

# Unit 8:

## Invertebrates

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- 1. Invertebrate animals**
- 2. The simplest invertebrates**
- 3. Worms**
- 4. Molluscs**
- 5. Arthropods**
- 6. Echinoderms**

### Think and answer?

- What animal can you see in the photograph?
- Is it an invertebrate? Why?
- Name some groups of invertebrates that you know.
- Invertebrates are everywhere. How is it possible?

### UNIT OBJECTIVES

In this unit you will learn:

- To recognise the main characteristics of invertebrates
- To classify invertebrates into groups
- To describe invertebrate ways of nutrition
- To describe invertebrate ways of interaction
- To describe invertebrate ways of reproduction

# 1. Invertebrate animals

Invertebrates are the animals without backbone (spinal column).

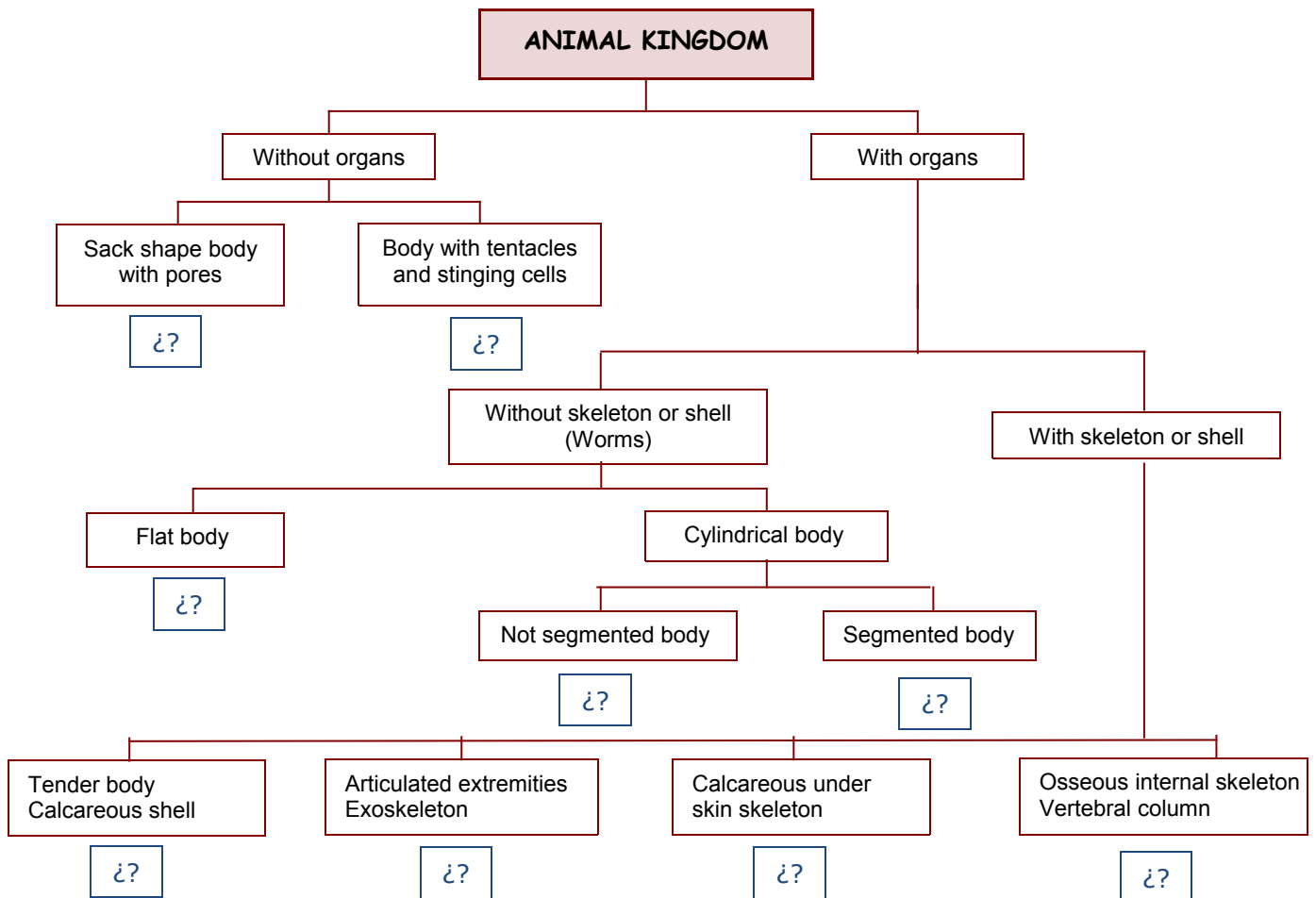
This group is very diverse. In fact, it includes a lot of animals with very different characteristics that are not evolutionarily related among them, so that, this is an **artificial classification**.

