



## LEARNING OBJECTIVES

After completing this chapter you will be able to

- classify animals into invertebrates and vertebrates.
- classify invertebrates into important groups.
- give characteristic features of each invertebrate group with examples.
- classify vertebrates into important classes.
- give characteristic features of each vertebrate class with examples.
- differentiate between invertebrates and vertebrates.

# Classification of Animals

We see many animals around us. One thing which is common to all animals is that they depend on plants and other animals for their food. Most animals can move from one place to another. Animals can be classified into two broad groups—**invertebrates** and **vertebrates**, based on the absence or presence of backbone or the vertebral column.

Animals without a backbone are called **invertebrates**. Animals with a backbone are called **vertebrates**. There are more invertebrates than vertebrates. However, most of the animals we see around us are probably vertebrates.

## CLASSIFICATION OF INVERTEBRATES

Based on their different characteristics, invertebrates are classified into many groups (Fig. 4.1). Let us study each group separately.

### Sponges (Poriferans)

Sponges or poriferans are animals of the Phylum **Porifera**. These animals are also called porous animals. Sponges (Fig. 4.2) are mostly found in



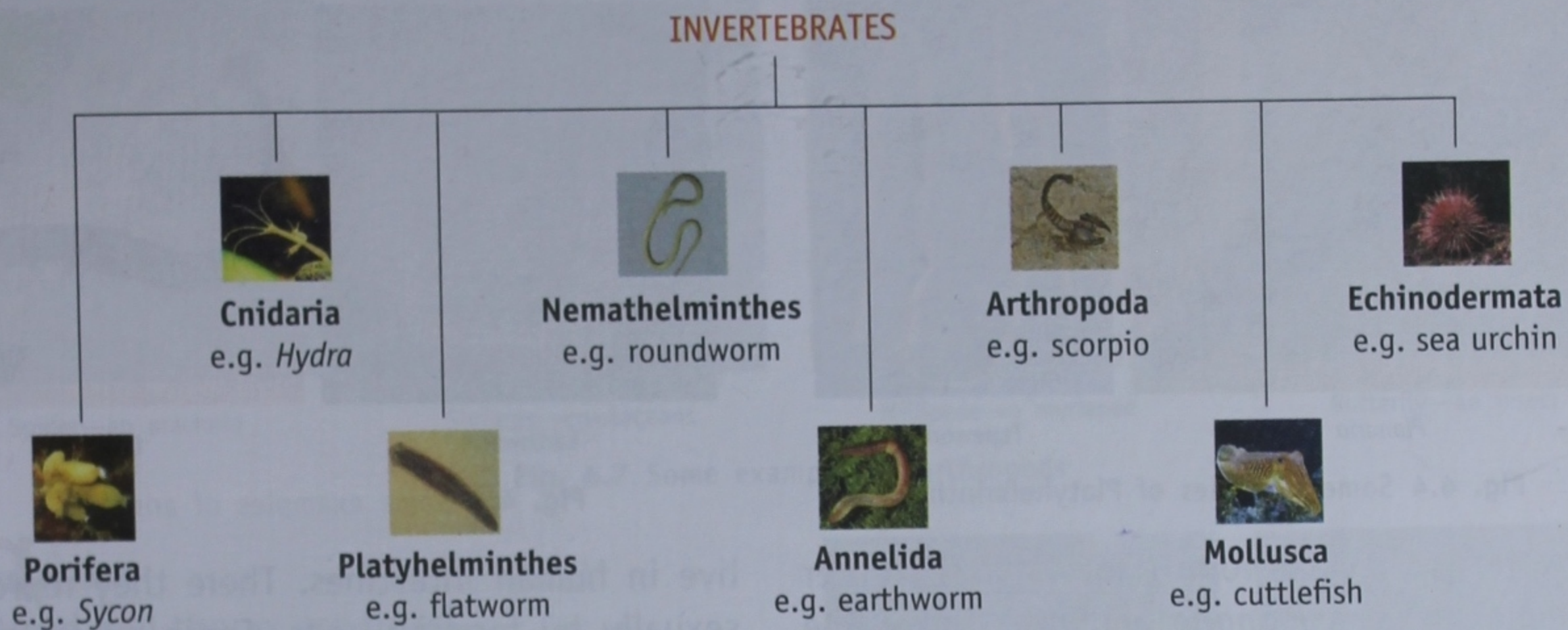


Fig. 4.1 Classification of invertebrates

salty sea water, however, a few are found in fresh water also. Most sponges remain fixed to the bottom of the sea or the pond or to some object.

Sponges do not have nervous, digestive or circulatory systems. Instead most rely on maintaining a constant water flow through their bodies to obtain food and oxygen and to remove wastes. They have many small pores all over the body. Water along with food enters the body cavity through these pores. There is also a large pore present at the top from where the water passes out. Other than sponges, some more examples of poriferans are *Sycon* and *Spongilla*.



