Ratna Sagar

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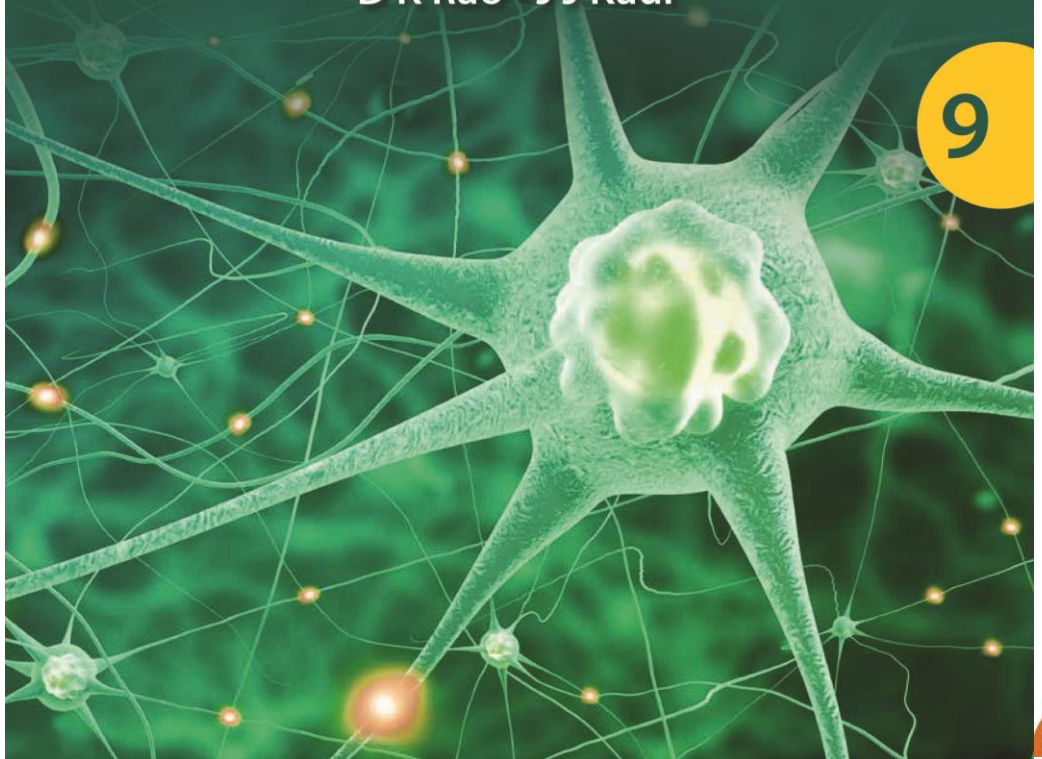
Revised and Updated

LIVING SCIENCE BIOLOGY

D K Rao • J J Kaur



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ICSE
Living Science
Biology

Class 9

Chapter 7 Diversity in the Living World

LEARNING OBJECTIVES

What is the basis of classification

- **Importance of classification**

The hierarchy in classification of groups

- **Kingdoms – two or five?**
- **Species – the basic unit of classification**
- **Genus, Family, Order, Phylum Kingdom**

Nomenclature – scientific naming of organisms

Five kingdom classification

- **Kingdom Monera, Protoctista, Fungi, Plantae, Animalia**

Kingdom Plantae

- **Sub-kingdom cryptogamae**
- **Sub-kingdom phanerogamae**

Kingdom Animalia

- **Major phyla of kingdom Animalia**

Group invertebrate

- **Phylum chordata**

What is Classification?

Classification means identifying similarities and differences between different kinds of organisms and then placing organisms with similar characteristics in one group and different kinds of organisms in different groups. The study of the kinds and diversity of organisms and the evolutionary relationships among them is known as **systematics** or **taxonomy.**

What is the basis of classification?

For classifying an organism, it is necessary to first identify characteristics on the basis of which the broadest division can be made. Then, this is to be followed by the next set of characteristics for making the sub-groups within these broader divisions.

