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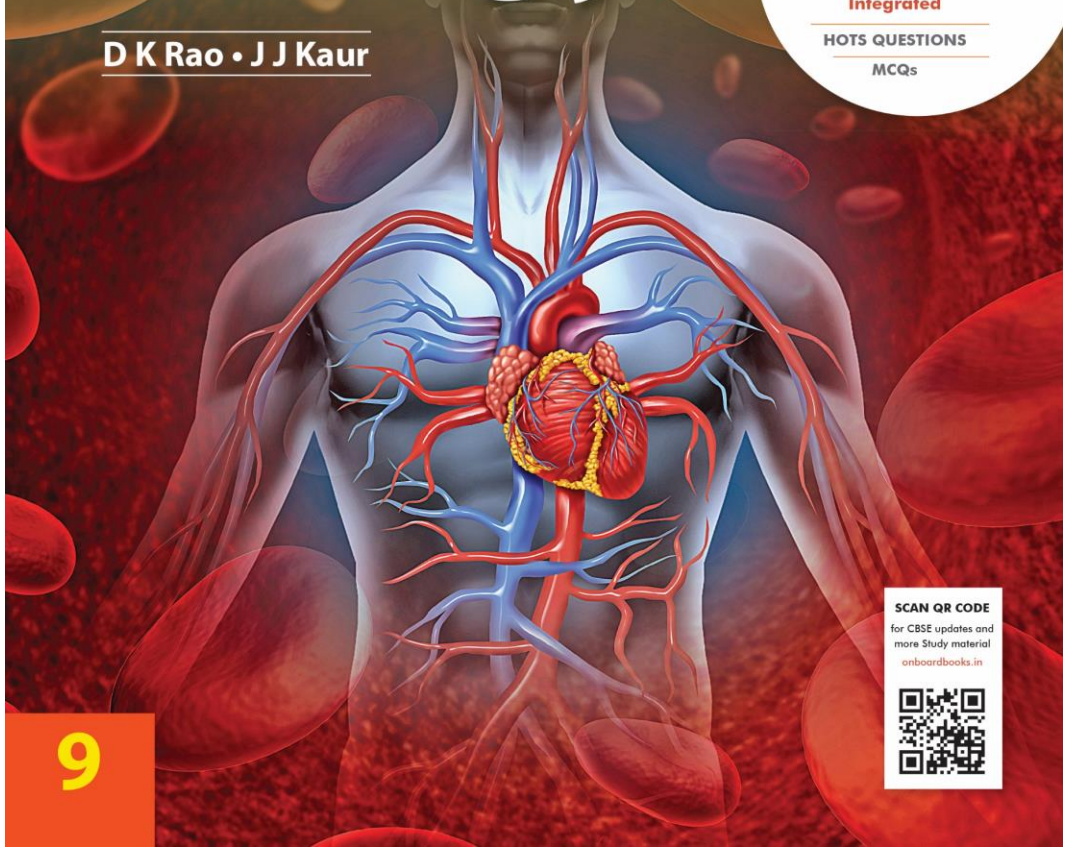
MCQs



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9

CBSE
Living Science
Biology

Class 9

Chapter 3 Diversity in Living Organisms

LEARNING OBJECTIVES

Biodiversity

What is Classification?

- **What is the basis of classification?**

Classification and Evolution

- **The hierarchy in classification of groups**

Nomenclature – Scientific Naming of Organisms

Five Kingdoms

- **Kingdom Plantae (Plant Kingdom)**
- **Sub-kingdom Cryptogamae**
- **Sub-kingdom Phanerogamae**
- **Kingdom Animalia**
- **Major Phyla of Kingdom Animalia**

Phylum Chordata (Sub-phylum Vertebrata)

What is Diversity?

Biodiversity means the diversity of life forms or occurrence of different living organisms and their variety in a particular region.

The tropical regions ranging between the Tropic of Cancer and the Tropic of Capricorn are rich in diversity of microorganisms, plant and animal life. This is because of the warm and humid climate in the tropical region. This region is also called the region of **megadiversity**

.

What is Classification?

Classification means identifying similarities and differences between different kinds of organisms and then placing these groups in an order of close relationship.

What is the basis of classification?

It is necessary to first identify characteristics on the basis of which the broadest division can be made. Then, this is followed by the next set of characteristics for making sub-groups within these broader divisions. In this way, each time a new characteristic can be taken to further classify each group.

A characteristic is a particular form or function exhibited by organisms.

Importance of classification

- A wide variety of organisms on the earth can be easily studied by classification.
- Classification projects a picture of all life forms at a glance.
- It helps us understand the relationship between different groups of organisms and helps in understanding their evolutionary history.
- It serves as a base for the development of other biological sciences such as ecology and behavioural sciences, biogeography and evolution.

- It helps in understanding the characteristics of whole group of organisms by studying only a few representatives from that group.
- It helps us in identification and classification of different organisms such as agricultural pests, pathogens and components of an ecosystem on which various fields of applied sciences such as agriculture, public health and environmental biology depend.

