BIOLOGY

CLASS NOTES FOR CBSE

Chapter 03. Diversity In Living Organisms

01. Introduction

- The term **"biodiversity"** is a concise form of **"biological diversity"** and was coined by Walter G. Rosen in 1986.
- **Biodiversity** is the occurrence of diverse or varied forms of living beings which differ from one another in external appearance, size, color pattern, internal structure, nutrition, behavior, habitat etc.
- Note : Mega diversity is the high degree of mega diversity on different types of forms found in an area. The area or region of mega diversity on earth is humid tropical region lying between tropic of Cancer and tropic of Capricorn.
- The system of grouping of living forms on the basis of similarities and differences is called **classification**.
- The branch of biology concerned with classification is called **taxonomy**. Taxonomy is a biological science which deals with identification, nomenclature and classification of organisms following certain rules.

02. Purpose of Classification (Importance of classification)

- Classification makes the study of a wide variety of living organisms easier.
- Classification helps in understanding the phylogeny of organisms.
- Classification provides knowledge about the origin and genetic relationship among living beings.
- Classification forms a base for the development of other biological sciences.

03. Classification and Evolution

- Early systems of classification were artificial i.e., they were based on a few arbitrarily chosen criteria such as size, colour and nature of the organisms.
- In the 19^{th} century, the artificial systems of classification were replaced by **natural systems** of classification. The important aspects of this natural basis of classification are :
- It considers a number of characters.
- It include internal (anatomical as well as external (morphological) characters.
- It indicated overall similarities and differences between the organisms.

- It places related organisms in the same group. The classification of life forms is closely related to their evolution. The idea of evolution was first described by **Charles Darwin** in his book, the **Origin of species** in 1859.
- He explained that first formed (older) organisms were simpler, while younger organisms (modern) are more complex, i.e., complexity in design of simple forms has increased over evolutionary time and has become modern complex form.

04. Binomial Nomenclature

- Binomial nomenclature is a system of giving distinct and proper names to organisms with each name consisting of two words, generic and specific.
- Binomial nomenclature was proposed by Carolus Linnaeus (Karl von Linnaeus).

05. Hierarchy of Categories or Groups

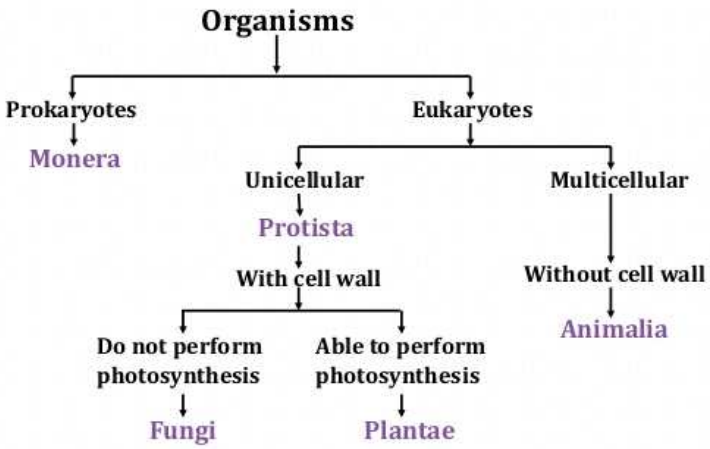
- The main aim of a taxonomic study is to assign organism an appropriate place in a systematic framework of classification. This. framework is called **taxonomic hierarchy** by which the taxonomic groups are arranged in definite order, from higher to lower categories.
- A category is called **taxon (plural taxa)**. **The taxa or categories used in the classification of animals** are kingdom, phylum, class, family, genus and species.
- **The categories used in plants** are kingdom, division, class, order, family, genus and species.

Note : Species is a group of individuals with similar morphological characters, which are able to breed among themselves and produce fertile offspring of their own kind.

06. Classification Systems

- Living organisms have been classified variously according to different criteria; however, the following two systems are most in use.

• Classification	Proposed by	Type of organisms
		(i) Plants
		(ii) Animals
		(i) Monera
		(ii) Protista
		(iii) Fungi
		(iv) Plantae
		(v) Animalia
		(i) Monera
		(a) Archaea
		(b) Eubacteria
		(ii) Prostista
		(iii) Fungi
		(iv) Plantae
		(v) Animalia



07. Two-Kingdom System of classification

- This system of classification was given by **Carolus Linnaeus** (1758). According to this system, the whole living beings are put into two kingdoms-Plant kingdom and Animal kingdom.
- Later taxonomic studies indicated that certain organisms did not fit either under Plant kingdom or Animal kingdom. Accordingly, a German zoologist, **E.H. Haeckel (1866)** raised a third kingdom Protista for unicellular organisms.

