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According to the Latest Syllabus

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BIOLOGY

Class-11 (Part-I)

For the Students of Rajasthan Board of Secondary Education

By

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Preface

We are extremely pleased to present this book according to latest syllabus of NCERT. The book has been written in easy and simple language so that students may assimilate the subject easily. We hope that students will get benefitted from it and teachers will appreciate our efforts. In comparison to other books available in market, this book has many such features which make it a unique book :

1. Theoretical subject-material is given in adequate and accurate description along with pictures.
2. The latest syllabus of NCERT is followed thoroughly.
3. Complete solutions of all the questions given at the end of the chapter in the textbook are given in easy language.
4. Topic wise summary is also given in each chapter for the revision of the chapter.
5. In every chapter, all types of questions that can be asked in the exam (Objective, Fill in the blanks, Very short, Short, Numerical and Long answer type questions) are given.
6. At the end of every chapter, multiple choice questions asked in various competitive exams are also given with solutions.

Valuable suggestions received from subject experts, teachers and students have also been given appropriate place in the book.

We wholeheartedly bow to the Almighty God, whose continuous inspiration and blessings have made the writing of this book possible.

We express our heartfelt gratitude to the publisher – Mr. Pradeep Mittal and Manoj Mittal of Sanjiv Prakashan, all their staff, laser type center and printer for publishing this book in an attractive format on time and making it reach the hands of the students.

Although utmost care has been taken in publishing the book, human errors are still possible, hence, valuable suggestions are always welcome to make the book more useful.

In anticipation of cooperation!

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Contents

Unit I : Diversity in The Living World

- | | |
|------------------------------|-------|
| 1. The Living World | 1-12 |
| 2. Biological Classification | 13-32 |
| 3. Plant Kingdom | 33-52 |
| 4. Animal Kingdom | 53-93 |

Unit II : Structural Organisation in Plants and Animals

- | | |
|---------------------------------------|---------|
| 5. Morphology of Flowering Plants | 94-115 |
| 6. Anatomy of Flowering Plants | 116-133 |
| 7. Structural Organisation in Animals | 134-150 |

Unit III : Cell : Structure and Functions

- | | |
|----------------------------------|---------|
| 8. Cell : The Unit of Life | 151-186 |
| 9. Biomolecules | 187-209 |
| 10. Cell Cycle and Cell Division | 210-228 |

Biology (Class-11)

Unit-1 : Diversity in the Living World

CHAPTER

1

THE LIVING WORLD

Chapter Overview

- 1.1 Diversity in the Living World
- 1.2 Taxonomic Categories
 - 1.2.1 Species
 - 1.2.2 Genus
 - 1.2.3 Family
 - 1.2.4 Order
 - 1.2.5 Class
 - 1.2.6 Phylum
 - 1.2.7 Kingdom

Introduction : Living organisms are studied under Biology. The word Biology is made up of the Greek words Bios = Life and Logos = to study. Aristotle is the father of biology and this term was coined by Lamarck and Treviranus (1802).

Living beings are found in various habitats on earth. Such as forests, mountains, rivers, waterfalls, oceans,

ponds and other extraordinary habitats like saline lakes, hot springs, cold mountains, poles etc., creatures also live in them. Despite all this, there are basic similarities among all living beings.

In this chapter we will study the characteristics of living beings.

1.1 Diversity in the Living World

There are innumerable different species of plants and animals in the world. We can see many of these with our eyes but many are so minute that they cannot be seen without a microscope. Thus, the presence of innumerable animals on earth is called biodiversity. It is estimated that more than 1.7 million living beings exist on Earth. There are still many creatures that remain to be discovered. Usually we know the names of these creatures in the local language. Not only this, the same plant is known by different names in different states of India. Hence, this creates confusion and the organism cannot be identified correctly.

We need to develop this type of method which gives the name of organisms at scientific level and that organism has the same name in every country and state of the world.

Every organism has a standard name, it is known by that name in the world. This process is called nomenclature. Naming system is possible only when we identify that organism on the basis of correct description. Scientists made efforts to identify and name living organisms. Scientists have formed committees such as International Code of Botanical Nomenclature (ICBN) for naming and identification of plants and International Code of Zoological Nomenclature (ICZN)

for naming and identification of animals. The scientific name of any organism given by them is accepted all over the world. Binomial nomenclature is used for naming organisms. The credit for providing the binomial system of nomenclature is given to Carolus Linnaeus of Sweden. He used this method in his book 'Species Plantarum'. Actually, the binomial system was propounded by Gaspard Bauhin in his book 'Pinax' but he could not popularise it. For this reason, the credit goes to Carolus Linnaeus and he is considered the father of modern taxonomy. In this system there is a combination of two names—first, of genus and second, of species. For example, the scientific name of mango is *Mangifera indica*. In this, *Mangifera* is the genus name while *indica* is the species name.