Classification and Evolution

Evolution is the process of gradual change or development in different kinds of living organism.

According to Darwin, there are some organisms with primitive body design that have not changed much over a period of time. These are called **older** or **primitive** or **lower organisms**, which are simple.

There are other groups of organisms which have acquired their peculiar body design quite recently. They have a complex body design. They may be considered as the **younger** or **advanced** or **higher organisms**.

The Hierarchy in Classification of Groups

Each organism is classified on the basis of its evolutionary relationship with other groups of organisms. All living organisms are classified into broad categories. These broad categories are called **kingdoms**.

Species

The lowermost category is the species. Each organism is classified into a particular species. It is basic unit of classification.

Apart from small variations, members of a species are almost identical in their anatomy, physiology and behaviour.

Members of a species often resemble each other very closely in appearance

Genus

Closely-related species are grouped into a **genus** (plural genera). Thus, genus is a group of species which have common external resemblance.

Family

Groups of similar genera are grouped together into a **family**. For example, cat (*Felis domestica*) and tiger (*Panthera tigris*) belong to the same family, Felidae.

Order

Similar families are grouped together into **orders**. For example, humans and apes are grouped together into the same order, Primates. Cat (Felidae) and dog (Canidae) are grouped together into the same order, Carnivora.

Class

Similar orders are grouped into **classes**. We belong to the class Mammalia along with other orders like Carnivora .

Phylum

Closely-related classes are grouped into **phylum**. For example, classes like mammals, fish, amphibians, reptiles and birds all belong to the phylum Chordata.

Kingdom

Similar phyla constitute a **kingdom**. For example, all animals belong to kingdom Animalia and all plants belong to kingdom Plantae.

Nomenclature – Scientific Naming of Organisms

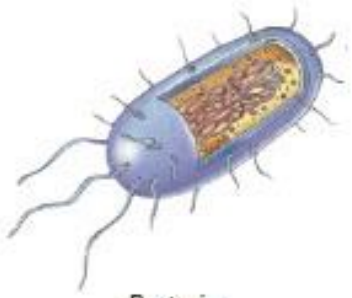
Mainly, the following rules apply to scientific names:

- The name of the genus comes first and its first letter is always capitalized. The name of the species comes second and starts with a small letter. For example, the binomial name for humans is *Homo sapiens*. In this, *Homo* is the genus, starting with capital letter while *sapiens* is the species starting with small letter.
- The scientific name is printed in italics or underlined (separately for genus and species name) if handwritten. For example, *Homo sapiens* or <u>Homo sapiens</u>.
- Scientific names are mostly in Latin and are accepted all over the world.

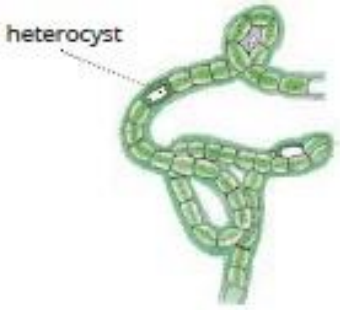
Five Kingdoms

Kingdom Monera

The organisms belonging to kingdom Monera are the oldest, simplest and prokaryotic microorganisms.



Bacteria



Nostoc, a blue-green algae

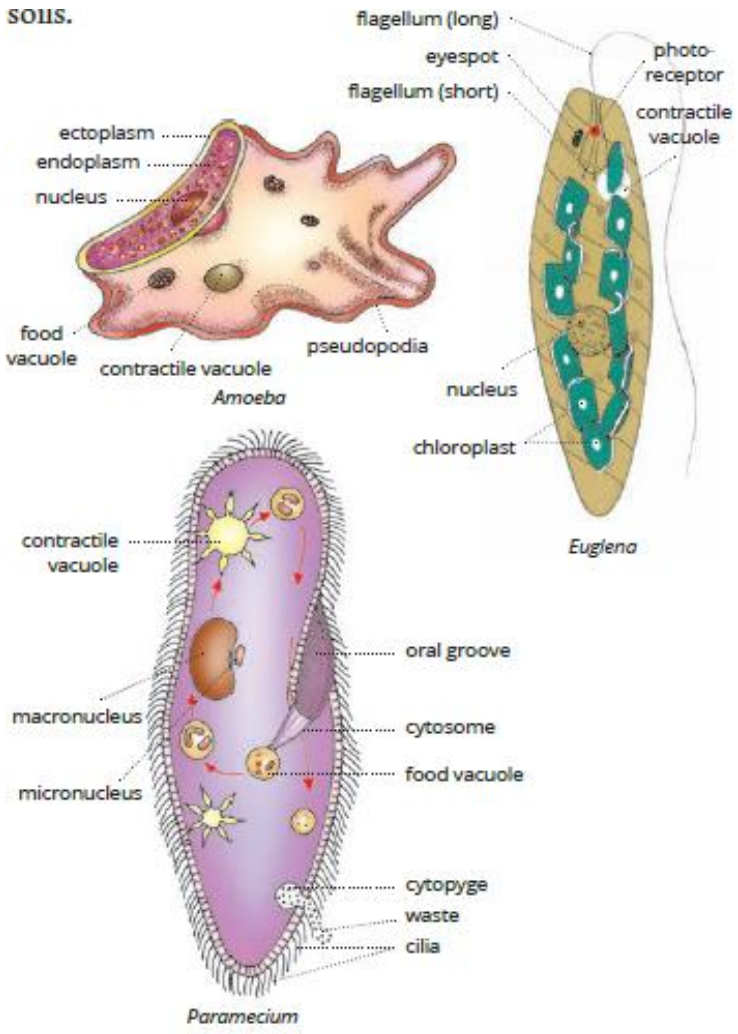
They have following characteristics:

- These are **prokaryotes**. They **do not have a defined nucleus or organelles**.
- They are unicellular. Some of them have cell walls while some others do not.
- Their mode of nutrition is mainly autotrophic or sometimes heterotrophic.
- They are usually non-motile, but some may have flagella and gliding movements. Cilia are absent.
- Their reproduction is primarily asexual (by fission).

Kingdom Protista

The organisms belonging to kingdom Protista include unicellular eukaryotic organisms. Primarily, they are aquatic and occur in oceans, lakes, ponds and damp soils.

- They have the following characteristics:
- They are first eukaryotes, having a well-defined nucleus and complex membranous organelles.
- They are unicellular or colonial forms without distinct division of labour.
- Some have cellulose wall and chloroplast and their mode of nutrition is autotrophic (algae). Some do not have cell wall and chloroplast and are heterotrophic (Protozoans).
- They have hair-like cilia (*Paramecium*) or whip-like flagella (*Euglena*) or pseudopodia (*Amoeba*) for moving around.

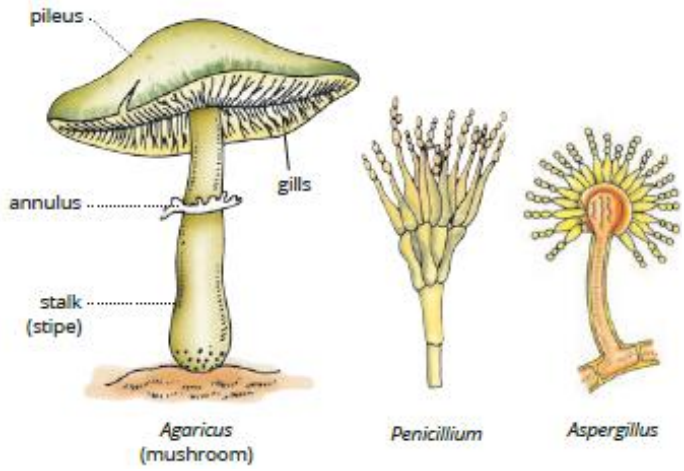


Kingdom Fungi

The organisms belonging to kingdom Fungi include heterotrophic (without chlorophyll) eukaryotic organisms living as parasites or saprophytes.

They have the following characteristics:

- They have a definite cell wall made up of tough complex sugar called chitin.
- They grow in dark and moist habitat and use dead organic matter as food. Hence, they are called **saprophytes**.



- Many of them have the capacity to become multicellular organisms at certain stages in their lives except **yeast** which is unicellular fungus.
- They are usually non-motile.
- They reproduce mostly by **spore formation**. However, sexual reproduction may also take place. Examples: yeast, mushrooms, etc.

Kingdom Plantae

Kingdom Plantae includes all organisms which are **truly multicellular eukaryotes** with cell walls. All plants are included in this kingdom. The plantae are distinguished by the following characteristics:

- They are multicellular eukaryotic organisms adapted to carry out photosynthesis. Hence, they are autotrophic.

- They perform photosynthesis due to chlorophyll present in chloroplasts.
- They have cell wall made up of true cellulose, enclosing cytoplasm with large vacuole.
- They are non-motile, without definite shape or size.

Kingdom Animalia

Kingdom Animalia includes all those organisms which are **multicellular eukaryotes without cell walls**. They are heterotrophs as they cannot synthesize their own food.

Sub-kingdom Cryptogamae

The plants belonging to sub-kingdom Cryptogamae are also known as lower plants, flowerless or seedless plants. These plants do not bear external flowers or seeds and hence are considered to have hidden reproductive organs. The sub-kingdom cryptogamae is further divided into three divisions, namely, Thallophyta, Bryophyta and Pteridophyta.

Division Thallophyta

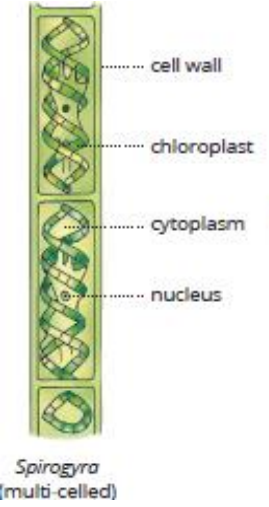
Characteristics of division Thallophyta

- The plant body is not differentiated into roots, stems and leaves. It is in the form of an undivided mass of cells called **thallus**.