08. Five-Kingdom System of classification

- **R. H. Whittaker (1959)** has classified the living organisms into following five kingdom :
  (i) Kingdom Monera (Prokaryotic bacteria and Blue green algae)
  (ii) Kingdom Protista (Unicellular eukaryotic organisms- protozoans, fungi and algae)

(iii) **Kingdom Fungi** (Multicellular fungi)
(iv) **Kingdom Plantae** (Multicellular green plants and advanced algae)
(v) **Kingdom Animalia** (Multicellular animals)

09. Characteristics of Five-Kingdom

Kingdom Monera :

(i) The monerns are extremely small and structurally the simplest of all the living beings.
(ii) The organisms belonging to this group are simple, unicellular and microscopic. These organisms are prokaryotic.
(iii) Cell wall is present in some organisms and absent in others.
(iv) They do not possess a defined nucleus and lack cell organelles.
(v) Some organisms can synthesize their food (autotrophic), while some organisms exhibit heterotrophic mode of nutrition.
(vi) This group includes Bacteria, mycoplasma and blue-green algae.

10. Kingdom Protista

(i) This group consists of many types of unicellular eukaryotes.
(ii) They have a defined nucleus and also membrane-bound organelles.
(iii) Some of these organisms use appendages, such as hair-like cilia or whip-like flagella for moving around.
(iv) Their mode of nutrition can be autotrophic or heterotrophic.
(v) This group includes Diatoms, protozoans and unicellular algae.

11. Kingdom Fungi

(i) Fungi are simple, eukaryotic non-green (lacking chlorophyll) organisms.
(ii) Cell wall is present. It is made up of a tough complex sugar called chitin.
(iii) They are non-photosyntheit. The mode of nutrition is heterophic. Most of then use dead and decaying organic matter as food and are therefore called saprophytes. Some of them are parasitic.
(iv) Some fungal species live in permanent mutually dependent relationships with blue-green algae (or cyanobacteria). Such relationships are called symbiotic. These symbiotic life forms are lichens.
(v) Most fungi are multicellular. Yeast is a unicellular fungus.
(vi) This group includes Mucus, Penicillium, yeast etc.

12. Kingdom Plantae

(i) This group consists of multicellular eukaryotic organisms.
(i) They are autotrophs and use chlorophyll for photosynthesis.
(ii) They possess a cell wall made of cellulose.
(iii) Kingdom Plantae is further classified as Thallophyta, Bryophyta, Pteridophyta, Gymnosperms and Angiosperms.
(iv) This group includes all photosynthetic plants.

13. Kingdom Animalia

(i) This group consists of all multicellular eukaryotes which do not possess a cell wall.
(v) These organisms are heterotrophic.
(vi) Cell wall is absent.
(vii) Kingdom Animalia is further classified as Porifera, Coelenterata, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca, Echinodermata, Protochordata and Vertebrata.
(viii) This group includes all animals.

	Monera	Prostista	Fungi	Plantae	Animal
Organization inside the cells	Consists of Prokaryotes.	Eukaryotes–some of them use appendages to move araound such as flagella (whip-like structure) and Cilia (hair-like structure)	Eukaryotes	Eukaryotes	Eukaryotes
Organization of cells in the body	Unicellular	Unicellular	Initially unicellular. Can become multicellular in later stages of life	Multicellular	Multicellular
Organisms obtain their food	Some of them are autotrophs like blue green algae while others are heterotrophs	Both autotrophs and heterotrophs	Heterotrophs. Most of them are decomposers or may be parasitic.	Autotrophs	Heterotrophs

Presence of cell wall	Some lack a cell wall while others have a cell wall	Only some have cell wall	Have cell walls. They are made up of complex sugar called chitin.	Have cell walls made of cellulose.	No cell walls
Example	Blue-green algae, Bacteria, Mycoplasma	Protozoan, Diatoms and Golden algae	Yeast and Mushroom (Agaricus), Rhizopus (Bread mould), Pencillium	Flowering plants, moss	Insects, reptiles

14. Plant Kingdom (Plantae)

The plant kingdom has been divided into two sub-kingdoms- Cryptogamae and Phanerogamae.