Importance of classification

- **Classification makes it easy to study a wide variety of organisms** on the earth.
- It **helps understanding the evolutionary relationship** between different groups of organisms, and helps in understanding their evolutionary history.
- It **helps in the identification and classification of different organisms** such as agricultural pests, pathogens, components of an ecosystem on which various fields of applied sciences such as agriculture, public health and environmental biology depend.
- It helps in understanding the characteristics of whole group of organisms by studying only a few representatives from that group.

The hierarchy in classification of groups

Each organism is classified on the basis of its evolutionary relationship with other groups of organisms.

Kingdoms – two or five?

The largest group of organisms recognized by biologists is the **kingdom**. Earlier, there were only two kingdoms, namely **plants** and **animals**. The five kingdoms that are recognized are **Monera**, **Protoctista (Protista)**, **Fungi**, **Plantae** and **Animalia**.

Species – the basic unit of classification

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

❖ Members of a species interbreed to produce fertile offsprings, which can perpetuate.

❖ 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 (but not exactly similar). For example, tigers belong to species *tigris* and humans belong to species *sapiens*.

Genus

❖ Closely-related species resembling each other are grouped into next higher category, the **genus** (pl. genera). Thus, genus is a group of species which have common external resemblance.

For example, lion (*Panthera leo*), leopard (*Panthera pardus*) and tiger (*Panthera tigris*) are three different species but belong to one genus *Panthera*.

Family

❖ Groups of similar genera with common characteristics are grouped together into a **family**. For example, the cat (*Felis domestica*) and the 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.

Class

❖ Similar orders are grouped into **classes**. For example, bats and primates belongs to the class Mammalia.

Phylum

❖ Closely-related classes are grouped into **phylum**.

Kingdom

❖ Similar phyla constitute a **kingdom**. The kingdom is the largest division of living beings.

Nomenclature – scientific naming of organisms

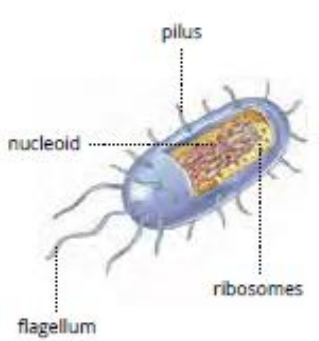
A simplified system of naming organisms called '**Binomial nomenclature**' was proposed by **Carl Linnaeus**

Binomial nomenclature means a two-name system of naming. The scientific name of an organism, is thus unique and can be used to identify it anywhere in the world.

Five kingdom classification

Kingdom Monera

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



Bacteria

Nostoc, a blue-green algae

❖ These are prokaryotes. **They do not have a defined nucleus or organelles.**

❖ They are mostly unicellular (single-celled), but may be present in the form of colonies or filaments of independent cells.

❖ Some of them have cell walls while some others do not (like *Mycoplasma*).

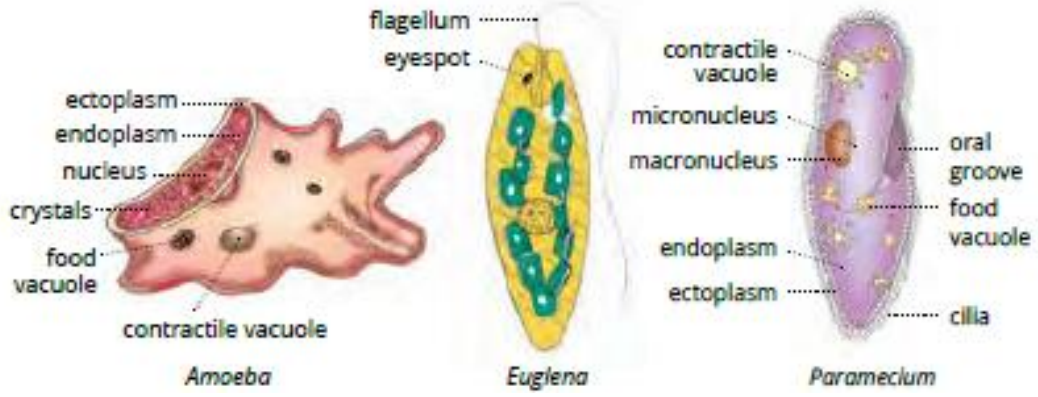
❖ The nuclear material is not enclosed in a nuclear membrane, rather it is distributed in the cell.