Fig. 4.2 Sponges—the poriferans

### Cnidarians

These animals are found in aquatic, mostly marine environment. They have **radially symmetrical** body, that is, the body can be divided into two identical halves along any plane. The body is tube-like and has only one opening called mouth. The mouth is surrounded by a number of finger-like structures called **tentacles**. Tentacles are used for capturing prey. Some examples are *Hydra*, jellyfish (Fig. 4.3) and sea anemone.

### Platyhelminthes (Flatworms)

Flatworms are the simplest worms and found in marine and fresh water. The most common



Fig. 4.3 Jellyfish—a cnidarian





*Planaria*



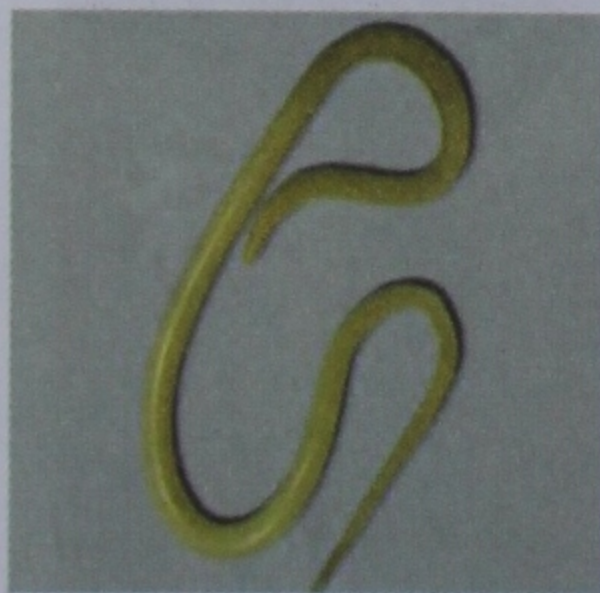
Tapeworm

**Fig. 4.4** Some examples of Platyhelminthes

flatworm is the tapeworm (Fig. 4.4). The other example includes *Planaria* and liver fluke. The body is **bilaterally symmetrical**, that is, it can be divided into two identical halves only through one plane. They have only one opening through which they take in food and get rid of wastes. Tapeworms and liver flukes are parasites, that is, they live inside or on another organism (called a host), and get their food from it. Tapeworms live in the digestive tract of many vertebrates including human beings.

### **Nemathelminthes (Roundworms)**

Roundworms are found in fresh water, marine and terrestrial environments. Some are thread-like as filarial worm while others such as hookworm are more rounded. The body is unsegmented and bilaterally symmetrical. They have a mouth opening where food is pulled in and crushed. Another opening called anus is present near the tip of the body. More of these are parasites and



*Ascaris*



Pinworm

**Fig. 4.5** Some examples of Nemathelminthes



Earthworm



Leech

**Fig. 4.6** Some examples of annelids

live in human intestines. There they reproduce sexually by forming eggs. Some examples are pinworm, *Ascaris* (Fig. 4.5) and whipworm.