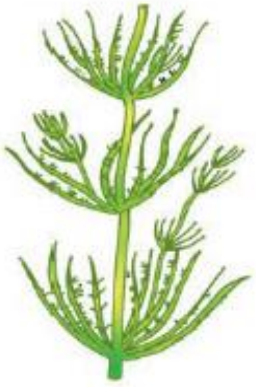
- Vascular system is absent.
- These plants are predominantly aquatic.
- The thallophytes mainly include algae.

Division Bryophyta

The **bryophytes are amphibians of the plant kingdom**. The bryophytes include mosses and liverworts. They usually range from 2 cm to 15 cm in length. They are unable to grow tall because they do not have xylem to support them, nor do they have a vascular system for transport of materials. They do not have true roots.



Spirogyra (multi-celled)

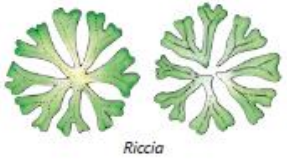

Chara


Cladophora


Ulothrix


Ulva

Some examples of Thallophytes – Algae


Riccia


Marchantia

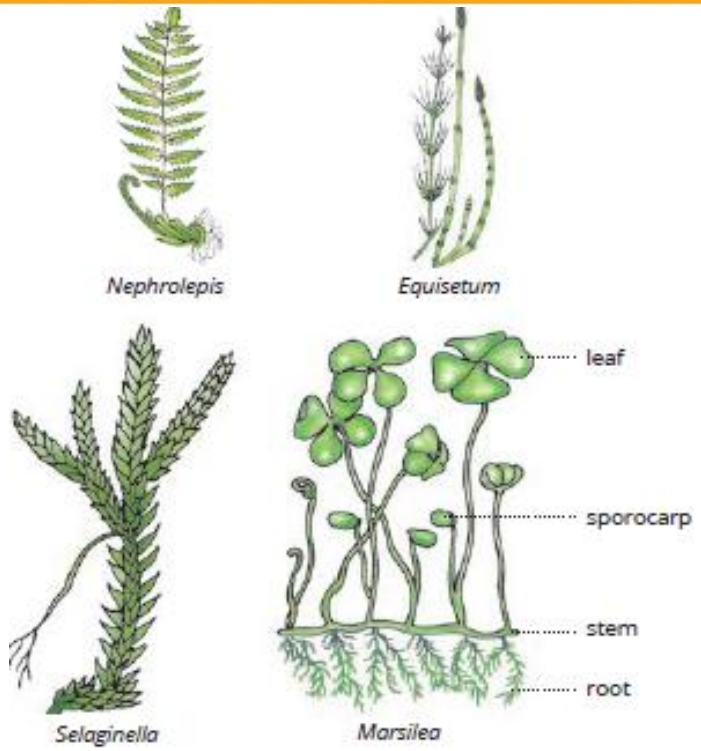

Rhizoids

Funaria

Some examples of Bryophytes

Division Pteridophyta

Pteridophytes have feather-like or pinnate fronds. Pteridophytes are seedless vascular plants that have sporophytic plant body. They are also called **vascular cryptogams** as they possess well-developed conducting system, i.e. vascular elements such as xylem and phloem. They grow well in shady areas like forests, mountain slopes and hills, especially in the tropical rainforests.



Some examples of Pteridophytes

SUb-kingdom Phanerogamae

The plants belonging to sub-kingdom Phanerogamae are **seed-bearing plants**. The body of these plants is differentiated into true roots, stem and leaves. The vascular system composed of xylem and phloem is well-developed. Sub-kingdom Phanerogamae is further sub-divided on the basis of presence or absence of fruits into two sub-divisions – Gymnospermae and Angiospermae.

Sub-division Gymnospermae

Gymnosperms are plants with naked seeds. They are found mostly in cold areas where snowfall occurs too often.

Gymnosperms are a small group of seed plants. All gymnosperms are perennial woody plants. Some of these live for thousands of years. Seed contains a food laden tissue called **endosperm** for the future growth of embryo.


Conifers


Cycas

Examples: *Cycas*, *Pinus*, *Ginkgo*, *Araucaria*, *Gnetum* etc.

Conifers and *Cycas* are gymnosperms

Sub-division Angiospermae

Angiosperms are plants with seeds covered by the fruit. On the basis of number of cotyledons, angiosperms are divided into two groups – monocotyledonous or monocots (seeds with a single cotyledon) and dicotyledonous or dicots (seeds with two cotyledons). These are flowering plants whose seeds are enclosed in a fruit. The seeds contain cotyledons called seed leaves. Cotyledons represent pre-designed plant in the seed. After fertilization, ovary develops into a fruit.


Rice


Ipomoea


Paphiopedilum


Mango

Note: Differences between Gymnospermae and Angiospermae are given in Table 3.3.