❖ They are usually non-motile, but some may have flagella and gliding movements. Cilia are absent. Examples: Bacteria, blue-green algae or cyanobacteria, and *Mycoplasma.*

Kingdom Protoctista (Protista)

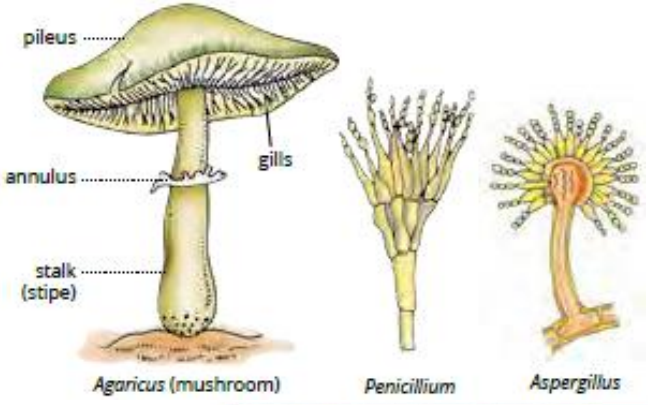
The organisms belonging to kingdom Protista include **unicellular**, **eukaryotic organisms**.

❖ They are first eukaryotes, having **a well-organized nucleus with a nuclear membrane** and complex membranous organelles.



Kingdom Fungi

The kingdom Fungi includes **heterotrophic, eukaryotic organisms**. They grow in dark and moist habitat and use dead organic matter as food and are therefore called **saprophytes.** Some fungi live in mutual relationship with blue-green algae. Such a relationship is called symbiotic relationship. These symbiotic forms are called **lichens** that are usually found growing on bark of trees.



Kingdom Plantae

Kingdom Plantae includes all organisms which are **truly multicellular eukaryotes with cell walls, and are photosynthetic**. They are autotrophs preparing food material by photosynthesis using chlorophyll for themselves as well as for the rest of the other organisms. Hence, all plants are included in this kingdom.

Kingdom Animalia

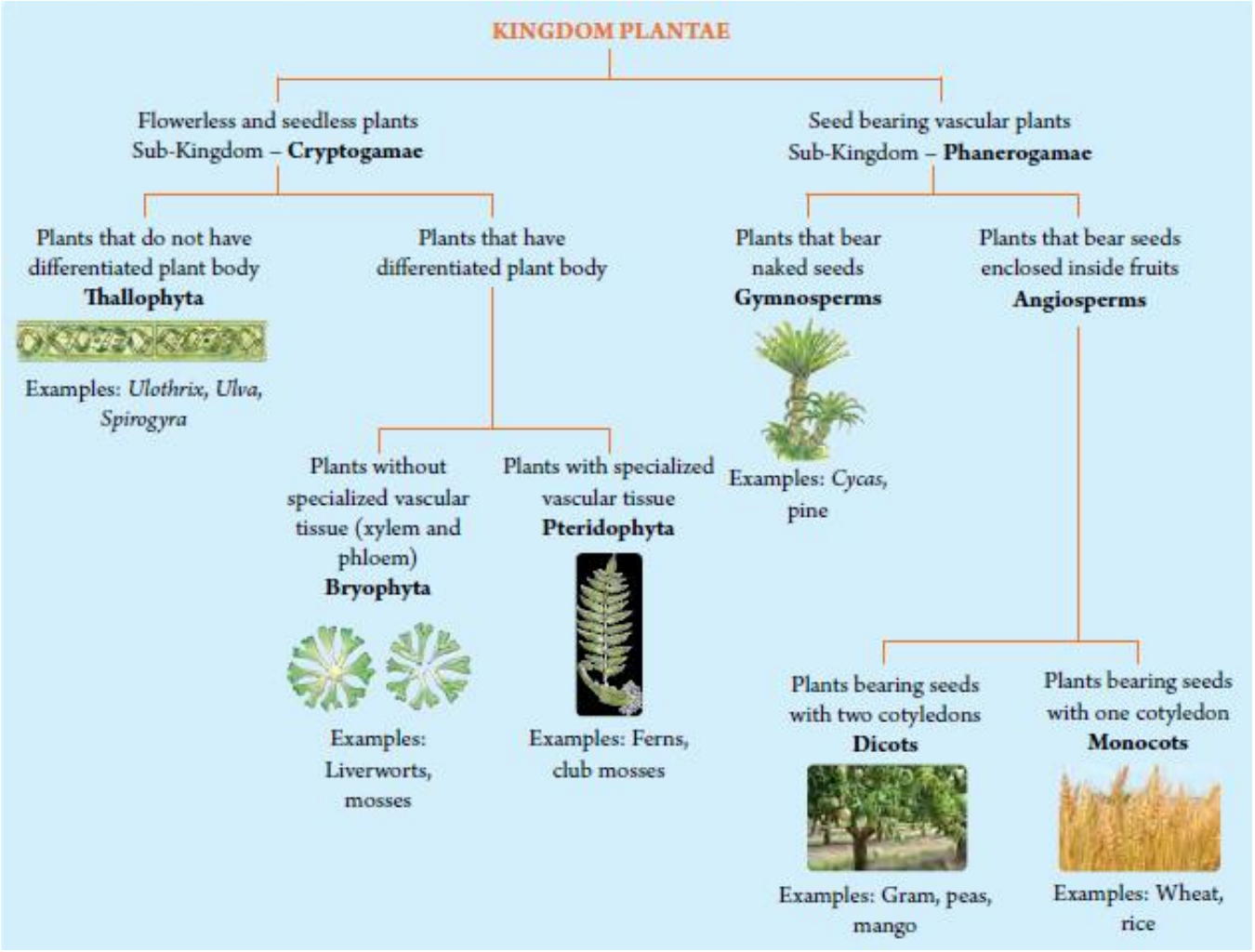
Kingdom Animalia includes all organisms which are **multicellular eukaryotes without cell walls**. They are heterotrophs as they cannot synthesize their own food.