### **Annelids (Segmented worms)**

Worms of this group are found in marine and fresh water. They have a soft, segmented and bilaterally symmetrical body. They have a body cavity. They have special organs of excretion called **nephridia**, for example, earthworm and leech (Fig. 4.6). Earthworms are considered as farmers' friends because while moving in the soil, they improve its fertility. Leech is a parasite and attaches itself to the body of the host and draws blood from there.

### **Arthropods (Animals with jointed legs)**

Animals belonging to this group have a segmented body. The body is bilaterally symmetrical and divided into three regions—head, thorax and abdomen. The body of most animals has a tough outer covering called **exoskeleton**. All arthropods have paired appendages with many joints. Arthropods are further classified into four subgroups or classes (Fig. 4.7).

#### **ARACHNIDS**

- ❖ Head and thorax are fused.
- ❖ Have four pairs of legs, and wings are absent. Some examples are scorpions and spiders.





Spider—an arachnid



Shrimps—crustaceans



Millipede—a myriapod



Butterfly—an insect

**Fig. 4.7** Some examples of arthropods

#### CRUSTACEANS

- ❖ Head and thorax are fused.
  - ❖ Appendages are present on all segments.
  - ❖ Have variable number of jointed legs.
- Some examples are shrimps and lobsters.

#### MYRIAPODS

- ❖ Body is divided into many segments.
  - ❖ Some myriapods have two pairs of legs per segment (for example, millipede).
  - ❖ Some myriapods have one pair of legs per segment (for example, centipede).
- Some examples are millipedes and centipedes.

#### INSECTS

- ❖ Body is divided into three regions—head, thorax and abdomen.
  - ❖ Most insects have three pairs of legs.
  - ❖ Have two pairs of wings. Some insects are wingless.
- Some examples are ants and butterflies.

#### Molluscs (Soft-bodied shelled animals)

This group consists of animals which have a soft, unsegmented body, often with an external hard shell. Some molluscs have a single shell. Others may have two shells that are attached on one side. Some molluscs, like octopus, have a shell inside their body. A snail has a coiled shell. Some examples are octopus, mussel,



Snail



Cuttlefish

**Fig. 4.8** Some examples of molluscs

cuttlefish, squid, snail (Fig. 4.8) and oyster.

#### Echinoderms (Spiny-skinned animals)

This group consists of marine animals like starfish and sea urchins (Fig. 4.9). They have sharp spines all over the body. They have a radially symmetrical body. They have a mouth on the lower side and an anus on the upper side. They also have a large number of tiny **tube-like feet** that end in suckers.



Starfish



Sea urchin

**Fig. 4.9** Some examples of echinoderms



### CHECK YOUR PROGRESS 1

Fill in the blanks.

1. Cnidarians have \_\_\_\_\_ symmetrical body.
2. \_\_\_\_\_ live in the digestive tract of many vertebrates including human beings.
3. \_\_\_\_\_ are considered as farmers' friend.
4. Most arthropods have a tough outer body covering called \_\_\_\_\_

### CLASSIFICATION OF VERTEBRATES

The animals belonging to this group have a distinct backbone. The backbone of vertebrates is not just one bone. It is made up of a number of separate bones called **vertebrae**. All vertebrates have a well-developed closed circulatory system which means that blood travels inside blood vessels to all parts of the body. The nervous system of vertebrates is more complex than that of invertebrates. Brain that controls many body functions is present in vertebrates. Vertebrates are further classified into five classes (Fig. 4.10).

#### Pisces (Fishes)

They have a **streamlined** body, that is, smooth and narrow at the front and the back. Such a body offers very little resistance while swimming (Fig. 4.11). They breathe with the help of **gills**. Majority of fish have **scales** which are overlapping flat plates that cover the animal's body and provide protection. They use fins to



Fig. 4.11 Fish have streamlined body.

swim. Fish are **cold-blooded** animals, that is, the temperature of their body changes with the temperature of their surroundings. For example, seahorse, carp, shark, ray fish, pomphret and eel.