15. Cryptogamae: Cryptogams includes seedless and flowerless plants. These plants reproduce by producing spores

It includes three divisions : Thallophyta, Bryophyta and Pteridophyta.

Thallophyta

- Most primitive and simple plants. The body is not differentiated into stem, root and leaves, but it is in the form of an undivided thallus.
- They do not possess a vascular system.
- The mode of nutrition is either photosynthetic (autotrophic) or heterotrophic.
- They reproduce both asexually and sexually. Asexual reproduction is generally takes place by spore formation.
- Sex organs are simple, single celled and there is no embryo formation after fertilization.

  Examples : Green algae- Spirogyra, Chara etc.

16. Phanerogamae: Phanerogamae includes higher pants bearing flowers and seeds

On the basis of presence and absence of fruits, the sub-kingdom phanerogamai is divided into two sub-divisions: Gymnosperms and Angiosperms.

Gymnosperms

- They are most primitive and simple seed plants.
- The seed produced by these plants are naked and are not enclosed within fruits.
- Usually perennial, evergreen and woody plants. they do not have flowers.

  Examples : Conifers-Pines, Firs and Cycades - Cycas etc.

Angiosperms

- They are highly evolved plants and they produce seed that are enclosed within fruits.
- These are also called flowering plants.
- Plant embryos in seeds have structures called cotyledons. Cotyledons are called 'seed leave' because in many causes they emerge and become green when the seed germinates.
- On the basis of number of cotyledons, angiosperms have further divided into two groups.
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- Dicotyledons (plants with seed having two cotyledons) examples- pea and potato.

17. Animal Kingdom (Animalia)

(i) Diversity of habitat	Aquatic, terrestrial, aerial, arboreal.
(ii) Diversity of habit	Free-living, parasitic, symbionts, saprophytic.
(iii) Diversity in level of organization	Cellular level, tissue level, organ level, system level.
(iv) Diversity of body symmetry	Asymmetry, radial symmetry, bilateral symmetry.
(v) Body cavity or coelom	Acoelomate, pseudocoelomate, coelomate.
(vi) Body temperature	Cold-blooded, warm-blooded.
(vii) Diversity in body support system	I Skeleton, digestive system, respiratory system, circulatory system and nervous system.
(viii) Diversity in reproduction	Asexual, sexual (oviparous, viviparous).

18. Phylum- Porifera

- They are non-motile animals attached to some solid support.
- Porifera means organisms with holes or pores all over the body. These lead to a canal system that helps in circulating water throughout the body to bring in food, water and oxygen.
- They are multicellular, diploblastic, radial symmetrical or asymmetrical organisms exhibiting cellular level of organization.
- These animals are covered with a hard outside layer or skeleton.
- They are commonly called sponges and are mainly found in marine habitats.

  Examples : Sycon, Spongilla.

19. Phylum- Coelenterate (Cnidaria)

- Coelenterates are primitive, multicellular, aquatic animals. Their cells are organized into tissues.
- They are diploblastic. Body shows radial symmetry.
- Body contains a large cavity called coelenterons or gastrovascular cavity.
- Body bears special cells called nematocysts for defence, offence and to capture food.
- Some of them live solitary life, e.g., Hydra while some live in colonies, e.g., corals.

Examples : Jellyfish, Sea anemone etc.

☞ **Note :** Coelenterates exist in two forms- an asexual polyp form and a sexual medusoid form.

19. Phylum- Platyhelminthes

- They are bilaterally symmetrical, dorsiventrally flattened animals, commonly called flat worms.
- They are triploblastic animals. They are without a body cavity.
- Body is soft, leaf-life (liver fluke) or ribbon-like (tapeworm).
- Excretory organs are in the form of flame cells. Digestive cavity (when present) with a single opening, the mouth (anus is absent).
- Mostly parasitic (e.g. Tapeworm) but some are free-living forms (e.g. Planaria).
- Mostly hermaphrodite, i.e., both male and female reproductive organs occur in the same individual.

Examples : Liver fluke, Planaria, Beef tapeworm.

20. Phylum- Nematoda

- Aquatic (freshwater or marine), terrestrial or parasitic forms, commonly called roundworm.
- Bilaterally symmetrical, triploblastic, unsegmented and pseudocoelomate (false coelom) animals.
- Body elongated, cylindrical, slender and tapering at the two ends.
- Straight alimentary canal with mouth and anus.
- Reproduce sexually, sexes are separate, fertilization internal.