Kingdom Animalia

Characteristic features of kingdom Animalia

- These are multicellular organisms.
- These are eukaryotic organisms, that is, the cells do not contain cell wall, but contain only cell membrane and membrane-bound organelles (like nucleus).
- They are heterotrophs.
- They are mostly mobile.
- They show increased sensitivity through the nervous system.

Major Phyla of Kingdom Animalia

Based on the extent and type of body design differentiation, the kingdom Animalia is divided into two groups, namely, Invertebrate (non-chordata) and Chordata.

Phylum Porifera – organisms with pores

The word porifera means organisms with pores or holes all over their body. Phylum Porifera includes sponges. Porifera are multicellular organisms with cellular level of body organisation.



Some sponges belonging to Phylum Porifera

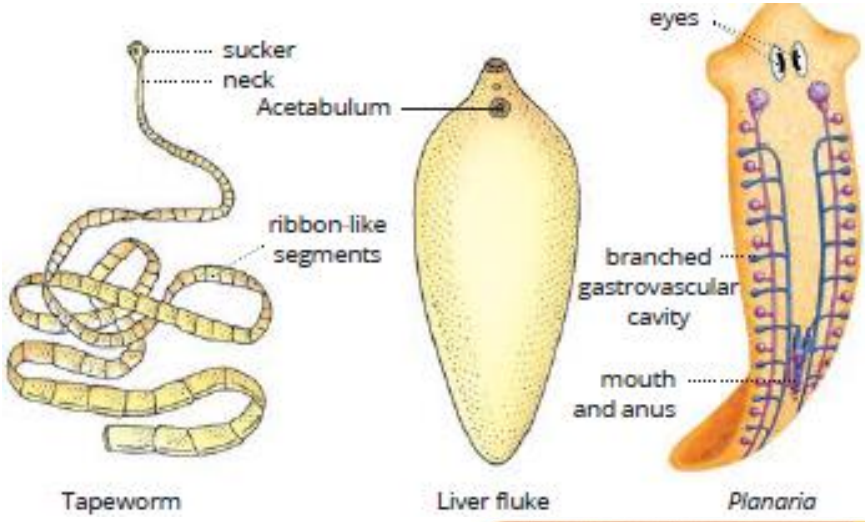
Phylum Coelenterata (Cnidaria)

The phylum Coelenterata includes *Hydra*, jelly fish, sea anemones and corals. Coelenterates are multicellular organisms which have tissue level of organization. Their body consists of two layers of tissues with a jelly-like substance in between.

The coelenterates mostly live in fresh water, in solitary or colonial forms. Some like *Hydra* may be seen with naked eyes and can be found attached to stones or aquatic plants.

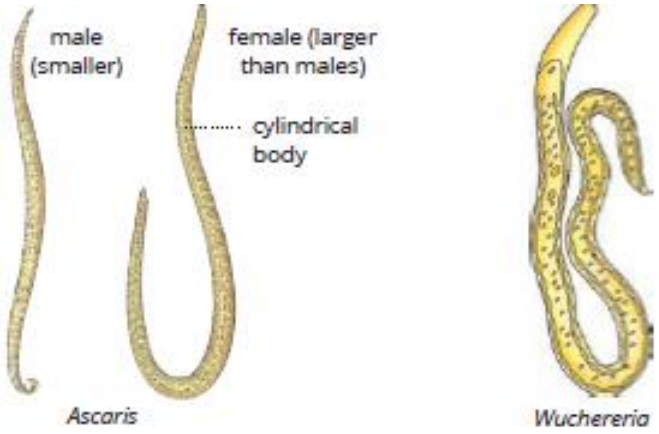
Phylum Platyhelminthes – the flatworms

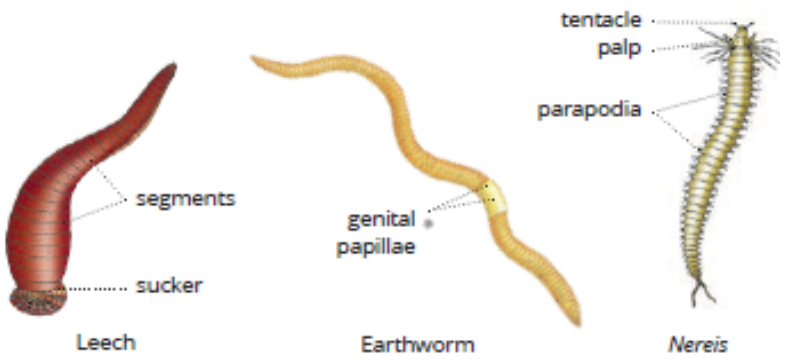
The Platyhelminthes are flatworms. Flatworms live in moist places. The body of platyhelminthes has complex body organization in comparison to poriferans and coelenterates. They range from a few millimetres to a few centimetres in size.



Phylum Nematoda (or Nemathelminthes)– Parasitic worms or roundworms

The organisms belonging to this phylum are also known as Aschelminthes. They are mostly parasites having slender, elongated bodies tapering at each end.