Other rules of this method are as follows :

- (i) The name of each organism should be given in two words. The first word in the biological name is the genus name while the second word is the species name.
- (ii) In the name of every organism, the name of the genus should be written with a capital letter and the name of the species should be written with a small letter.
- (iii) Biological names are usually in Latin language.
- (iv) Handwritten biological names should always be underlined and printed names should always be written in italics.
- (v) Only the name of any organism given for the first time is valid.
- (vi) In the biological name, the name of the author is written in brief at the end of the species. Like the biological name of banyan is *Ficus bengalensis* Linn. Here Linn means that the species was first described by Linnaeus.

After naming all types of organisms, a problem arises as to how these innumerable organisms should be studied. Therefore, classification was made the basis for studying organisms systematically.

Taxonomy : The branch of biology under which organisms are classified is called taxonomy. Grouping all living organisms on the basis of their similarities and differences is called classification. Aristotle is called the father of taxonomy. The word taxonomy was first used by A.P. De Candolle. The word systematics was first used by Carolus Linnaeus in his book 'Systema Naturae'.

The purpose of biological classification is to organise known organisms into such categories that they can be named, identified and studied. As a result, by studying one organism of that class, the characteristics of the remaining organisms can be inferred. For example, if we see a dog, then on the basis of identification we call it a dog and not a cat because the signs of identification of both are different. Every living being belongs to some category or the other. These are called 'Taxa'. Dog, cat, wheat, rice are all taxa.

For a long time, humans have been taking interest in knowing about different types of living beings and their relationships including their diversity. This branch of study is called classification system.

The word systematics is derived from the Greek word 'Systemae' which means to put together or group. Some scientists consider taxonomy and systematics as synonymous, but in reality these are two different scientific terms. While taxonomy is the systematic study of living organisms and their classification, taxonomy is not only the study of living organisms but also the study of their mutual relationships.

1.2 Taxonomic Categories

There is a hierarchy of steps in classification. In which each step represents a rank or category. Since a category is a part of the entire taxonomic system, it is called a taxonomic category and all the categories together form a taxonomic hierarchy. Each category represents a unit of classification. In fact, it represents a rank and is often called a taxon. Taxonomic categories and hierarchy can be illustrated by an example. Insects represent a group of organisms sharing common features like three pairs of jointed legs. It means insects are recognisable concrete objects which can be classified, and thus were given a rank or category.

As a result of the study of all known organisms, general categories like Kingdom, Phylum, Class, Order, Family, Genus and Species have been developed.

Species category is the lowest among plants and animals.

1.2.1 Species

Those classes of living beings which have fundamental similarity are called species. We can differentiate any species from its related species on the basis of their morphological differences. It is the smallest category of classification and is the basic unit of classification. A species is a group of organisms that can reproduce with each other and produce

viable offspring. For example, in the three names *Mangifera indica* (mango), *Solanum tuberosum* (potato) and *Panthera leo* (lion) etc., the species designations are *indica*, *tuberosum* and *leo*. While the first words *Mangifera*, *Solanum* and *Panthera* are the names of genera. There may be one or more species in the same genus and they are similar in morphological characters. For example, in the *Solanum* genus, there are also *nigrum* and *melogena* species. The human race is *sapiens* and comes in the *Homo* genus. Hence the scientific name of human is *Homo sapiens*.

1.2.2 Genus

A genus is a class of related species in which the characteristics of the species are similar compared to the species in other genus. It can also be said that genus is a group of closely related species. For example, potato, tomato and brinjal, all these are different species, but they all come under the *Solanum* genus. Similarly, Lion, Tiger and Leopard, which are similar in many characteristics, all of them come in the *Panthera* genus.

1.2.3 Family

This is a group of related genera with still less number of similarities as compared to genus and species. Families are characterised on the basis of both vegetative and reproductive features of plant species. Among plants for example, three different genera *Solanum*, *Petunia* and *Datura* are placed in the family Solanaceae. Among animals for example, genus *Panthera*, comprising lion, tiger, leopard is put along with genus, *Felis* (cats) in the family Felidae. Similarly, if you observe the features of a cat and a dog, you will find some similarities and some differences as well. They are separated into two different families – Felidae and Canidae, respectively.

1.2.4 Order

An order is formed from a group of related family. Order is a higher taxonomic category. It is identified on the basis of aggregates of characters. Order being a higher category, is the assemblage of families which exhibit a few similar characters. The similar characters are less in number as compared to different genera included in a family. Plant families like *Convolvulaceae*, *Solanaceae* are included in the order *Polymoniales* mainly based on the floral characters. The animal order, Carnivora, includes families like *Felidae* and *Canidae*.

