chilopoda

- flattened, multi-segmented bodies
- one pair of legs on most segments
- one pair of antennae
- lack wings
- terrestrial
- 5,000+ species

Centipedes



Five major classes of arthropods



5) Insecta

- three pairs of legs
- three body regions
- one pair of antennae
- one or two pairs of wings (sometimes absent)
- mostly terrestrial and freshwater, a few marine
- 1 million+ species currently identified

Examples: flies, beetles, walkingsticks, bees, ants, cockroaches, ladybugs, crickets, butterflies



Arthropod Taxonomy



Honey bee

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Hymenoptera

Family: Apidea

Genus: *Apis*

Species: *mellifera*



Cyanide-producing millipede

Kingdom: Animalia

Phylum: Arthropoda

Class: Diplopoda

Order: Polydesmida

Family: Vestodesmidae

Genus: *Harpaphe*

Species: *haydeniana*



Arthropod Development

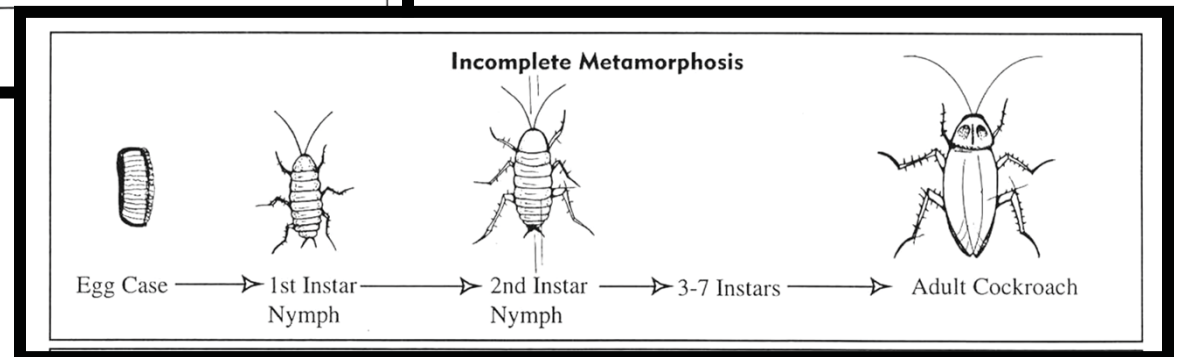
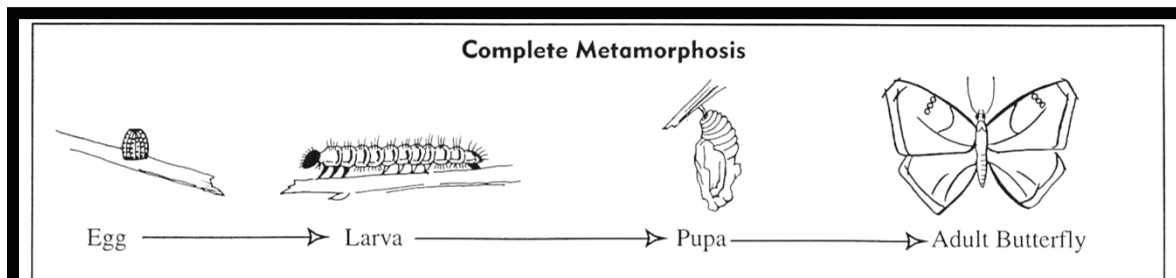


- Complete metamorphosis:

1. egg
2. larva
3. pupa

- Incomplete metamorphosis:

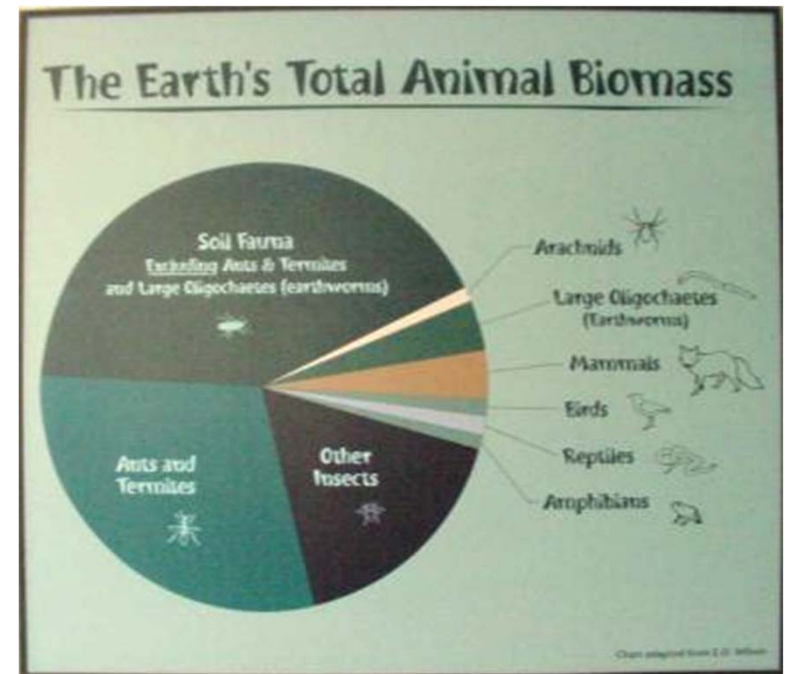
1. egg
2. nymph (instars)
3. adult



Arthropod Diversity and Abundance



- Over one million insect species identified to date. Estimated that 30 million insect species may exist.
- Approximately three-fourths of all animal species that exist today are insects. Nearly 90% are arthropods.
- An estimated 10% of the world's biomass is ants and another 10% is termites



Arthropod Diversity and Abundance



Arthropod diversity is a function of:

- Small **size** = infinitely more niches available
- Advantages of **exoskeleton** - prevents water loss, provides protection, allows for muscle attachment, and forms legs and wings for locomotion
- **Wings** - disperse to new habitats, avoid unsuitable conditions or predators, forage over greater distance
- **Larval and adult stages** occupy different niches
- **Mouthparts** - different structures to feed on different resources



Roles of Arthropods in Ecosystems: Benefits for Humans



- Decomposition
- Pollination and seed dispersal
- Abundant food resource for many other animals
- Prey on other arthropod species - control populations (biological control)
- Products - honey, cochineal (red dye), shellac, silk, arthropods as food



Roles of Arthropods in Ecosystems: Fun Facts



- Dung beetles bury approximately 1/2 ton of dung per acre each year on the savannas of West Africa
- A single honeybee may visit 1,000 blossoms each day. An estimated 250,000 wild flowering plant species depend on animal pollinators, most of which are insects.
- An average hummingbird may eat 10-15 insects per day.
- An adult dragonfly can eat up to 300 insects per day, mainly mosquitoes

Bugs Rule! Threats to humans

- Damage to agriculture, forest resources
- Damage to structures, products
- Disease vectors (humans, domestic animals)
- Injury (painful or poisonous bites)
- Only 1% of all known insect species have a negative effect on humans



Cultural Entomology: Insects in human culture



Scarab (dung) beetles in Egyptian culture:

- scarab rolling a dung ball invokes the movement of sun across sky = “buried” at night and rises from the earth in the morning
- scarabs bury dung balls (equated with eggs); larvae pupate and new adults emerge
- pupa were inspiration for mummies - if the sun and beetles can be buried and then resurrected, why not people?



Appreciation and Conservation



“Conservation of wildlife, especially invertebrates, will necessitate a far greater understanding of why we react with hostile and negative feelings toward various creatures, particularly insects and spiders...

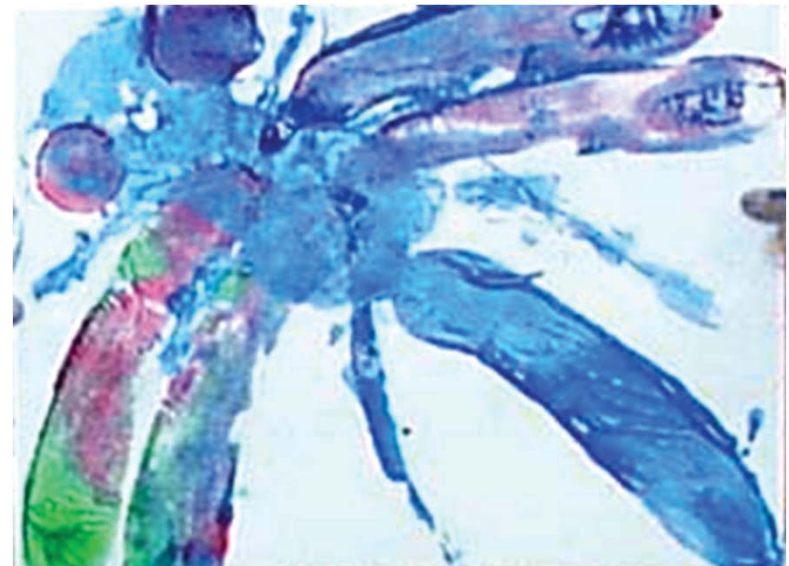


Appreciation and Conservation



...more than 90% of the planet's currently estimated 30 million animal species are invertebrates, mainly arthropods. Despite the possible catastrophic extinction of invertebrate species, the general public and most policymakers appear unaware of how such a loss may affect human well-being.”

Dr. Steve Kellert,
Yale University,
School of Forestry
and Environmental
Studies





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