Phylum Annelida – the ringed worms

Organisms belonging to phylum Annelida are worms with body appearing as if made up of a series of rings. It includes earthworms, ragworms (*Nereis*) and leeches. They are first animals with true coelom.

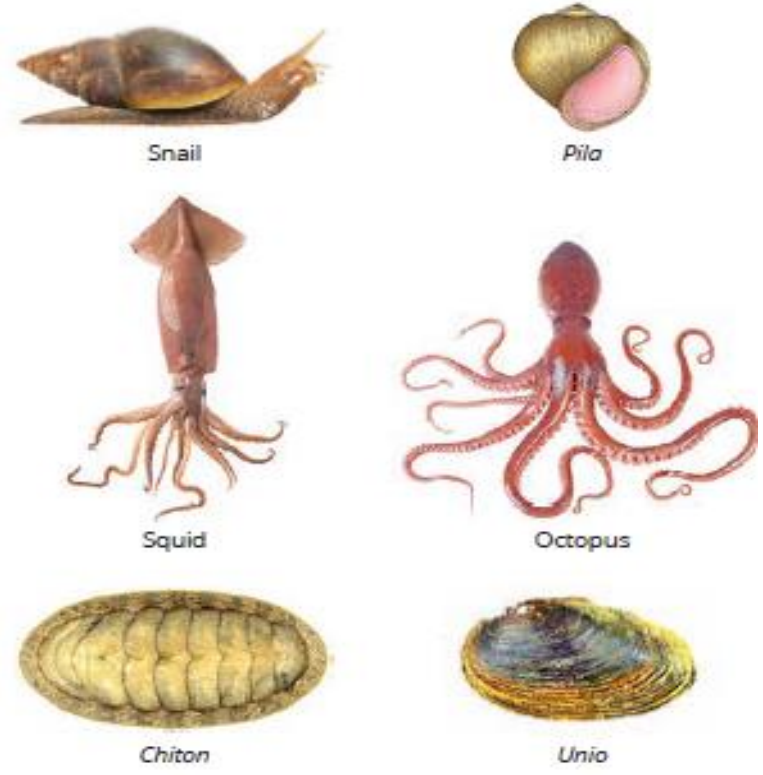
Phylum Arthropoda – organisms with jointed appendages

Organisms belonging to phylum Arthropoda have jointed appendages (legs and antennae). This is the largest invertebrate phylum. Insects, centipedes, millipedes and spiders are the common organisms belonging to phylum Arthropoda.

Phylum Mollusca

The organisms belonging to phylum Mollusca have an outer shell and soft body. The fold of skin around the body is called **mantle** which secretes the outer shell. They have muscular foot which is used for movement. Phylum Mollusca includes slugs, snails and octopus.

Some examples of Phylum Arthropoda



Some examples of Phylum Mollusca

Phylum Echinodermata – organisms with spiny skin

The word Echinodermata has come from Greek words *echinos* meaning spiny and *derma* meaning skin. Thus, they are organisms with spiny skin. They are exclusively free-living marine animals living in sand at the bottom of the sea.

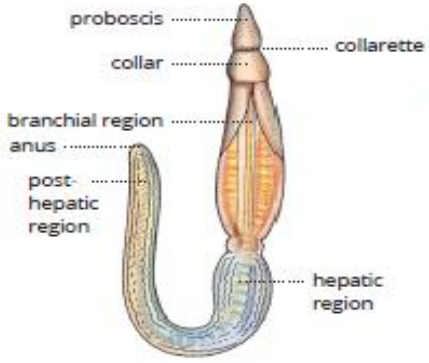

Sea urchin


Feather star

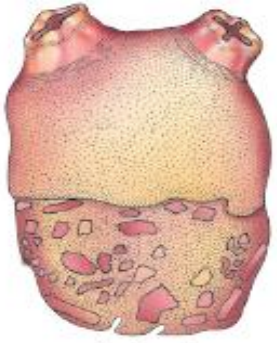

Sea cucumber


Starfish

Their body is unsegmented. There is no head and body surface has five radial arms (pentamerous symmetry). They move by tube feet. The body cavity has water-vascular system.



Balanoglossus


Herdmania


Amphioxus

Sub-Phylum Protochordata

The word Protochordates means primitive chordates. They possess notochord at some stage of their life. **Notochord** (chord means string) is a stiff rod-like structure that runs along the back of the animal and separates nervous tissue from the gut. It also provides a place for muscle attachment for easy movement.

Phylum Chordata (Sub-phylum Vertebrata)

The vertebrates are triploblastic, coelomate animals with bilaterally symmetrical body. They include the fish, amphibians, reptiles, birds and mammals. **Vertebrates have a true vertebral column and internal skeleton** which allows a different distribution of muscle attachment points for movement of the body parts.