#### Amphibia (Frogs, toads and salamanders)

These animals can live both on land and in water. They are cold-blooded animals. They have thin, moist and slippery skin. They breathe through lungs and the skin. Amphibians return to water in order to reproduce and always lay their eggs in water. Some examples are frog, toad and salamander (Fig. 4.12).



Toad



Salamander

Fig. 4.12 Some examples of Class Amphibia

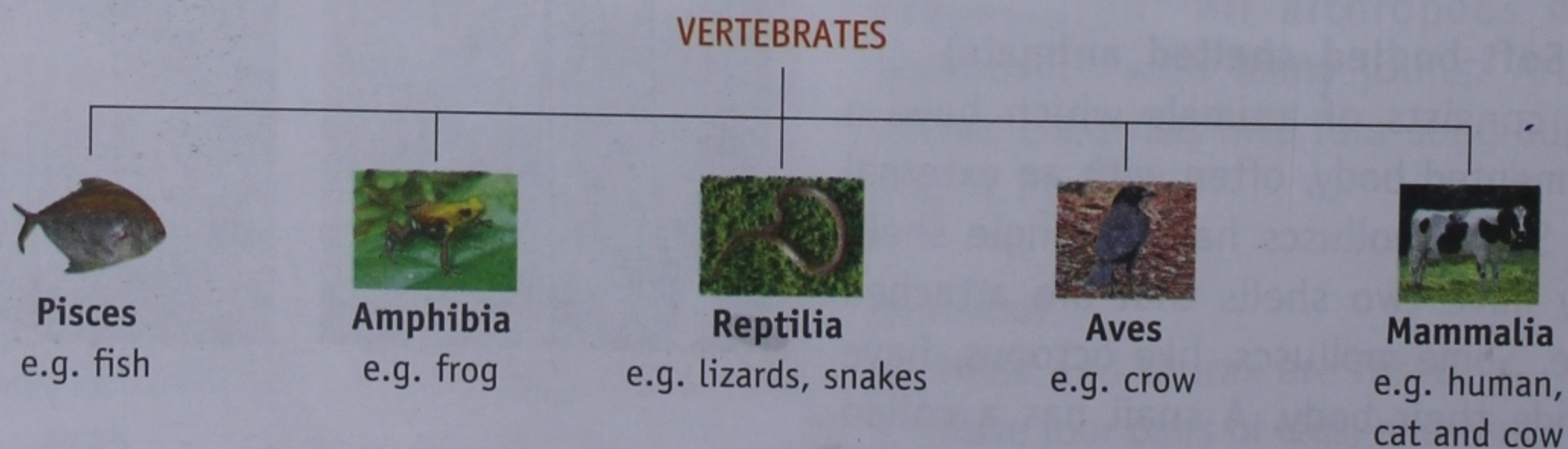


Fig. 4.10 Classification of vertebrates





Snake



Tortoise

**Fig. 4.13** Some examples of Class Reptilia

#### Did you know?

Tadpoles, the young frogs are like fish and breathe through gills. They also have tails. Salamanders have tails and look more like lizards.

### Reptilia (Lizards and snakes)

Reptiles are cold-blooded vertebrates. Most of them spend their life on land. They have dry skin covered with scales. They breathe through lungs. They lay eggs that have leathery shells. For example, snake (Fig. 4.13), lizard, turtle, tortoise, alligator and crocodile.