Examples : Liver fluke, Planaria, Beef tapeworm.

☞ **Note :** Parasitic nematodes are pathogenic, meaning they produce disease in the hosts. For example, elephantiasis.

21. Phylum- Annelida

- Body triploblastic, bilaterally symmetrical, soft, elongated, vermiform and cylindrical.
- Body metamerically segmented, i.e. divisible into more or less similar segments.
- True coelom present, which is divided into segments by internal septum.
- Locomotory organs are setaeor parapodia.
- Excretory organs are nephridia. Circulatory system is of closed type.
- Reproduction is by sexual means. Sexes may be united (hermaphrodite) or separate.
- Mostly aquatic, marine or freshwater, some are terrestrial, burrowing in tubes, some free-living forms.

Examples : Earthworm, Indian cattle leech.

22. Phylum Arthropoda

- Triploblastic, bilaterally symmetrical, coelomate, metamerically segmented body.
- There is an open circulatory system, so the blood does not flow in well-defined blood vessels. The coelomic cavity is blood-filled.
- They have joined legs.
- Excretory organs are malpighian tubules, coxal or green glands.
- Sexes are usually separate, sexual dimorphism well marked in several forms.
- Terrestrial or aquatic, free living or parasitic.
- Arthropoda probably forms the largest phylum of animal kingdom.

Examples : Prawn, Spider, Cockroach.

Phylum-Mollusca

- Marine, freshwater and terrestrial forms.
- Body is soft, bilaterally symmetrical, triploblastic and unsegmented.
- Body cavity is haemocoel. Open type of circulatory system.
- Excretion by a pair of metanephridia or kidney.
- Sexes are usually separate.
- There is a foot that is used for moving around.

Examples : Snails and Mussels.

Phylum-Echinodermata

- All members of this phylum are marine, free-living, having a spiny body surface.
- The body is triploblastic, coelomate, unsegmented and radially symmetrical.
- Body wall is covered by spiny hard calcareous (calcium carbonate) plates (ossicle) forming a rigid or flexible endoskeleton.
- Body cavity is modified into a unique water vascular system which moves respiratory and locomotory organs, the tube feet or podia.

- Excretory organs absent.
- Reproduction sexual, asexual or by regeneration. Sexes are separate.

Examples : Starfish, Sea urchins etc.

Phylum-Chordata

Chordates are characterized by :

- Bilaterally symmetrical, triploblastic, coelomate animals inhabiting all types of habitat.
- A dorsal hollow tubular nerve cord is present.
- Presence of notochord lying ventral to nerve cord. In higher forms, notochord transformed into vertebral column.
- Presence of paired gill slits in the throat called pharyngeal clefts.

Phylum chordate is divided into two groups

(i) Protochordata (Acrania)
(ii) Vertebrata (Craniata)

Protochordata

- Notochord is present only on the tail of free-living tadpole-like larva, sessile adult has no notochord.
- The notochord is a rod-like support structure that runs along the back of the animal separating the nervous tissue from the gut. It provides a place for muscles to attach for ease of movement.
- Protochordates may not have a proper notochord present at all stages in their lives or for entire length of the animal.
- Exclusively marine, solitary and colonical.

Examples : Herdmania, Salpa etc.

23. Vertebrata

- Vertebral column is present.
- Brain is present inside the brain-box called cranium.
- Vertebrates are triploblastic, bilaterally symmetrical, coelomic and segmented with complex differentiation of body tissues and organs.

Vertebrates are grouped into five classes :

Class I

(i) **Pisces :**

These are fishes and aquatic animals.
Streamlined body. Locomotory organs are fins.
Cold-blooded animals.
Heart is two-chambered with single circulation.

Gills are present which help in obtaining oxygen dissolved in water.
Skeletons of some fish are made up of only cartilade (Sharks). Others have skeleton made of both cartilage and bone (Tuna or Rohu).
Sexes are separate. They lay eggs.
Examples : Tuna, Sharks etc.

(ii) **Amphibia**
- They are adapted to live both on land and water.
- Respiration is through either gills or lungs.
- Three-chambered heart is present.

Examples : Frogs, Toads, Salamander

(iii) **Reptilia**
- These are crawling animals.
- Skin is rough and modified to withstand extreme temperatures.
- Heart is three chambered in most, while four chambered in crocodiles.
- Cold-blooded animals.