Characteristics of chordates

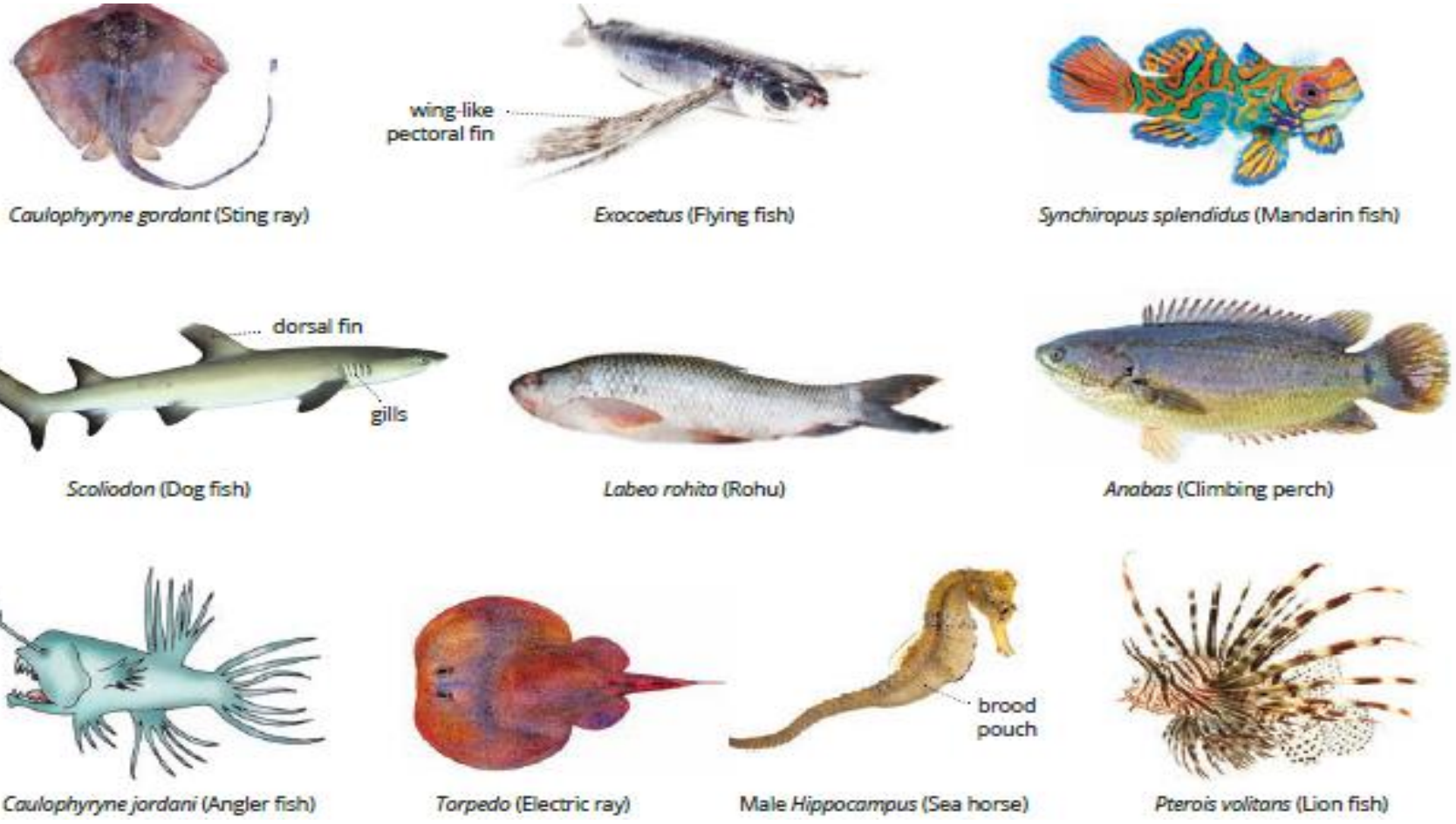
- **Presence of notochord:** At some stages of their life all chordates possess a stiff rod-like structure running along the body, close to the dorsal surface.
- **Dorsal tubular nerve cord:** They have a dorsal, hollow, tubular nerve cord close to the notochord.
- **They are triploblastic animals** with three germ layers.
- **They have paired gill pouches** at some stages of their life.
- **They are true coelomate** animals.

Vertebrates are further grouped into five classes.

Group Pisces (fish)

The group called Pisces contains many classes. They are all exclusively water living (aquatic) animals.

Some well-known examples are **cartilaginous fish**, such as sharks and **bony fish** such as tuna or rohu. The cartilaginous fish belong to **Class Chondrichthyes**, and the bony fish belong to **Class Osteichthyes**. These are the two classes under the Pisces group.



Caulophryne gordani (Sting ray) | *Exocoetus* (Flying fish) | *Synchiropus splendidus* (Mandarin fish)

Scoliodon (Dog fish) | *Labeo rohita* (Rohu) | *Anabas* (Climbing perch)

Caulophryne jordani (Angler fish) | *Torpedo* (Electric ray) | Male *Hippocampus* (Sea horse) | *Pterois volitans* (Lion fish)

Some examples of pisces

Class Amphibia

The amphibians have evolved from fish. Thus, they are partly adapted to live on land, and partly in water. They differ from fish as they do not possess scales. They have three-chambered heart and mucous glands in the skin.