The main groups of invertebrates are: **Poriferans, Cnidarians, Nematodes, Platyhelminthes, Annelids, Molluscs, Arthropods** and **Echinoderms**.

## READING ACTIVITIES

### 1.1. Copy and complete the genealogic tree of animals.

Cut out and glue each picture and its correspondent label in its place.



## 2. The simplest invertebrates

### 2.1. Poriferans

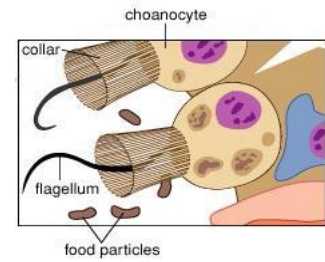
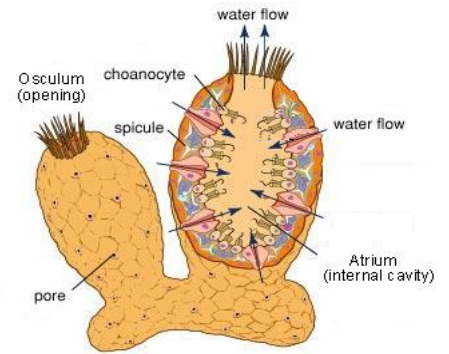
This phylum is also known as **sponges**. They are the simplest invertebrates.

#### a) Habitat

They are **aquatic animals**, mainly marines, which live attached to rocks.

#### b) Morphologic characteristics

Their bodies are bag-shaped and they are hollow. The inner space is called **atrium**. The body wall is full of **pores**. They have a bigger opening called **osculum**. They don't have organs or systems. There are little pieces of calcium carbonate or silica called **spicules** among the wall body cells which act as a skeleton.



#### c) Vital functions:

They feed by **filtration**. Water enters by the pores and exits through the osculum. Nutritive particles of water are caught by the cells that cover the atrium (**choanocytes**). These cells have a flagellum that is responsible for creating the water flow through the sponge.

They have **asexual** reproduction through fragmentation or budding, and **sexual** reproduction through eggs.

### 2.2. Cnidarians

This phylum includes **jellyfish**, **anemones**, **hydra** and **corals**.

#### a) Habitat

They are **aquatic animals**, mainly marines.

#### b) Morphologic characteristics

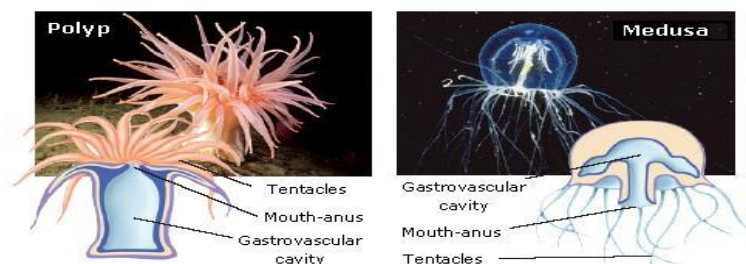
They have **radial symmetry**. They don't have organs or systems. Their body is soft with only one opening (mouth-anus) surrounded by **tentacles**. The inside is hollow and it is called **gastrovascular cavity**. They have two basic body forms:

##### - Medusa

Their bodies are umbrella-shaped. They are swimmers.

##### - Polyp

Their bodies are bag-shaped. They live attached to substrate (sessile).



Many Cnidarians species, such as corals, produce **colonies** that are composed by many single organisms that live together.