Kingdom Plantae

The plant kingdom includes mosses, liverworts, ferns, conifers and flowering plants.

The plants can be classified at three levels.

- **Level one:** Whether plant body has well differentiated, distinct components.
- **Level two:** Whether the differentiated plant body has special tissues for the transport of water and other substances within it.
- **Level three:** Whether plants are able to bear seeds and whether the seeds are enclosed within the fruits.



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.

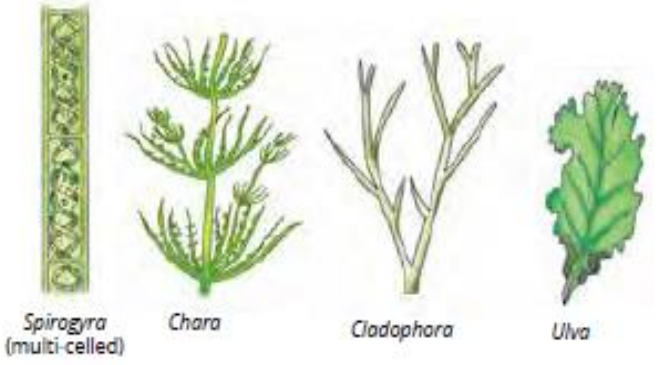
The sub-kingdom cryptogamae is further divided into three divisions, namely, Thallophyta, Bryophyta and Pteridophyta.

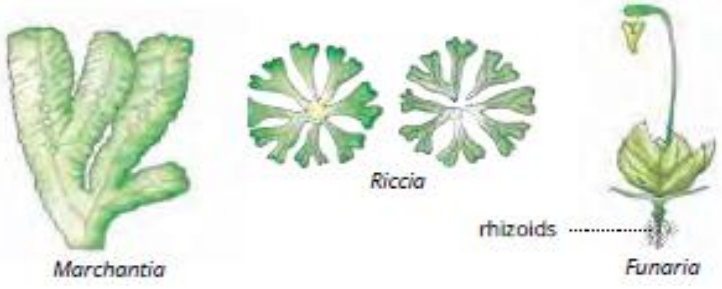
- ❖ The epicotyl elongates and pierces out of the grain in opposite direction to coleorhiza and cotyledons remain underground.
- ❖ The plumule pierces out of the coleoptile and grows straight upwards.
- ❖ The cotyledon absorbs food from endosperm till it is exhausted.