They have smooth skin. It is covered by mucus, which keeps the skin moist and slippery. Respiration takes place either through gills or lungs. Most amphibians lay their eggs in water, where they develop into tadpoles. The tadpoles after metamorphosis become adults and can live in water as well as on land.

Class Reptilia

They are the cold-blooded animals with their body covered with horny epidermal scales. They can live solely on land and are very less dependent on water. They lay eggs covered with waterproof shells, so they need not lay eggs in water like amphibians. Their skin is waterproof and covered with protective horny scales.

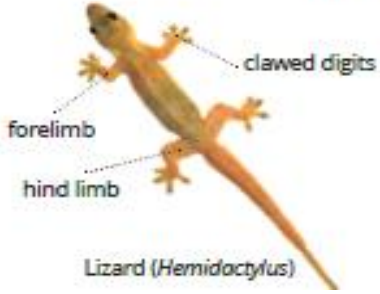

Chameleon


Crocodile


Flying lizard (*Draco*)

Tortoise

Snake



Lizard (*Hemidactylus*)

Some examples of reptilia

Class Aves

Birds evolved from reptiles and have many similarities with them. Birds are easily distinguished because their bodies are covered with feathers. All birds are warm-blooded and have four-chambered heart.Their forelimbs are modified to form wings for flight. Their jaw has a horny beak. Teeth are absent. They have lungs for respiration. They lay eggs.


Male tufted duck


Crow


Penguin


House sparrow


White stork

Class Mammalia

All mammals possess mammary glands which are more developed in females than in males to suckle their young ones. Like birds, mammals are also warm-blooded animals. Mammals have body covered with hair. All female mammals secrete milk on which their young ones feed. Sexes are separate – male and female. Their young ones usually develop inside the uterus of the mother. Heart is four-chambered. They are warm-blooded animals.

External features of a rabbit

Examples: Rat (*Rattus rattus*), human, tiger, elephant, cat, whale, bat, etc.

SUMMARY...

- Classification means grouping organisms on the basis of their similarities and dissimilarities.
- The scientific naming of organisms is according to the Linnaeus system of Binomial Nomenclature.
- As per modern Whittaker system of classification, there are five kingdoms of living organisms namely, Monera, Protista, Fungi, Plantae and Animalia.
- Monerans do not have a defined nucleus or cell organelles, nor do they show multicellular body design.
- Protists include unicellular eukaryotic organisms such as algae, diatoms and protozoans.
- Organisms belonging to kingdom fungi are heterotrophic eukaryotic organisms which use decaying organic matter as food material. Yeast and mushrooms are included in kingdom fungi.
- All multicellular eukaryotes, which are photosynthetic autotrophs, are grouped under kingdom Plantae.
- Kingdom Plantae is classified into two sub-kingdoms – Cryptogamae and Phanerogamae.
- Thallophyta are plants that have undifferentiated body.

- Bryophyta are amphibians of plant kingdom.
- Pteridophyte are vascular plants that do not produce seeds.
- Gymnosperms are plants that bear naked seeds.
- Angiosperms are plants that bear seeds enclosed inside fruits.
- Angiosperms are divided into two classes depending upon the number of cotyledons in their seeds – monocotyledons and dicotyledons.
- Animals are multicellular, eukaryotes with heterotrophic nutrition, locomotion and sensitivity through the nervous system.
- Animals may be at a cellular level of organization (Porifera), tissue level of organization (Cnidaria) or organ level of organization (humans)
- Kingdom Animalia is divided into two groups – Non-chordata (animals without a notochord) and Chordata (animals with a notochord).
- Phylum Porifera is characterized by multicellular, heterotrophic organisms whose bodies have pores, canals and chambers.
- Phylum Coelenterata includes diploblastic animals with no body segmentation.
- Phylum Platyhelminthes includes free living organisms and parasites like tapeworm and flatworms.

- Phylum Nematoda includes roundworms like *Ascaris lumbricoides*.
- Phylum Annelida includes coelomate, triploblastic animals with a segmented body.
- Arthropods have jointed appendages and chitinous cuticle.
- Phylum Mollusca includes soft-bodied animals covered by a calcareous shell.
- Phylum Echinodermata is composed of spiny-skinned animals that have tube feet for locomotion.
- Phylum Chordata is composed of animals having a notochord, a dorsal hollow nerve cord and gill slits at some stages of life.
- Pisces have streamlined body, exoskeleton made of scales and endoskeleton made of either bone or both cartilage and bone.
- Class Amphibia includes animals that can live in water and on land.
- Reptiles have horny scales covering their body and are mostly terrestrial.
- Class Aves includes birds which are flying vertebrates with forelimbs modified into wings.
- Class Mammalia is characterized by the presence of hair on the body and mammary glands, which secrete milk.

THANK YOU