

INTRODUÇÃO AOS

ARTROPODES

PHYLUM ARTHROPODA

- ▶ Ex. Insects, crustaceans (crabs), arachnids (spiders), etc
- ▶ Over 1 000 000 species
- ▶ Found in every habitat on earth
- ▶ Arthropods make up over 82% of all living things
- ▶ 10^{18} arthropods living right now!



ARTHROPODA

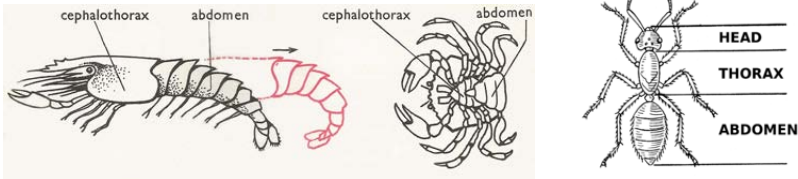
OBJECTIVES

- ▶ **Describe** the distinguishing characteristics of arthropods.
- ▶ **Explain** the process of molting (muda) in an arthropod.
- ▶ **List** the five major subphyla of the phylum Arthropoda.

ARTHROPODA

ARTHROPOD CHARACTERISTICS

- ▶ **Segmented body** = Specialization
 - ▶ Head - Contains mouth parts, sense organs, antenna
 - ▶ Thorax - Attachment of appendages
 - ▶ Cephalothorax = head & thorax fused
 - ▶ Abdomen - Organs, few appendages



ARTHROPODA

CHARACTERISTICS OF ARTHROPODS

- ▶ The members of the phylum **Arthropoda** are called **arthropods**.
- ▶ Arthropods are segmented animals with body segments that bear **appendages**.
- ▶ Arthropods have an exoskeleton that provides protection and support and contains **chitin**.
- ▶ Arthropods show a high degree of cephalization. Most have segmented antennae and **compound eyes**.

ARTHROPODA

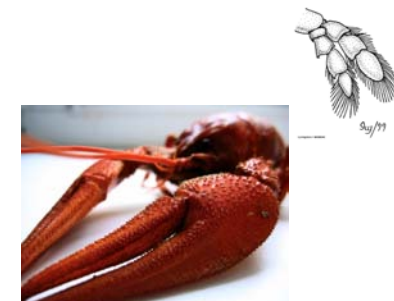
- ▶ Exoesqueleto de quitina, mudado periodicamente
- ▶ Sistema nervoso, olhos e outros órgãos sensitivos bastante desenvolvidos
- ▶ Corpo segmentado: cabeça, tórax e abdomen, diversamente distintos ou fundidos
- ▶ Segmentos com extremidades articuladas - apêndices
- ▶ Sistema digestivo completo
- ▶ Sistema circulatório aberto

ARTHROPODA

ARTHROPOD CHARACTERISTICS

Jointed Appendages = Locomotion, feeding, reproduction

- ▶ Uniramous (single branch)
eg. Insects
- Biramous (two branches)
eg. Crustaceans



ARTHROPODA

ARTHROPOD CHARACTERISTICS

- ▶ Body Type: Bilateral Symmetry
- ▶ Body Organization: Triploblastic (3 layers)



ARTHROPODA

ARTHROPOD CHARACTERISTICS

- ▶ Digestive System
 - ▶ Complete - Mouth and anus separate
 - ▶ Specialized by segmentation
 - ▶ Specialized mouthparts
 - ▶ Chelicera - Piercing, sucking or Mandible - Biting, chewing

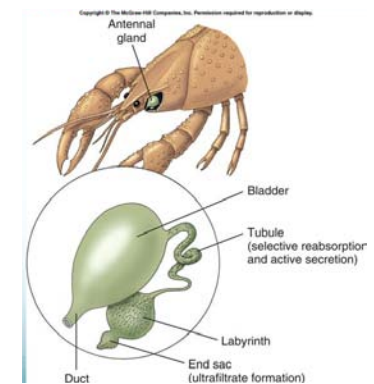
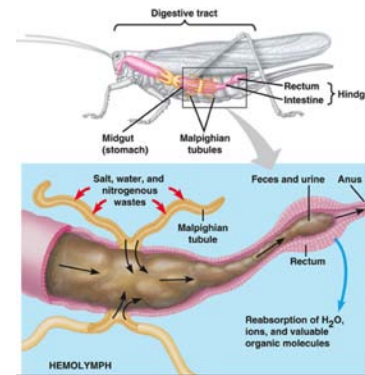