### Aves (Birds)

They are **warm-blooded** animals, that is, their body temperature remains same and is not affected by the temperature of their surroundings. They are the only animals whose body is covered with feathers. Their forelimbs are modified into **wings** and hindlimbs are



Duck

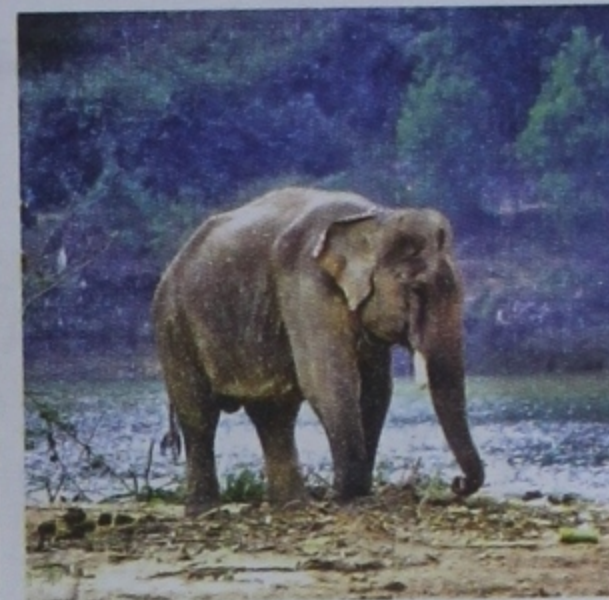


Peacock

**Fig. 4.14** Some examples of Class Aves



Lion



Elephant

**Fig. 4.15** Some examples of Class Mammalia

adapted for walking, perching or swimming (Fig. 4.14). They breathe through lungs. The skeleton of birds is very light because their bones have large air cavities. They have **horny beak** and do not have teeth. They lay eggs which have hard shell. For example, crow, ostrich, peacock, parrot and pigeon.

### Mammalia (Animals with mammary glands)

They are warm-blooded and have hair on their body. They give birth to babies and are the only animals that produce milk for their young ones. They have **mammary glands** to produce milk. Most mammals have external ears, nose and possess specialized teeth. They breathe through lungs. They use their limbs to walk, climb, swim, and fly. Some land mammals have toes that produce claws and hooves for climbing and running. Aquatic mammals such as whales and dolphins have fins which evolved from legs. For

#### ACTIVITY 1

Go out in the school garden. Write the names of all the organisms belonging to the animal kingdom which you can see. You may see a variety of animals around the trees and in the soil.

Classify these animals into different groups. Write at least two important features which helped you in deciding the group in which the animal should be put.



example, mouse, human, dog, tiger and bat (Fig. 4.15).

#### Did you know?

One of the most extraordinary mammals is the duck-billed platypus. It is one of the few mammals that do not give birth to babies but lays eggs.

#### CHECK YOUR PROGRESS 2

Write True or False.

1. The backbone of vertebrates is made up of one bone.
2. In fishes, fins are their organs of locomotion.
3. Amphibians are cold-blooded animals.
4. Amphibians can only live on land.
5. Aves have horny beaks and do not have teeth.

## Now you know

- ▶ All animals can be classified into vertebrates and invertebrates based on the presence or absence of a backbone. Invertebrates are further divided into many groups, i.e. Porifera, Cnidaria, Platyhelminthes, Nematelminthes, Annelida, Arthropoda, Mollusca and Echinodermata.
- ▶ Poriferans rely on maintaining a constant water flow through their bodies to obtain food and oxygen and to remove wastes. They have many pores all over the body.
- ▶ Cnidarians have a tube-like body and only one opening called mouth. The mouth is surrounded by a number of finger-like structures called tentacles.
- ▶ Platyhelminthes (flatworms) are simplest worms and are found in marine and fresh water.
- ▶ Nematelminthes (roundworms) are worms with an unsegmented and bilaterally symmetrical body. Most of these are parasites and live in human intestine.
- ▶ Annelids have a soft, segmented and bilaterally symmetrical body. They have special organs of excretion called nephridia.
- ▶ Arthropods have a segmented, bilaterally symmetrical body which is divided into three regions—head, thorax and abdomen. They also have paired appendages with many joints. Arthropods are divided into four subgroups or classes—arachnids, crustaceans, myriapods and insects.
- ▶ Molluscs have a soft, unsegmented body, often with an external hard shell.
- ▶ Echinoderms (spiny-skinned animals) have sharp spines all over the body.
- ▶ Vertebrates are classified into five classes—Pisces, Amphibia, Reptilia, Aves and Mammalia.
- ▶ Pisces (fishes) are cold-blooded animals with a streamlined body covered with scales. They breathe with gills. Majority of fish have scales on their body for protection.
- ▶ Amphibians are cold-blooded animals which can live both on land and in water. They breathe through lungs and skin. They always lay their eggs in water.
- ▶ Reptilia are cold-blooded, land animals with scales on their body. They breathe through lungs and reproduce by laying eggs.
- ▶ Aves (birds) are warm-blooded animals with feathers on their body. Forelimbs are modified into wings for flying. Hindlimbs are adapted for walking, perching or swimming. They have horny beak and do not have teeth.
- ▶ Mammalia are warm-blooded, hairy animals that give birth to babies and produce milk to feed them. Most mammals have external ears, nose and possess specialized teeth.