Examples : Lizards, Turtles, Snakes

(iv) **Aves**
- Body is covered with feathers and forelimbs are modified for flying.
- Breathing through lungs.
- Warms blooded animals.
- Four-chambered heart is present.

Examples : Sparrow, Eagle, Crow, Parrot

(v) **Mammalia**
- Mammary glands are present which produce milk to nurture young ones.
- Skin is covered with hairs and has sweat glands and sebaceous glands.
- Warm-blooded animals with four-chambered heart.
- Most animals are viviparous (giving birth to live young ones), some are oviparous (producing eggs).

Examples : Man, Horse, Kangaroo, Lion

CBSE Pattern
Exercise (1)

(Q 1 to 3) One Mark

1. Name one basic characteristic for classifying organisms.

2. What was the modification introduced by Woese in kingdom Monera ?

3. Define the term hermaphrodite. Give one example

(Q 4 to 6) Two Marks

4. What are species ? State in terms of
   (i) hierarchy of classifications and
   (ii) in relation to reproduction.

5. Differentiate between Bryophyta and Pteridophyta. Give one example of each.

6. What is meant by warm-blooded and cold-blooded animals ? Explain.

(Q 7 to 8) Three Marks

7. Explain the following terms:
   (i) Bilateral symmetry,
   (ii) Triploblastic animals and
   (iii) Open circulatory system.

8. How are pteridophytes different from the phanerogams?

(Q 9 to 10) Five Marks

9. X, Y and Z are living organisms.
   (a) Identify the group to which they belong on the basis of following features.
      (i) X — Microscopic, unicellular, prokaryotic.
      (ii) Y — Microscopic, unicellular, eukaryotic, and shows locomotion with the help of pseudopodia/flagella.
      (iii) Z — Multicellular, filamentous, eukaryotic, autotrophic and aquatic.
   (b) Which amongst the above is most advanced ?
   (c) Name one organism each belonging to the groups of X, Y and Z.

10.
   (a) Identify three features possessed by all chordates.
   (b) Name the classes of vertebrates which have the following characteristics:
      (i) Animals that have streamlined body and gills for breathing.
      (ii) Animals that are found both on land and in water.
      (iii) Animals that have mammary glands for the production of milk to nourish their young ones.

ANSWER

Q1. Cell structure.

Q2. Carl Woese modified the Kingdom Monera by dividing it into Archae-bacteria and Eubacteria.

Q3. A hermaphrodite is an organism that has both male and female genitalia.
Example: Earthworm

Q4.
(a) Hierarchy of classification: Species is the lowermost category in the hierarchy of classification of groups of organisms.
(b) In relation to reproduction : A species includes all organisms that are similar enough to breed and perpetuate.

Q5.

Bryophyta	Pteridophyta
• True roots, stem and leaves are not present.	• True roots, steam and leaves are present
• Does not have specialised vascular tissue.	• Has vascular tissues which conduct water and other substances.
• Example: Marchanitia, Moss.	• Example: Fern, Marsilea.

Q6. Warm-blooded animals have a relatively higher blood temperature and can maintain the constant internal body temperature through metabolic processes. Mammals and birds are warm-blooded animals.
Cold-blooded animals like reptiles, amphibians and fish continuously change their body temperature with change in the temperature of the environment.

Q7.
(i) Bilateral symmetry : It means that the left and right halves of the body have the same design. It is fourid in Platyhelminthes.
(ii) Triploblastic animals : In triploblastic animals, there are three layers of cells from which differentiated tissues can be made.
(iii) Open circulatory system : In open circulatory system, blood does not flow in well defined blood vessels. Blood is pumped by a heart into the body cavities, where tissues are surrounded by the blood.

Q8.

Pteridophytes	Phanerogams
• They are commonly known as '*cryptogamae*'.	• This group includes *gymnosperms* and angiosperms.
• They have hidden reproductive organs.	• They have well differentiated reproductive tissues.
• They have naked embryos.	• They consists of the embryo along with stored food that are called '*seeds*'

Q9.

(a)

(i) Monera, (ii) Protista, (iii) Plantae (Thallophyta)

(b) Fungi are most advanced organisms as compared to Protista and Monera.

(c) X — Bacteria
Y — Amoeba
Z —Spirogyra

Q10.

(a) Features of chordates:

- They have notochord.
- They have a dorsal hollow nerve chord.
- They are triploblastic.
- They have paired gill pouches.
- They are coelomate.

(b)

- Pisces
- Amphibians
- Mammals.