ARTHROPODA

ARTHROPOD CHARACTERISTICS

- ▶ Excretory System
 - ▶ Anus
 - ▶ Malpighian Tubules (terrestrial)
 - ▶ Nitrogenous wastes crystalized and combined with feces
 - ▶ Conserve water
 - ▶ Green Gland (aquatic)
 - ▶ Concentrates nitrogenous wastes
 - ▶ Excreted nead base of antennae

ARTHROPODA



ARTHROPODA

ARTHROPOD CHARACTERISTICS

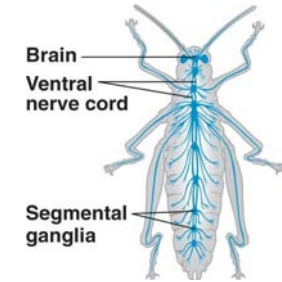
- ▶ Reproduction
 - ▶ Sexual - Dioecious
 - ▶ Internal fertilization (terrestrial, some aquatic) or external fertilization (some aquatic)
 - ▶ Asexual
- ▶ Undergo metamorphosis
 - ▶ Complete: egg - larva - pupa - adult
 - ▶ Incomplete: egg - juvenile - adult



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ARTHROPOD CHARACTERISTICS

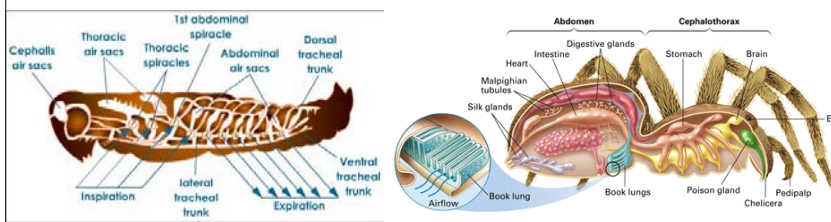
- ▶ Nervous System
 - ▶ Brain
 - ▶ Ventral nerve cord
 - ▶ Specialized sensory organs
 - ▶ Antenna
 - ▶ Compound eyes & ocelli
 - ▶ Olfactory organs



ARTHROPODA

ARTHROPOD CHARACTERISTICS

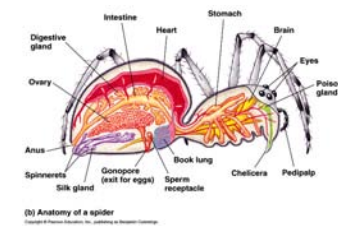
- ▶ Respiration
 - ▶ Aquatic - Gills
 - ▶ Terrestrial - Book lungs (pulmões foliaceos) (arachnids)
 - Trachea/Spiracles (insects)



ARTHROPODA

ARTHROPOD CHARACTERISTICS

- ▶ Circulatory System
 - ▶ Open circulation - Blood pumped by heart to sinuses around tissues
 - ▶ Blue colour due to copper



ARTHROPOD CHARACTERISTICS

▶ Ecological Roles

- ▶ Predators/Prey
- ▶ Parasites/Vectors (lice, ticks, mosquitos)
- ▶ Food source
- ▶ Agricultural pests (locusts, caterpillars, beetles,)
- ▶ Pollinators (bees, butterflies)
- ▶ Produce honey, silk
- ▶ Medical uses (bee pollen, crab blood)

CHARACTERISTICS OF ARTHROPODS



Melting (MUDA)

- ▶ The rigid exoskeleton limits the size to which an arthropod can grow.
- ▶ So, each arthropod periodically sheds its exoskeleton and makes a new one in the process of **molting**.
- ▶ An arthropod goes through many cycles of molting during its life.