## Keywords

VERTEBRATES	animals with a backbone
INVERTEBRATES	animals without a backbone
ARTHROPODS	animals with jointed legs
AMPHIBIANS	animals that live both on land and in water
MAMMALIA	animals with mammary gland

## Exercises

### A. Tick the most appropriate answer.

- The arm-like structures present around the opening of cnidarians are called
  - pseudopodia.
  - tentacles.
  - spines.
  - bristles.
- Annelids have a
  - soft, unsegmented, bilaterally symmetrical body.
  - soft, cylindrical, segmented, bilaterally symmetrical body.
  - soft, segmented, bilaterally symmetrical body.
  - soft, segmented, laterally symmetrical body.
- Organs of excretion in annelids are
  - kidney.
  - nephridia.
  - suckers.
  - lungs.
- The body temperature of warm-blooded animals
  - keeps fluctuating.
  - changes according to the temperature of the environment.
  - does not change with the change in the temperature of the environment.
  - decreases when the temperature of the environment increases.
- Bones with large air spaces are present in
  - mammals.
  - fish.
  - annelids.
  - birds.
- Milk in the body of mammals is produced by
  - sweat glands.
  - salivary glands.
  - mammary glands.
  - none of these
- Scorpions and spiders are
  - crustaceans.
  - arachnids.
  - myriapods.
  - insects.

### B. Fill in the blanks.

- The animals without a backbone whose body is soft and often covered by a hard shell are \_\_\_\_\_
- Invertebrates with jointed legs belong to \_\_\_\_\_
- Fish obtain oxygen from water through \_\_\_\_\_
- Vertebrates which spend a part of their life on land but reproduce in water are called \_\_\_\_\_
- The backbone of vertebrates is made up of a number of small bones called \_\_\_\_\_



**C. Write true or false for each statement. Rewrite the false statements correctly.**

1. Fish have fins, scales and they breathe through gills.
2. Reptiles have a scaly skin. They lay eggs with a hard shell and are warm-blooded animals.
3. Arthropods have a soft, outer covering called endoskeleton.
4. A tapeworm is a flatworm that lives in the human intestine.
5. Insects belong to the amphibian group of animals.

**D. Differentiate between**

1. insects and crustaceans
2. aves and mammals
3. amphibians and pisces
4. flatworms and roundworms

**E. Given below is a table consisting of different groups of animals, and their characteristics features. Some of the features are incorrect. Identify the odd one out in each.**

GROUP	CHARACTERISTIC FEATURES	ODD ONE OUT
Porifera	porous animals, have tentacles, fixed to surface	
Amphibia	cold blooded, lungs in adults, scaly skin	
Aves	cold blooded, wings, feathers, bones with large air spaces	
Pisces	live in water, scaly skin, warm blooded, fins for swimming	

**F. Match the following.**

**GROUP**

1. molluscs
2. sponges
3. flatworms
4. mammals
5. fish
6. cnidarians
7. arthropods