**c) Vital functions:**

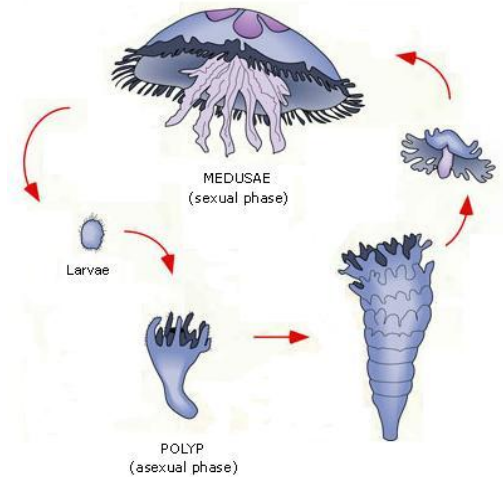
They are carnivorous. They use their tentacles to capture prey.

Tentacles have stinging-cells (**cnidocytes**). These cells contain a poisonous liquid and a filament that inject the poison when tentacles touch the prey.

Their life cycle is complex.

They have **alternation of generation** that includes individuals with sexual reproduction (medusae) and individuals with asexual reproduction (polyps).

**LIFE CYCLE OF A JELLYFISH**



**READING ACTIVITIES**

**After reading the text, copy and answer the following questions into your notebook:**

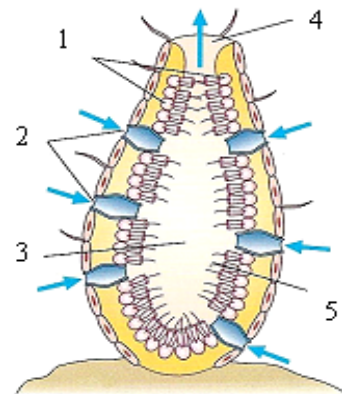
Remember: you must make complete sentences.

**2.1. The picture represents a.....**

a. Indicate what number corresponds to every one of the following words:

- Pores ( )
- Osculum ( )
- Atrium ( )
- Choanocytes ( )
- Flagellum ( )

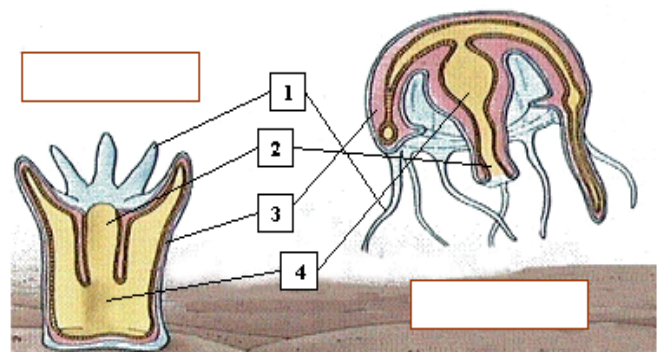
- b. What do arrows indicate?
- c. What is the function of choanocytes? Why do they have a flagellum?
- d. How do sponges get their food?
- e. Does sponges have skeleton? What is it made of?



**2.2. Relate the numbered parts of the picture with the words of the column and indicate which type of Cnidarians is every one of the represented animals.**

- Body wall
- Mouth-anus
- Gastro-vascular cavity
- Tentacles

- a) What type of reproduction do Cnidarians have?
- b) What type of organism corresponds to the sexual stage and to the asexual stage of Cnidarians life cycle?

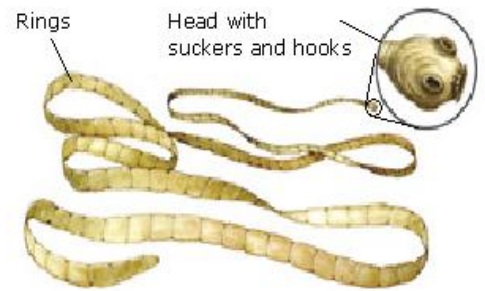


### 3. Worms

This group includes several phyla: Annelids, Nematodes and Platyhelminthes. They have in common: bilateral symmetry and soft and elongated body without skeleton or limbs.