1.2.5 Class

This category includes related orders. For example, order *Primata* comprising monkey, gorilla and gibbon is placed in class *Mammalia* along with order Carnivora that includes animals like tiger, cat and dog. Class *Mammalia* has other orders also.

1.2.6 Phylum

A group of different related classes is called a phylum. Various classes in which animals like fish, amphibians, reptiles, birds and mammals all together form phylum. Some common characteristics are found in all of them, like notochord, dorsal hollow nervous system, on the basis of which they have been placed in the phylum Chordata. In plants, classes with some similar characteristics have been placed in a higher category which is called Division.

1.2.7 Kingdom

All animals belonging to various phyla are assigned to the highest category called Kingdom Animalia in the classification system of animals. The Kingdom Plantae, on the other hand, is distinct, and comprises all plants from various divisions. Thus, the two highest categories in taxonomy are the animal kingdom and the plant kingdom.

The taxonomic categories mentioned above can be arranged in an ascending hierarchy (Fig. 1.1). This type of classification is called hierarchical classification. Carolus Linnaeus first proposed this type of classification. In this, the smallest category is species and the largest category is kingdom. If we look carefully at the hierarchy, as we move up from species to kingdom, the number of common characteristics gradually decrease. Taxonomists have also developed sub-categories in this hierarchy to facilitate more sound and scientific placement of various taxa.

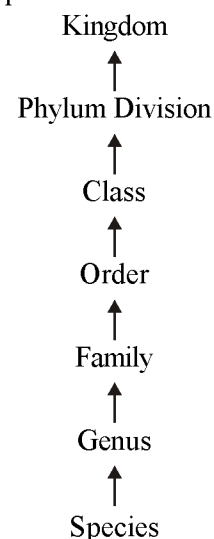


Fig. 1.1 : Taxonomic categories showing hierarchical arrangement in ascending order

According to the International Code of Botanical Nomenclature (ICBN), different terms of classification or taxa have suffixes.

Table 1.1

Category	Suffix
Division	phyla
Sub-division	phytina
Class	opsida, phyceae
Sub-class	opsidae
Order	ales
Sub-order	ineae
Family	aceae
Sub-family	oideae

Table 1.2

Different taxonomic categories of some common organisms

Common Name	Biological Name	Genus	Family	Order	Class	Phylum/ Division
Man	<i>Homo sapiens</i>	<i>Homo</i>	Hominidae	Primata	Mammalia	Chordata
Housefly	<i>Musca domestica</i>	<i>Musca</i>	Muscidae	Diptera	Insecta	Arthropoda
Mango	<i>Mangifera indica</i>	<i>Mangifera</i>	Anacardiaceae	Sapindales	Dicotyledonae	Angiospermae
Wheat	<i>Triticum aestivum</i>	<i>Triticum</i>	Poaceae	Poales	Monocotyledonae	Angiospermae

SUMMARY

- **Diversity of organisms** : To make the study of their varieties convenient and simple, biologists propounded some rules and principles which would make identification of organisms, their nomenclature and classification possible.
- **Naming System** : Every organism has a standard name, by which it is known all over the world. This process is called nomenclature.
- For plants, scientific names are based on agreed principles and criteria, which are provided in International Code for Botanical Nomenclature (ICBN). Animal taxonomists have evolved International Code of Zoological Nomenclature (ICZN).
- **Binomial nomenclature system** : Every name has two components – (i) generic name (ii) specific epithet. This system in which two names have two components is called binomial system. This system was suggested by Carolus Linnaeus. Example : *Mangifera indica*.
- Taking similarity and difference as the basis, every organism has been identified and given binomial name. In binomial, the name of each organism consists of two words, genus and species.
- There are many categories in taxonomy which are called categories or taxa. All these categories form a taxonomic hierarchy.

- The universal rules of nomenclature are as follows :
 - (i) Biological names are generally in Latin and written in italics. They are Latinised or derived from Latin irrespective of their origin.
 - (ii) The first word in a biological name represents the genus while the second component denotes the specific epithet.
 - (iii) Both the words in a biological name, when handwritten, are separately underlined, or printed in italics to indicate their Latin origin.
 - (iv) The first word denoting the genus starts with a capital letter while the specific epithet starts with a small letter.
- **Taxonomy** : It is the branch of biology which includes the classification of animals. The study of classification and naming of plants is called taxonomy.
- **Classification** : The method of placing living organisms into different groups and classes on the basis of their similarities and differences is called classification.
- **The order of classification** : The terms used to classify animals is divided into different levels. These levels are placed in a certain order. This is called Hierarchical Classification. This order is as follows—Kingdom, Phylum or Division, Class, Order, Family, Genus, Species.