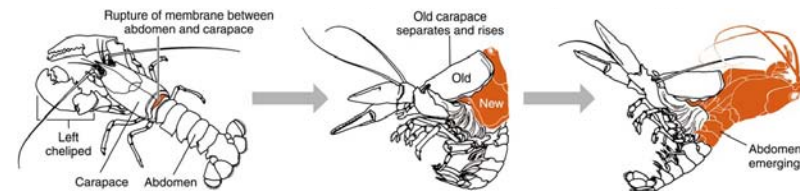
ARTHROPOD CHARACTERISTICS

▶ Exoskeleton = Protection

- ▶ Hard covering outside of ectoderm
- ▶ Made from chitin (protein)
- ▶ Protects organs
- ▶ Prevents water loss (waxy cuticle)
- ▶ Site of muscle attachment
- ▶ Limits the size an arthropod can grow (heavy!)
 - ▶ Exoskeleton does not grow once it has formed - organism must molt and regrow skeleton to increase size



ARTHROPOD CHARACTERISTICS



ARTHROPODA

EVOLUTION AND CLASSIFICATION

- ▶ Arthropods likely evolved from a common ancestor that lived about 545 million years ago.
- ▶ However, biologists are still uncertain about much of arthropod phylogeny.
- ▶ The similar characteristics of many modern subgroups of arthropods may be the result of convergent evolution.

ARTHROPODA

EVOLUTION AND CLASSIFICATION

- ▶ Many ancient and extinct arthropods, such as **trilobites**, had many body segments and one pair of appendages on each segment.
- ▶ Most living arthropod species have some body segments that lack appendages and some segments called a **tagma** (p



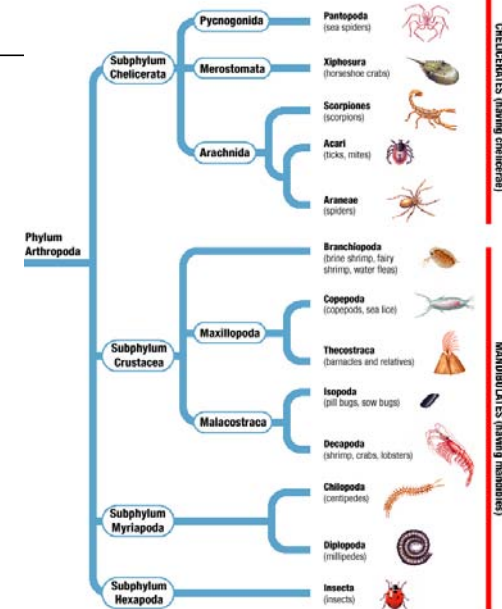
ARTHROPODA

EVOLUTION AND CLASSIFICATION

- ▶ Arthropods are usually divided into **five subphyla** on the basis of differences in development and in the structure of appendages, such as mouthparts.
- ▶ The two major types of mouthparts are:
 - ▶ **mandibles**, which are jawlike
 - ▶ **chelicerae** (singular, **chelicera**), which are pincerlike