#### 3.1. Platyhelminthes

They are also known as **flatworms**. Some of them, such as *planarian*, are aquatics **free-living**, and others, such as *taenia* (tapeworm), are **parasites**. They have a **flat body** divided into **rings**. They do not have digestive or respiratory systems. They reproduce **sexually** and they are **hermaphrodites**. This is that the same individual has both sexual organs: male and female. They have **self-fertilization**.



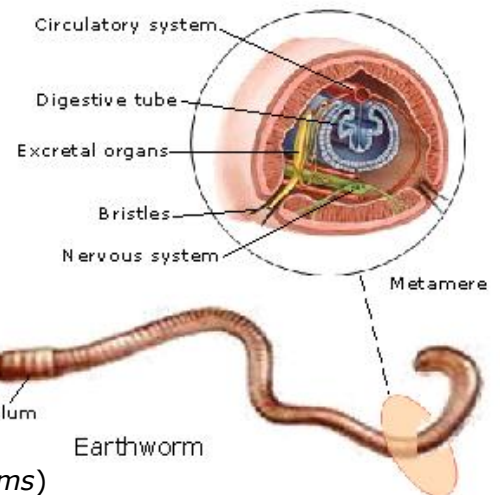
Taenia (tapeworm)

#### 3.2. Nematodes

Some of them are **free-living**, aquatics or terrestrials, and others are **parasites** (e.g. *Hookworms*) They have a **cylindrical body** not divided into segments or rings. They do not have respiratory system. They reproduce **sexually** and they have **separate sexes**. This means there are male and females individuals.

#### 3.3. Annelids




They are also known as **ringed worms**. They have a **cylindrical body** divided into segments called **metameres**. Each segment is similar and has the same organs. There are **bristles** between metameres that make easy the movement. They reproduce **sexually** and there are separate sexes species and hermaphrodite species. They have **cross-fertilization**. The phylum is divided into three classes:



- **Polychaetes** (*Bristle worms, rag worms or lugworms*)  
They are free-living aquatic animals.  
They have many bristles.  
They breathe through **gills** and they are **filter feeders** or **carnivores**.
- **Oligochaetes** (*Earthworms*)  
They are free-living terrestrial animals.  
They have few bristles.  
They breathe through the **skin** and they are **detritus feeders**.
- **Hirudineans** (*Leeches*)  
They are parasites (bloodsuckers).

### READING ACTIVITIES

#### 3.1. Complete the table about the types of Annelids:

Class	Bristles (few or many)	Nutrition	Habitat	Examples
 .....				
 .....				
 .....				



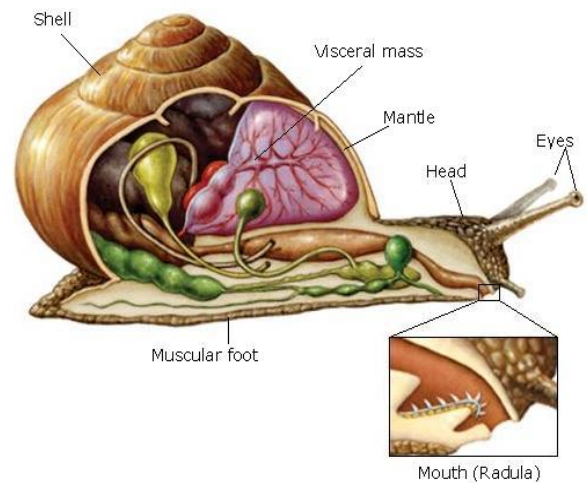
## 4. Molluscs

### a) Habitat

Most part of Molluscs is aquatic. They live in the sea or in fresh water. Some of them are terrestrial.

### b) Morphologic characteristics

- They have **bilateral symmetry**.
- They have a **soft body** divided into three parts:
  - **Head**.
  - **Visceral mass** with organs.
  - **Muscular foot** with different shapes depending on the group.
- The body is covered by a thick membrane, the **mantle**. This produces a protective **shell**.



### c) Vital functions:

#### Nutrition:

The **digestive system** has a mouth, anus and glands. They can be herbivorous or carnivorous.