In this germination, the epicotyl elongates but the hypocotyl does not elongate and the germination is hypogeal.

Division Thallophyta

The plant body is not well-differentiated into roots, stems or leaves. It is in the form of an undivided **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** (because they live in soil but depend on water for sexual reproduction). They include mosses and liverworts.

Division Pteridophyta

Pteridophytes have feather-like or pinnate fronds. Pteridophytes are **seedless vascular plants** that have sporophytic plant body. They grow well in shady areas like forests, mountain slopes and hills, specially in the tropical rainforests.

Sub-kingdom Phanerogamae

These 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. The reproductive organs are multicellular seeds and an embryo develops from a fertilized egg. It has division Spermatophyta.

Division Spermatophyta

This division is further sub-divided on the basis of presence or absence of fruits (i.e. seeds are naked or enclosed in fruits) into two sub-divisions:


Conifers


Cycas

Sub-division Gymnospermae:
(**Gymnosperms are plants with naked seeds.** They are found mostly in cold areas where snowfall occurs too often.

Sub-division Angiospermae:
Angiosperms are plants with seeds covered by 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).

Kingdom animalia

Characteristic features

- These are multicellular eukaryotic organisms.
- The cells do not contain cell wall, but contain only cell membrane.
- They are heterotrophic, i.e. they do not perform photosynthesis and depend on others for food.
- They have the power of locomotion, i.e. they are mostly motile.
- They show increased sensitivity through the nervous system

Major phyla of kingdom animalia

The kingdom Animalia is divided into two groups, namely, group Invertebrata and phylum Chordata. Invertebrata is further divided into many phyla while phylum Chordata is divided into Protochordata, Vertebrata and many classes.

KINGDOM ANIMALIA

Organisms with cellular level of organization

Phylum Porifera

Examples: Sponges (*Sycon*, *Euplectella*, etc.)

Organisms with tissue level of organization

Organisms having no body cavity between epidermis and gastrodermis (food canal)

Acoelomates

Multicellular organisms, the body of which consists of two layers of tissues (ectoderm and endoderm) with a jelly-like substance in between

Phylum Coelenterata

Examples: *Hydra*, *Obelia*

Flatworms with dorsoventrally flattened, triploblastic, bilaterally symmetrical body

Phylum Platyhelminthes

Examples: Tapeworm, liver fluke

Organisms having false body cavity, i.e. coelom not lined by mesoderm on all the sides

Pseudocoelomates

Triploblastic, parasitic animals with bilaterally symmetrical, unsegmented cylindrical body tapering at both ends

Phylum Nematoda

Examples: *Ascaris*, *Wuchereria*

Organisms with true coelom, i.e. coelom lined by mesoderm completely

Coelomates

Coelom formed from mesodermal cells from a single cell during growth of the embryo

Elongated, segmented, ringed worms; body triploblastic and contains true coelom

Phylum Annelida

Examples: Earthworm, leech

Body with jointed appendages; triploblastic, bilaterally symmetrical and segmented body

Phylum Arthopoda

Examples: Crab, butterfly

Soft body with an outer shell; triploblastic, bilaterally symmetrical body, muscular foot present for locomotion

Phylum Mollusca

Examples: *Pila*, octopus

Coelom formed from pouches pinched off from the endoderm

Notochord absent

Exclusively free living marine animals; adult forms having pentamerous symmetry

Phylum Echinodermata

Examples: Starfish, sea urchins

Notochord present

Chordata

contd.