**CHARACTERISTICS**

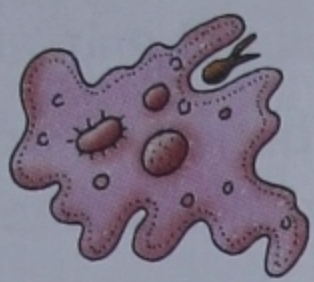


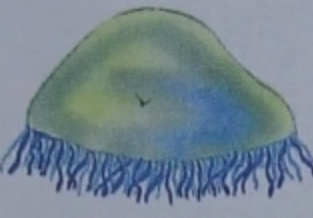

- a. feed milk to young ones, warm-blooded
- b. bag-like body with tentacles around the opening
- c. fins, gills and cold-blooded
- d. body with large opening and many small pores all over
- e. hard shell, soft body
- f. soft body without a body cavity and one opening only
- g. jointed legs, exoskeleton
- h. cylindrical, unsegmented body with mouth at one end and anus at the posterior end

**G. Find the odd one out. Give reasons.**

1. ant, cockroach, spider, dragonfly
2. frog, shark, seahorse, carp
3. snail, oyster, earthworm, octopus
4. snake, alligator, eel, turtle
5. sea urchin, starfish, brittle star, jellyfish
6. jellyfish, *Hydra*, sea anemone, butterfly



H. Each animal drawn below is an invertebrate. Fill in the characteristics of each one.

	GROUP TO WHICH IT BELONGS	WHERE IT LIVES	TWO OTHER MEMBERS OF THE SAME GROUP	ONE CHARACTERISTIC FEATURE OF THE GROUP
				
				
				
				
				

I. Classify the given animals into different categories indicated.

1. Jellyfish, liver fluke, pinworm, *Ascaris*, tapeworm, *Hydra*, sea anemone into cnidarians, Platyhelminthes and Nematelminthes.
2. Crab, millipede, fly, ant, scorpion, centipede, spider, lobster, moth, prawn into arachnids, crustaceans, myriapods and insects.

J. Write short answers.

1. What are invertebrates?
2. What do you mean by radially symmetrical body?
3. Give two examples of Platyhelminthes.
4. What are the special organs of excretion in annelids?
5. What is an exoskeleton?

K. Answer in detail.

1. Write two characteristics each of
  - a. birds
  - b. amphibians
  - c. reptiles
2. List four characteristics of reptiles.



3. Why do adult amphibians tend to stay near water?
4. How do fish exchange gases?
5. What happens to the body temperature of a fish when the temperature of water drops?
6. How are the bones of birds different from those of other vertebrates?
7. What is the most notable characteristic of birds which is not found in any other group of animals?
8. You are asked to classify an animal in the correct group. The animal has a soft body and arm-like tentacles. You dissect the animal and find that it has an internal shell. Is the animal a cnidarian or a mollusc? Explain your answer.
9. How do warm-blooded and cold-blooded animals differ?

## Fun to do

1. Prepare a home for woodlice in an old aquarium or a large glass trough. Put damp sawdust at the base. Put a piece of damp rotten wood. Pieces of carrot, potato, etc. can be put along with it. Cover the glass trough with a sheet of glass to prevent woodlice crawling out. Observe their habits.
2. Create a Bulletin Board. Put charts showing
  - ◆ vertebrates with some strange and interesting features.
  - ◆ animals on the verge of disappearing from planet earth (endangered species).
  - ◆ invertebrates found in seas and lakes.
3. Reptiles may seem very repulsive, creepy animals. Collect some interesting information under the following headings.
  - ◆ reptiles with limbs and without limbs
  - ◆ reptiles which live in water
  - ◆ feeding and breeding habits of snakes
  - ◆ What makes some snakes poisonous? Are snakes our friends or enemies?

Collect as many pictures as possible to make the project interesting. Do not cut the pictures from books. Get them photocopied.