Aquatic species breathe through **gills**, and terrestrial species breathe through **lungs**.

Molluscs have an **open circulatory system**. Blood exits from blood vessels to the tissues and then is collected by other blood vessels to return to the heart.

#### Interaction

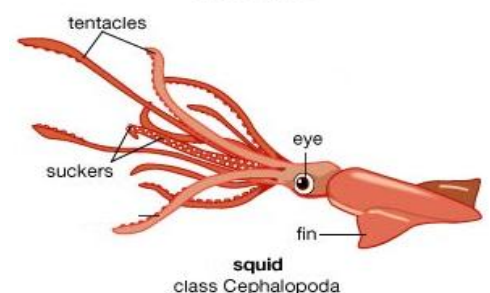
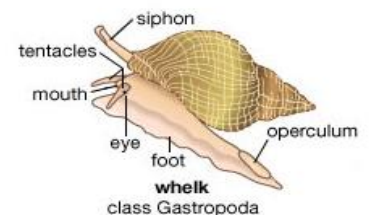
They have a well-developed **brain** and **sense organs**.

#### Reproduction:

Most are **hermaphrodites** and **oviparous**. Larva hatches and undergoes **metamorphosis** to become adult.

### d) Classification:

- **Gastropods** (E. g. Snails, slugs and sea snails).
  - They are terrestrial and aquatic animals.
  - They have a **single spiral-shaped shell**, except slugs that doesn't have shell.
  - Their head is well-developed and has **four tentacles** and two of them have the eyes.
  - They are herbivores. The tongue (**radula**) is rasping.
  - They have a **single muscular foot** to move around.
- **Bivalves** (E.g. Clams, cockles and mussels).
  - They are aquatic.
  - They have a **shell with two valves**.
  - They don't have head.
  - They are filter feeders.
  - They have a **single axe-shaped foot** to excavate.
- **Cephalopods** (E. g. Octopus, squids and cuttlefish).
  - They are aquatic.
  - They have an **internal shell**, except octopus that doesn't have it.
  - Their head is well-developed with big eyes.
  - Their foot is transformed into **tentacles** around the mouth, to catch prey. They are carnivores.
  - The mouth has a special chewing structure called **beak**.



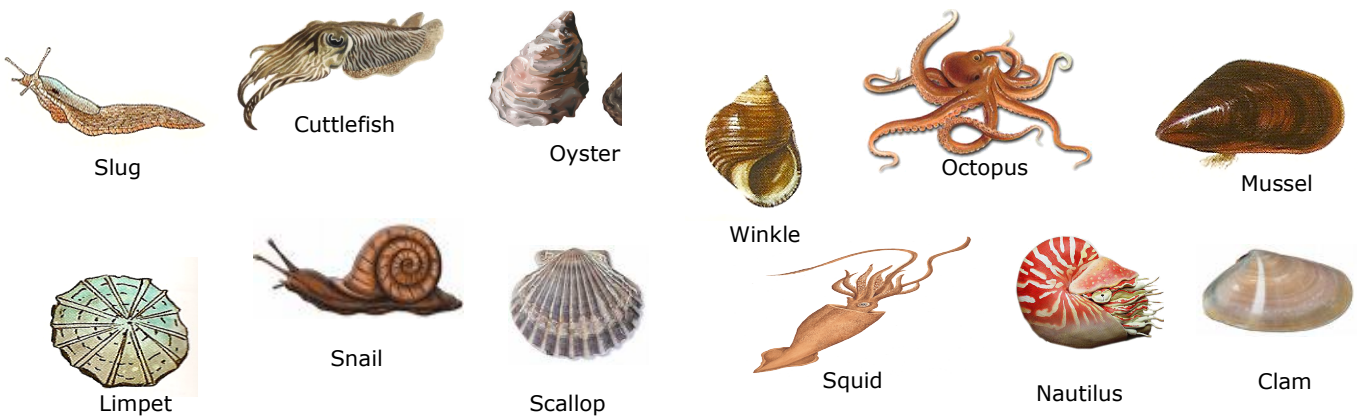
**READING ACTIVITIES**

**After reading the text, copy and answer the following questions into your notebook:**

Remember: you must make complete sentences.