Organisms with true coelom; notochord present

Chordata

Notochord very rudimentary; present at least at some stage of life

Sub-phylum Protochordata

Examples: *Herdmania*, *Balanoglossus*

In adult stage, notochord replaced by vertebral column

Sub-phylum Vertebrata

Body streamlined; skeleton made of bone or cartilage; body with scales; respiration through gills

Group Pisces

Examples: Rohu, sea horse

Live partly on land and partly in water; gills in larva, lungs in adults; slimy skin covered with mucus, rich in glands

Class Amphibia

Examples: Frogs, toads

Body covered with horny epidermal scales; eggs laid outside water

Class Reptilia

Examples: Tortoise, snakes, crocodile

Exoskeleton of feathers, flight capacity; eggs laid outside water

Class Aves

Examples: Pigeon, ostrich

Exoskeleton of hair, mammary glands; external ears; mostly give birth to young ones

Class Mammalia

Examples: Rat, tiger, elephant

Group invertebrata

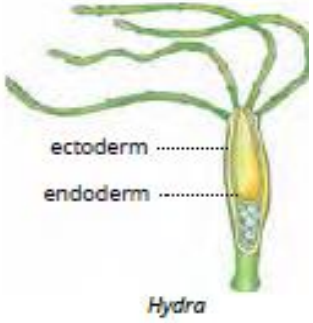
Invertebrata is a major group of the animal kingdom. The organisms belonging to this group **do not possess notochord**, hence, the term non-chordata or invertebrata.

Phylum Porifera – organisms with pores

The word ‘porifera’ means organisms with pores in the body. Phylum Porifera includes sponges. Most sponges are marine (found in oceans), although some are found in freshwaters such as lakes also.

Sycon, *Euplectella*, *Euspongia*, *Spongilla* and *Leucosolenia*

Sea anemone



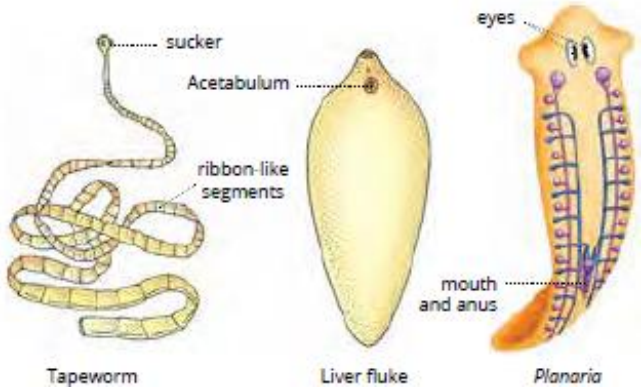
Hydra

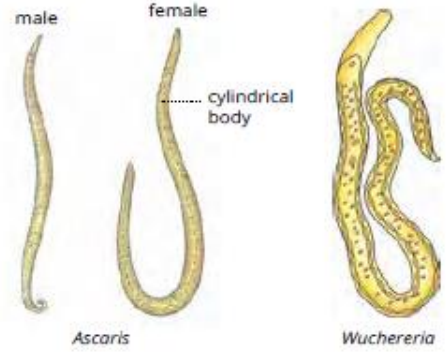
Phylum Coelenterata (Cnidaria)

Coelenterates are multicellular organisms which have tissue level of organization. Some like *Hydra* may be seen with naked eyes and can be found attached to stones or aquatic plants. The coelenterates mostly live in fresh water, in solitary or colonial forms.

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. Their bodies are dorsoventrally flattened, that is why they are called flatworms. They range from a few millimetres to a few centimetres in size.



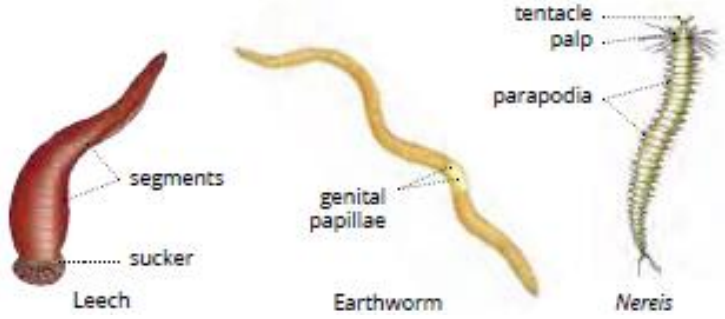


Phylum Nematoda or Aschelminthes or Nemathelminthes – the roundworm

The organisms belonging to this phylum are mostly parasites having slender, elongated bodies, tapering at each end.

