References:


- Encyclopedia of Entomology, John L. Capinera, 2008
Different search engines, especially TDR
Introduction to the Arthropods
The real ruler of the earth
• The largest phylum of animals (three out of four of all animals), about 85% of described animal species are arthropods.
• The true no. is probably in the tens of millions.
• The most successful animals

Arthropods: A success story

Almost any way you look at them, arthropods are successful:

• They have been around for more than 500 million years and are still evolving.
• They live on Earth in overwhelming numbers.
• There have come in all shapes and sizes.
• They have evolved to fill a variety of ecological niches — from tiny internal parasite to giant bird-eating predator.
Arthropods range in distribution from the deep sea to mountain peaks
In size from the king crab with its 12-foot to microscopic insects and crustacean
Sheer numbers

Let's get an idea of just how dominant arthropods are, by looking at how many of them there are.

- About a billion billion \((1,000,000,000,000,000,000)\) insects are alive at any time. That's about 160 million insects for each person on Earth!

We've got your allotment of insects here...where do you want 'em?

- At any moment, there are about \(1,000,000,000,000,000\) ants alive on the planet. If each ant were half a centimeter long, they would form a chain long enough to circle the Earth 125,000 times!

Uh...Houston, we have an ant problem.
In spite of being a diverse group:

They share some basic inherited characters
Bilateral (left/right) symmetry

One character inherited by all arthropods is bilateral symmetry.

Click the button to see a demonstration of the character:

1. Bilateral symmetry
Segmented body

Another character inherited by all arthropods is a body divided into segments that are often grouped into larger functional units.

Click each button to see a demonstration of that character:

1. Bilateral symmetry
2. Segmented body
Hard exoskeleton

We've seen that arthropods all have bilateral symmetry and segmented bodies. Another character inherited by all arthropods is a hard exoskeleton.

Click each button to see a demonstration of that character:

1. Bilateral symmetry
2. Segmented body
3. Hard exoskeleton
Jointed legs

We've seen that arthropods all have bilateral symmetry, segmented bodies, and hard exoskeletons. Another character inherited by all arthropods is jointed legs.

Click each button to see a demonstration of that character:

1. Bilateral symmetry
2. Segmented body
3. Hard exoskeleton
4. Jointed legs

they used for:
Classification of Arthropods:

- Monophyletic theory

- Different kind of classification
- Kingdom: Animalia
  Phylum: Arthropoda
    Subphylum: I-Trilobitomorpha
    II- Chelicerata
      Class: Arachnida
        Merostomata (horse shoe crab)
        Pycnogonida (see spider)
    III-Myriapoda
      Class: Chilopoda
        Diplopoda
        Pauropoda

IV- Crustacea (Branchipoda, Shrimp, maxillipods)
V- Hexapoda

Class: Insecta
  Collembola
  Diplura uniramia
  Protura
- Kingdom: Animalia
  Phylum: Arthropoda

Class: I- Arachnida
   II- Chilopoda
   III- Diplopoda
   IV- Crustacea
   V- Petastomida
   VI- Insecta
<table>
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<tr>
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<tr>
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<td>32- Zoraptera</td>
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I-Arachnida:

[Diagram of a spider with arrows pointing to different parts]

scorpions

Acari
II- Diplopoda (millipedes)

- Two pairs of legs per segment, except,
• The rare species *Illacme plenipes* have up to 750 legs.
• Common species have between 36 and 400 legs.
The giant African millipede
25 cm
III- Chilopoda (Centipedes)

- One pair of legs per body segment.
- A pair of venom claws or forcipules
Size can range from a few millimeters to 30 cm.
IV-Crustacea
• Pentastomida live in the respiratory tracts of snakes and reptiles.
• Humans acquire the disease when they ingest uncooked snake, contaminated water, or contaminated food.

Pentastomiasis is mostly asymptomatic, it is not a primary health threat.
VI- Insecta (56%)
The Mouthparts

Head

Housefly

Butterfly

Mosquito

Maxillary palp
Labrum
Labial palp
Maxillae
Mandibles
Maxillary pulp
Labium
Abdomen

The Insect Abdomen

Grasshopper Abdomen

Tergites

Spiracles

Tympanum

Sternites

Supra-anal Plate

Cercus

Ovipositor Valves

Subgenital Plate
Integument

- Bristle
- Duct of Dermal Gland
- Trichogen Cell

- Soie sensorielle
- Epicuticule
- Exocuticule
- Endocuticule

- Canalicules
- Cellule épidermique
- Lame basale
- Cellule glandulaire
I will talk about internal anatomy of insects briefly
Digestive system

The "generalized" digestive system of insects.
Nervous system
Respiratory system

Breathing

Diagrammatic Representation of the Insect Tracheal System

- Dorsal Longitudinal Trunk
- Ventral Longitudinal Trunk
- Thoracic Spiracles
- Abdominal Spiracles
- Lateral Longitudinal Trunk
Excrecratory system

The Insect Gut (Digestion and Reproduction)

- Aorta
- Crop
- Gizzard
- Heart
- Malpighian Tubes
- Intestine
- Rectum
- Anus
- Genital Aperture
- Oesophagus
- Salivary Duct
- Salivary Gland
- Gastric Caeca
- Stomach
- Reproductive Organs

Colors:
- Green: The Fore Gut
- Purple: The Mid Gut
- Brown: The Hind Gut
Male reproductive organ

- External genitalia (genital claspers)
- Identification character
- Aedeagus
- Accessory gland
Female reproductive organ

- External genitalia
- Accessory gland
- Spermatheca
- Larviparous insects
• Entomology
• Medical entomology:
  The role of insects in the causation of human disease
• Patrick Manson
Why medical entomology?

• Bites and stings

• **Allergic reaction** (cockroach, house dust mite)

• **True parasite** (Scabies)

• **Vectors** (Malaria, Leishmaniasis, yellow fever, Chagas)
- African trypanosomiasis
- Dengue fever
- Leishmaniasis
- Malaria
- Chagas disease
- Onchocerciasis
- Lymphatic filariasis
Advantages of Arthropods:

• Vital role in keeping the world alive
• They are critical to the food chain
• They are great recycler and decomposer
Beneficial insects

• It’s difficult to estimate the value of insects

• Pollination

  Pollination services are worth about 19 billion $ annually

• Commercial products like: honey, beeswax, silk.....

• Commercial products worth 300 million $

• Insects as food
"I simply cannot eat with that disgusting arthropod there!!!
In medicine and surgery

- Cantharidin
- Bee venom
- Military surgeons
- Scientific research
• Metamorphosis
  
  I- Holometabolous insects (Fleas)
  egg, larvae, pupa, adult

  II- Heterometabolous insects (lice)
  egg, nymphs, adult
I- Mechanical transmission

- not essential, no multiplication, no development
- House fly
II- Biological transmission

II-1- Propagative transmission
   multiplication (bacterial and viral pathogen, Epidemic typhus)

II-2- Cyclo-propagative transmission
   multiplication, developmental changes
   (Chagas disease, sleeping sickness, malaria)

II-3- Cyclo-developmental transmission
   no multiplication, just developmental changes
   (Elephantiasis)
• III-Transovarial transmission

• IV- Trans-stadial transmission
Role of Arthropods in human disease

I- Direct effects
   I-1- adult insect as ectoparasite
   I-2- Adult insect as endoparasite
   I-3- larval stage make annoyance
   I-4- Entomophobia

II- indirect effects

III- Arthropods as reservoirs

IV- Envenomization

V- Allergic reaction (bee, cockroach)
Anthropophilic species
Zoophilic species
Ornithophilic species

Zoonosis disease