**4.1. Complete the chart about the main groups of Molluscs and classify the molluscs that are represented:**

	Gastropods	Bivalves	Cephalopods
Foot			
Type of shell			
Environment			
Feeding			
Breathing			
Examples			



## 5. Arthropods

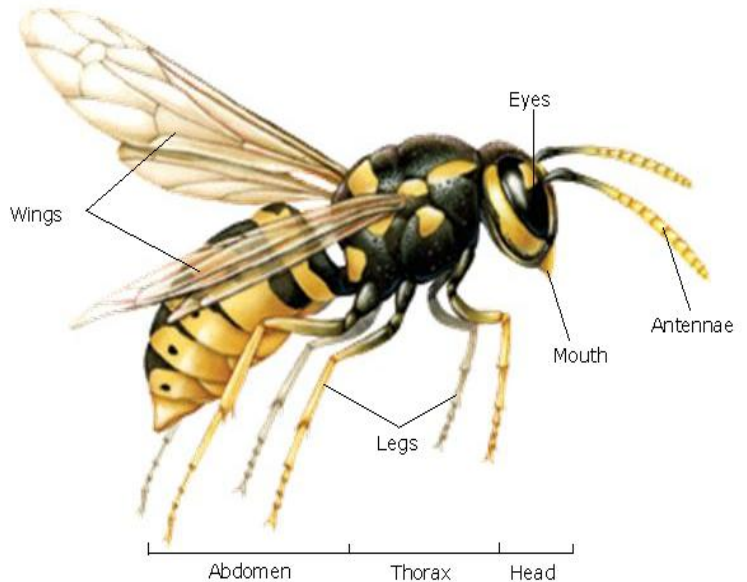
### a) Habitat

Arthropods represent close to 90% of all animal species. They are more than one million. They are the largest and most varied group of animals.

Most part of them is terrestrial and some are aquatic, of sea and fresh water.

### b) Morphologic characteristics

- They have **bilateral symmetry**.
- They have a **segmented body** covered by a rigid **exoskeleton** (an external skeleton of chitin)
- Their body is divided into three parts: **head, thorax** and **abdomen**. In some groups head and thorax are joined and form the **cephalothorax**.
- They have **jointed legs**, that can be used for walking, swimming, hopping, digging, or catching prey.
- They have **appendages** (mouthparts, antennae, legs, wings...)



### c) Vital functions:

#### Nutrition:

The **digestive system** has a mouth, anus, and glands. They can be herbivorous or carnivorous. The **mouthparts** of arthropods are adapted to different styles of feeding. In general, arthropods have mouthparts for cutting, chewing, piercing, sucking and licking.

In addition, they can have other appendages near the mouth with different characteristics in every group. For example, spiders have **chelicerae** that inject digestive juices directly into prey, and insects have **pedipalps**.

Aquatic species breathe through **gills**, and terrestrial species breathe through **tracheae**. Tracheae form an exclusive respiratory system. It consists on a system of tiny tubules that branch into the body, bringing oxygen directly to cells.

Arthropods have an **open circulatory system**.

#### Interaction

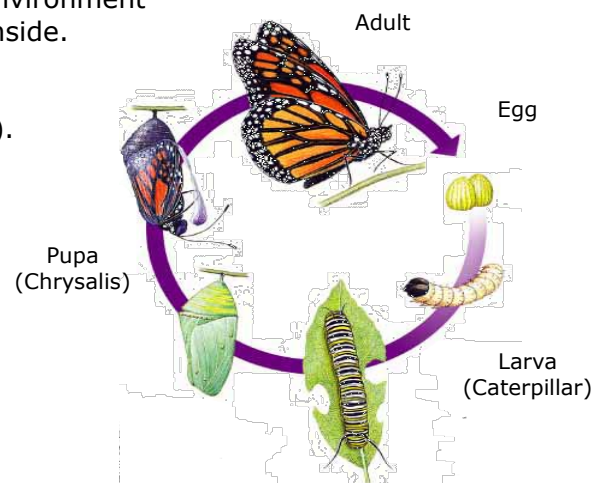
They have a well-developed **brain** and **sense organs**: eyes (compound and simple), ears, pedipalps and antennae. **Antennae** are sensory organs which can feel smells, flavours, heat, or touch. They are attached on the head between the eyes and their size and shape can vary.