Phylum Annelida – the ringed worm

Organisms belonging to phylum Annelida are worms with body appearing as if made up of a series of rings. The phylum Annelida includes earthworms, ringworms and leeches. Annelids are triploblastic animals.



Phylum Arthropoda – organisms with jointed legs

Organisms belonging to phylum Arthropoda have jointed appendages. Arthropods can be distinguished from other kind of non-chordates because arthropods are the **only animals with jointed appendages** (legs and antennae). This is the **largest invertebrate phylum**.

Insects, centipedes, millipedes, spiders are the common organisms belonging to phylum Arthropoda.

Phylum Mollusca

Phylum Mollusca includes slugs, snails and octopus. Most of the molluscans live in water. However, a relatively small number live on land also. 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.

Phylum Echinodermata – organisms with spiny skin

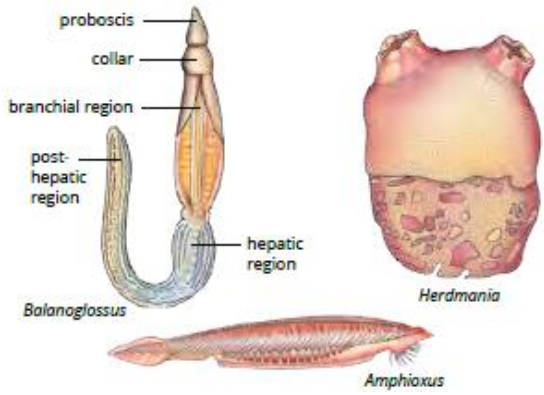
They are organisms with spiny skins. The adult forms possess pentamerous (five arms) symmetry.

Phylum chordata

Phylum chordata is categorized into sub-phylum Protochordata and Vertebrata.

Sub-Phylum Protochordata

The word ‘Protochordates’ means primitive chordates. They possess notochord at some stage of their life. Notochord 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. They are marine animals.



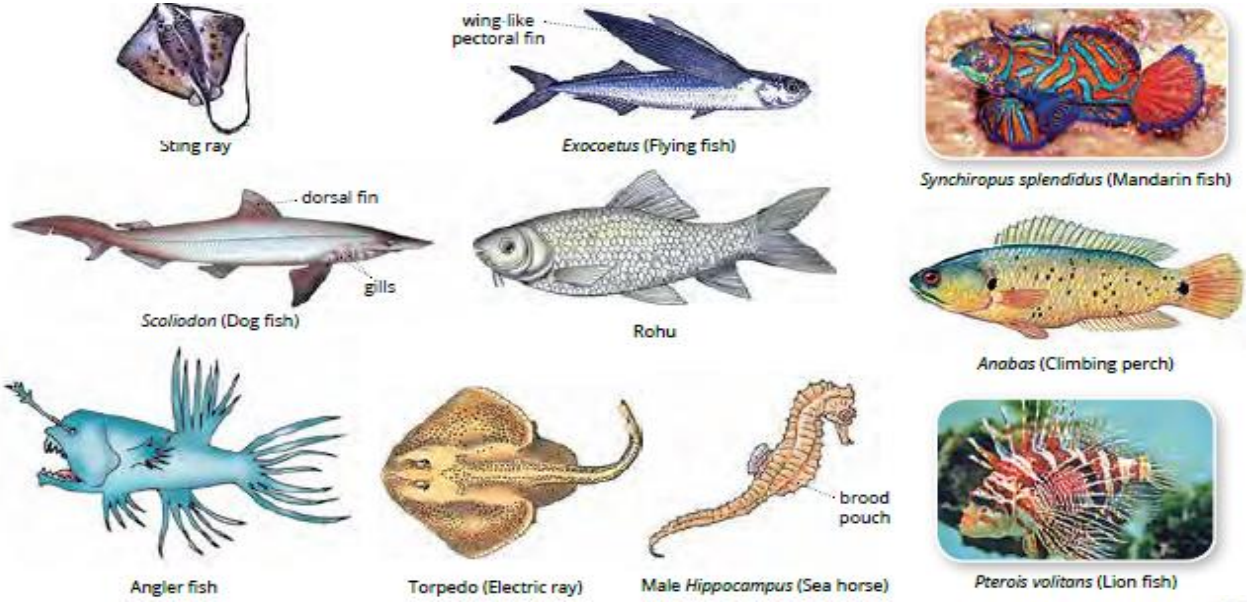
Sub-Phylum Vertebrata

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

Group Pisces (Fishes)