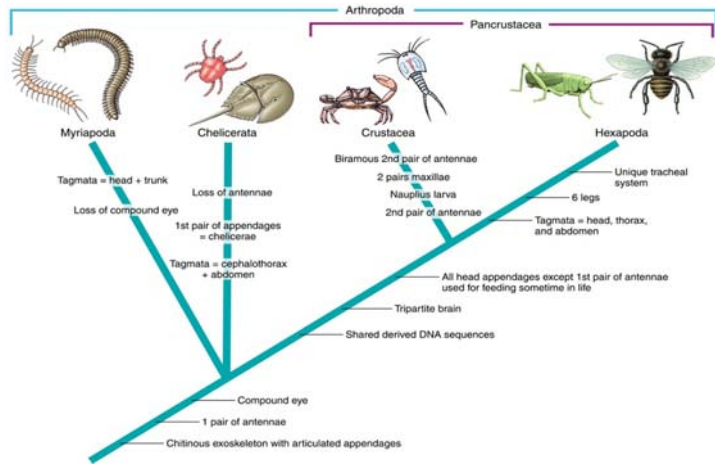
ARTHROPODA

PHYLOGENETIC DIAGRAM OF ARTHROPODS



ARTHROPODA

PHYLOGENETIC DIAGRAM OF ARTHROPODS



ARTHROPODA

EVOLUTION AND CLASSIFICATION

- ▶ The five main subphyla are:
 - ▶ **Trilobita**
 - ▶ **Crustacea**
 - ▶ **Chelicerata**
 - ▶ **Myriapoda**
 - ▶ **Hexapoda**

Subph
Crust



CRUSTACEA

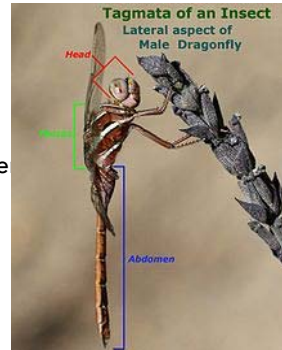
OBJECTIVES

- ▶ **Describe** the characteristics of crustaceans.
- ▶ **Compare** aquatic crustaceans with terrestrial crustaceans.
- ▶ **Explain** the functions of the appendages.

CRUSTACEA

CHARACTERISTICS

- ▶ The subphylum **Crustacea** contains about 38,000 known species.
- ▶ Crustaceans are so diverse that their single defining characteristic is having two pairs of antennae.
- ▶ Most crustaceans also have:
 - ▶ a pair of mandibles
 - ▶ a pair of appendages on each body segment
 - ▶ some branched appendages
 - ▶ 16 to 20 segments besides tagmata



CRUSTACEA

CHARACTERISTICS

Some crustaceans respire through their exoskeleton, others respire through gills.

- ▶ Many have a free-swimming larval stage called a **nauplius**.

CRUSTACEA

DIVERSITY OF CRUSTACEANS

Aquatic Crustaceans

- ▶ **Copepods** are abundant in marine environments and an important part of the ocean's **plankton**.
- ▶ In freshwater environments, much of the plankton is composed of **water fleas** such as *Daphnia* species.
- ▶ **Barnacles** are sessile as adults.
 - ▶ Free-swimming barnacle larvae attach themselves to marine surfaces and develop a shell that encloses the body.
 - ▶ Barnacles use their **cirri** (singular, **cirrus**) to sweep food from the water into their mouths.

CRUSTACEA

DIVERSITY OF CRUSTACEANS

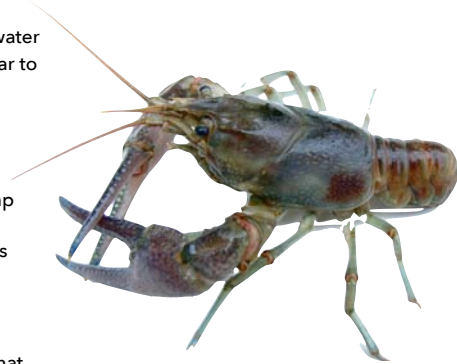
Terrestrial Crustaceans

- ▶ Sow bugs (bichos-de-conta) are terrestrial **isopods**.
- ▶ They lack adaptations for conserving water and live only in moist environments.
- ▶ They generally feed on decaying vegetation.
- ▶ Pill bugs roll into a ball when disturbed or threatened.

CRUSTACEA

THE CRAYFISH (LAGOSTIM DE ÁGUA DOCE)

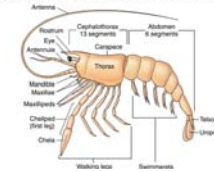
- ▶ The crayfish is an abundant freshwater crustacean that is structurally similar to lobsters, which are marine crustaceans.
- ▶ Crayfish, lobsters, crabs, and shrimp are **decapods**, or members of the order **Decapoda**. Decapoda means "10 feet."
- ▶ Decapods have five pairs of legs that are used for locomotion.