**Exoskeleton** gives protection from the outside environment and strong points for muscle attachment on the inside.

The hard exoskeleton does not grow or stretch. As the animal grows, it needs to shed its old exoskeleton a number of times (**moulting**). After the old exoskeleton has been moulted, the soft covering underneath hardens and becomes the new exoskeleton.

#### Reproduction:

Most have male and female sexes. They are **oviparous**. Fertilization is internal. Larva hatches and undergoes **metamorphosis** to become adult.





**d) Classification:**

The scientific criteria used for classifying them are based on the number of **legs, antennae** and **body parts** that they have.

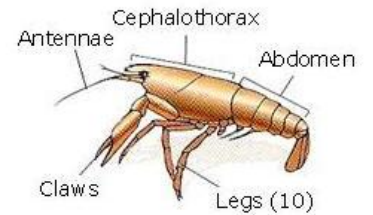
- **Arachnids** (E. g. Spiders, scorpions, ticks and mites).

They are terrestrial.  
 They are carnivorous.  
 They have two body parts: cephalothorax and abdomen  
 They have eight legs (four pairs)  
 They do not have antennae.



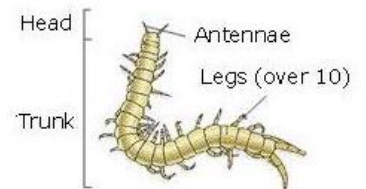
- **Crustaceans** (E.g. Lobsters, crabs, prawns, etc)

They are aquatic.  
 They can be filter feeders, carnivorous or herbivorous.  
 They have two body parts: cephalothorax and abdomen.  
 They have usually ten legs and often more.  
 Many of them have the first pair transform into claws.  
 They have four antennae.



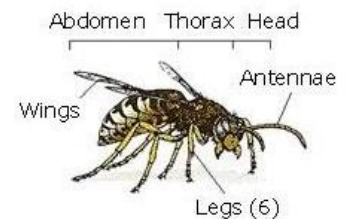
- **Myriapods** (E.g. Centipedes, millipedes, etc).

They are terrestrial.  
 They are carnivorous.  
 They have two body parts: head and a long segmented trunk.  
 They always have more than ten legs.  
 They have two antennae.



- **Insects** (E. g. Butterflies, ants, bees, grasshoppers, beetles, etc).

They are terrestrial.  
 They can be carnivorous or herbivorous.  
 They have three body parts: head, thorax and abdomen.  
 Legs and wings are attached to the thorax.  
 They always have six legs (three pairs)  
 Many of them have four wings too (two pairs)  
 They have two antennae.



**READING ACTIVITIES**

After reading the text, copy and answer the following questions into your notebook:

**5.1. Complete the following table about Arthropods:**

	Parts of body	Legs	Antennae	Wings	Examples
<b>ARACHNIDS</b>					
<b>CRUSTACEANS</b>					
<b>MYRIAPODS</b>					
<b>INSECTS</b>					

**5.2. Identify every type of mouthparts with its correspondent picture.**

.....mouthparts Ex:.....	.....mouthparts Ex:.....	.....mouthparts Ex:.....	.....mouthparts Ex:.....

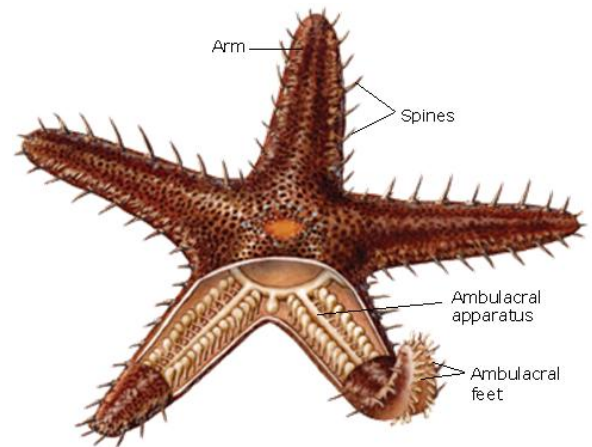
## 6. Echinoderms

### a) Habitat

All the animals included in this group are **aquatic** and **marines**. They live on the sea bed, some fixed to substrate and others move slowly about.