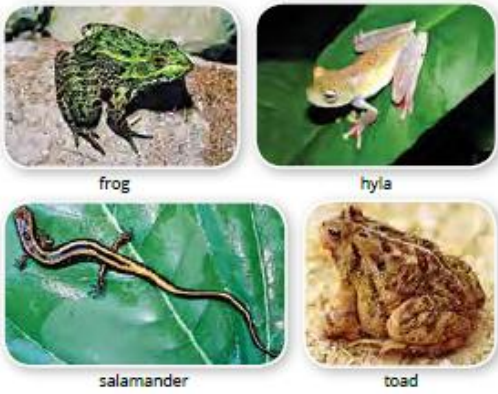
The group called fishes or Pisces contains many classes. They are all exclusively water living (aquatic) animals. Some well-known examples are **cartilaginous fishes** (such as sharks) and **bony fishes**

(such as tuna or rohu). The cartilaginous fishes belong to **Class Chondrichthyes**, and the bony fishes belong to **Class Osteichthyes** which are two important classes of Pisces.



Class Amphibia

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



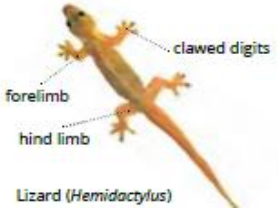

Chameleon


Crocodile


Flying lizard (*Draco*)

Tortoise

Snake



Lizard (*Hemidactylus*)

Class Reptilia

The animals belonging to class Reptilia can live solely on land and are very less dependent on water.

Class Aves

Birds have 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**

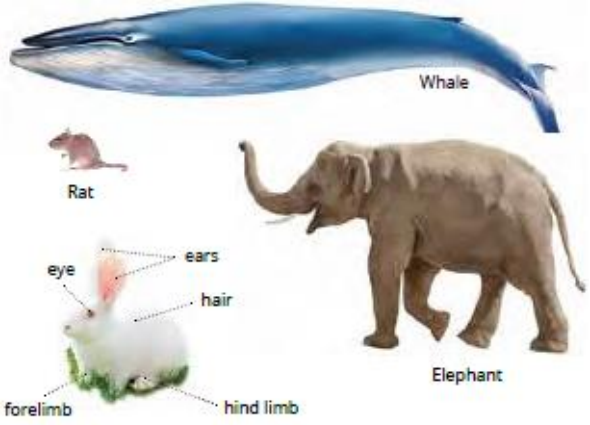

Male tufted duck


Crow


Penguin


House sparrow


White stork



External features of a rabbit

Class Mammalia

All mammals possess mammary glands, which are more developed in females than males to suckle their young ones. Like birds, mammals are also warm-blooded animals. Mammals have body covered with hairs.

SUMMARY...

- Classification means grouping organisms on the basis of their similarities and differences.
- The scientific naming of organisms is according to the Linnaeus system of binomial nomenclature.
- There are five kingdoms namely, Monera, Protoctista, Fungi, Plantae and Animalae.
- Monerans do not have a defined nucleus or cell organelles. They are prokaryotic unicellular organisms.
- 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.
- Bryophyta are amphibians of plant kingdom.

❖ 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. All animals are included in kingdom Animalia.

❖ Kingdom Animalia is divided into two groups – Non-chordata (animals without a notochord) and Chordata (animals with a notochord).

❖ Non-chordates are classified into eight major phyla namely, Porifera, Coelenterata, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca and Echinodermata.

❖ Phylum Chordata has been divided into Protochordata and Vertebrata.

❖ Sub-phylum Vertebrata has been classified into many classes namely, Pisces, Amphibia, Reptilia, Aves, and Mammalia.

❖ 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 roundworm like *Ascaris lumbricoides*.

❖ Phylum Annelida includes acoelomate, 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.

❖ 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 presence of hair on the body and mammary glands, which secrete milk.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