CRUSTACEA

THE CRAYFISH

External Structure



- ▶ The crayfish's body is divided into
 - ▶ the **cephalothorax**, which is covered by the **carapace** and is divided into
 - ▶ the head, which has five segments
 - ▶ the thorax, which has eight segments
 - ▶ the **abdomen**, which is divided into six segments

CRUSTACEA

THE CRAYFISH

External Structure

- ▶ A pair of appendages is attached to each segment of the crayfish. Several pairs have specialized functions.
- ▶ These appendages include:
 - ▶ **Antennae**
 - ▶ **Antennules**
 - ▶ **Mandibles**
 - ▶ **Maxillae**
 - ▶ **Maxillipeds**
 - ▶ **Chelipeds**

CRUSTACEA

THE CRAYFISH

Digestion

- ▶ Crayfish have a **digestive gland** that is near the stomach and that secretes enzymes for digestion.

Respiration

- ▶ Walking circulates water across the gills.

Circulation

- ▶ The circulatory system is open.

CRUSTACEA

THE CRAYFISH

Excretion

- ▶ **Green glands** assist in excretion of excess water that enters the body by osmosis.

Neural Control

- ▶ The nervous system of the crayfish is typical of arthropods and is similar to that of annelids.

Sensory Organs

- ▶ Crayfish sense vibrations and chemicals in the water with thousands of small sensory hairs.
- ▶ Their compound eyes are set on two stalks.

Subphylum Chelicerata

CHELICERATA AND MYRIAPODA

OBJECTIVES

- ▶ **List** the characteristics of arachnids, as represented by a spider.
- ▶ **Explain** the adaptations that spiders have for a predatory life on land.
- ▶ **Identify** the unique characteristics of scorpions, mites, and ticks.
- ▶ **Compare** the characteristics of millipedes and centipedes.

CHELICERATA

HABITAT E NÚMERO DE ESPÉCIES

- ▶ Maioria terrestres e de água doce
- ▶ Poucas espécies marinhas (caranguejo ferradura)
- ▶ Mais de 77,000 espécies vivas
- ▶ Estimam-se 130,000 espécies ainda não descritas

CHELICERATA

- ▶ Corpo dividido em cefalotórax e abdomen
- ▶ 6 pares de apêndices - quelíceras, pedipalpos e pernas
- ▶ Peças bucais adaptadas para sugar
- ▶ Glândulas de veneno
- ▶ Respiração por pulmões foliáceos , traquéias ou brânquias
- ▶ Excreção por túbulos de Malpighi, glândulas coxais ou ambos

CHELICERATA

- ▶ Subfilo Chelicerata
 - ▶ Subclasse Merostomata
 - ▶ Orden Euryptera
 - ▶ Orden Xiphosura
 - ▶ Subclasse Aracnida
 - ▶ Orden Acari
 - ▶ Orden Amblypygi
 - ▶ Orden Araneae
 - ▶ Orden Opiliones
 - ▶ Orden Palpigradi
 - ▶ Orden Pseudoescorpionida
 - ▶ Orden Ricinulei
 - ▶ Orden Schizomida
 - ▶ Orden Scorpiones
 - ▶ Orden Solpugida
 - ▶ Orden Uropygi



Subphylum Myriapoda



MYRIAPODA

SUBPHYLUM MYRIAPODA

- ▶ Members of the subphylum **Myriapoda** have antennae, mandibles, and unbranched appendages.

Class Diplopoda

- ▶ **Millipedes** have rounded bodies and two pairs of jointed legs on each body segment except the last two segments.

Class Chilopoda

- ▶ **Centipedes** have flattened bodies and one pair of jointed legs on each body segment except the first segment and the last two segments.

CHARACTERISTICS OF ARTHROPODS

- Jointed appendages
- Segmentation
- Distinct head, often with compound eyes
- Exoskeleton
- Respiration by gills, tracheae, or book lungs
- Open circulatory system
- Excretion through Malpighian tubules
- Wings on many arthropods