### b) Morphologic characteristics

- They have **radial symmetry**.
- Their body can have several shapes and it is formed by **five equal sections**.
- They have an internal skeleton (under the skin) made of *plaques of calcium carbonate*, called **dermal skeleton**. Usually they have *spines* too.
- They do not have a differentiated head.



### c) Vital functions:

#### Nutrition:

The **digestive system** has mouth, anus and glands. They are carnivorous.

They have an exclusive system called **ambulacral apparatus**. It consists on a series of tubules filled with sea water that end in **ambulacral feet** with suckers. It has several functions: locomotion, breathing, circulation and excretion.

#### Interaction

They do not have a well-developed nervous system: neither a brain nor complex sense organs.

#### Reproduction:

They have **sexual reproduction**. Most have separated sexes and some are hermaphrodites. Fertilization is external.

They are **oviparous**.

Larva hatches and undergoes **metamorphosis** to change into adult.

Some species have **regeneration** power. This is the capacity to develop again lost body parts.

### d) Classification:

- **Asteroideans** (E. g. Starfish).  
They are star-shaped with five arms.  
They are carnivorous.
- **Echinoideans** (E.g. Sea urchins)  
They are rounded-shaped and long spines.  
They are herbivorous.
- **Ophiuroideans** (E. g. Brittle stars).  
They are star-shaped, with very long and flexible arms.  
They are filter feeders.
- **Crinoideans** (E.g. Sea lilies)  
They live attached to substrate and they are feathery-shaped.  
They are filter feeders.
- **Holothurideans** (E.g. Sea cucumbers)  
They are cylindrical-shaped.  
Their mouth is surrounded by tentacles. They eat plankton.



**READING ACTIVITIES**

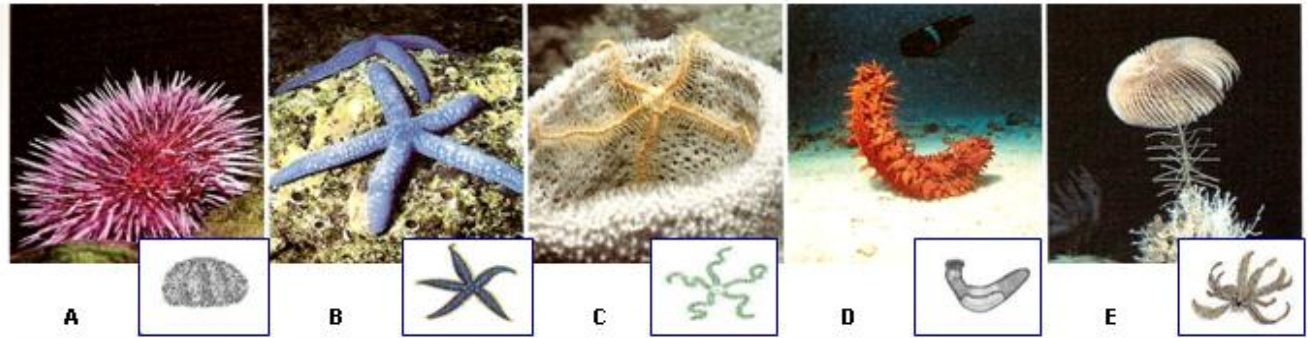
**After reading the text, copy and answer the following questions into your notebook:**

Remember: you must make complete sentences.

**6.1. Answer the following questions about Echinoderms:**

- a. What is the *dermal skeleton*? What is it made up? Where is it located?
- b. What is the *ambulacral apparatus*? What are its functions?

**6.2. There are five groups of Echinoderms. Can you identify them among the pictures?**



A

Group:.....  
E.g.....

B

Group:.....  
E.g.....

C

Group:.....  
E.g.....

D

Group:.....  
E.g.....

E

Group:.....  
E.g.....