

APPOLO STUDY CENTRE

**LIFE SCIENCE
TEST - 7 Part - 1**

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6TH TERM 1
Unit 4 The Living World of Plants

Introduction

Biology is a natural science concerned with the study of life and living organisms, including their structure and functions. The living world comprises of plants and animals. Plants can prepare food itself, grow in size, and reproduce. Various parts of the plants are used as food, medicine, wood, and shelter.

Plant forms and functions:

Our body is made up of many organs. Similarly the plant body is also made up of several organs such as root, stem leaves and flowers. Plants are of many forms and many colours, yet they are alike in some manner. That is, they all have stems and leaves above the ground which we can see easily and roots below the ground.

As shown in the picture, a flowering plant consists of two main parts. They are,

1. Root system.
2. Shoot system

Let us learn about these in detail.

1.Root system

Root

The underground part of the main axis of a plant is known as root. It lies below the surface of the soil. Root has no nodes and internodes. It has a root cap at the tip. A tuft of root hairs is found just above the root tip. Roots are positively geotropic in nature. Plants root system is classified into two types.

1. Tap root system
2. Fibrous root system

Tap root system	Fibrous root system
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It consists of a single root, called taproot, which grows straight down into the ground. Smaller roots, called lateral roots arise from the taproot. They are seen in dicotyledonous plants.

Example: Bean, Mango, Neem.

2. Fibrous root system

It consists of a cluster of roots arising from the base of the stem. They are thin and uniform in size. It is generally seen in monocotyledonous plants. Example: Grass, Paddy, Maize.

Functions of the Root

- Fixes the plant to the soil.
- Absorbs water and minerals from the soil.
- Stores food in some plants like Carrot and beet root.

2. Shoot system

Stem

The aerial part of the plant body above the ground is known as the shoot system. Main axis of the shoot system is called the stem. The shoot system consists of stem, leaves, flowers and fruits. Stem grows above the soil, and it grows towards the sunlight. It has nodes and internodes. Nodes are the parts of stem, where leaf arises. The part of the stem between two successive nodes is called internode. The bud at the tip of the stem is known as apical or terminal bud, and the buds at the axils of the leaves are called auxiliary buds.

Functions of the stem

The stem,

- Supports the branches, leaves, flowers and fruits.
- Transports water and minerals from roots to upper aerial plant parts.
- Transports the prepared food from leaves to other parts through stem.
- Stores food as in the case of sugarcane.

Structure of a leaf

The leaf is a green, flat expanded structure borne on the stem at the node.

A leaf has a stalk called petiole. The flat portion of the leaf is called leaf lamina or leaf blade. On the lamina, there is a main vein called midrib. Other veins are branch out from mid rib. The portion of the leaf connected in the nodal region of the stem is known as the leaf base. Leaves of some plants possess a pair of lateral outgrowth on the base, on either side of auxiliary bud. These are called stipules.

The green colour of the leaf is due to the presence of green coloured pigment called chlorophyll. On the lower side of the leaf there are tiny pores or openings known as stomata.

Functions of the leaf

The green leaves

- Prepare food by the process of photosynthesis.
- Helps in respiration.
- Carry out transpiration.

Victoria amazonica, the leaves of this plant grow up to 3 metres across. A mature Victoria leaf can support an evenly distributed Load of 45 Kilograms or apparently young person.

How do we classify the plants?

1. Based on flower: Plants can be classified into two main groups. Flowering plants and Non-flowering plants.

Sun Flower - Flowering Plant	Riccia - Non Flowering Plant
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2. Based on position of seed: Plants can be divided into two groups. Angiosperms. and Gymnosperms

Mango Angiosperm	-	Cycas-Gymnosperm
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Each and every organism needs a place to live and reproduce. Such a dwelling place is called habitat. From the depths of the ocean to the top of the highest mountain, habitats are places where plants and animals live.

Types of Habitat

Let us study the two major types of habitat with the help of following:

Types of habitat	
Terrestrial	Aquatic
Desert (Driest places on earth)	Fresh Water 1. Rivers 2. Lakes 3. Pools 4. Ponds
Grasslands (Areas where vegetation is dominated by grasses)	Marine

Mountains

(Large land form that stretches above the surrounding land)

I. Aquatic habitat

When we visit a pond, we see some plants appear to float on water. One of the common plants is the lotus plant. Its leaves float on the water. There is a small frog sitting on a leaf. It is ready to catch the insects flying/fluttering around the flowers. The stem of the plant is seen to be inside (submerged) the water. Its roots are found within the muddy floor of the pond. As this plant grows in water, shall we call it an aquatic plant?

Aquatic habitat includes areas that are permanently covered by water and surrounding areas that are occasionally covered by water. There are two types namely Fresh water habitat and Marine water habitat.

Nile is the longest river in the world. It is 6650 Km long. The Longest river in India is Ganges River. It is 2525 Km long.

I. a. Fresh water Habitat:-

Rivers, lakes, ponds and pools are the fresh water habitat. Water hyacinth, water lily and lotus are seen in the fresh water habitat. In these plants roots are very much reduced in size. Stem and leaves have air chambers that allow aquatic plants to float in water.

Air spaces in stems and petioles of lotus are useful for floating in water

b. Marine water habitat:-

From outer space earth looks like an awesome blue marble, That's because most of earth's surface, more than 70% is covered by oceans. Oceans also support the growth of plants. Marine plants perform about 40% of all photosynthesis that occurs on the planet. Example: Marine Algae, Sea grasses, Marsh grass, Phytoplanktons.

II. Terrestrial habitat:

Terrestrial habitats are the ones that are found on land like forest, grassland and desert. It also includes man-made habitats like farms, towns and cities. They can be as big as a continent or as small as an island. They make up about 28% of the entire world habitat Example : Rubber tree, teak tree and Neem tree.

- ❖ The first land plants appeared around 470 million years ago. They were mosses and liverworts.
- ❖ The Amazon Rain Forest in South America produces half of the world's oxygen supply.

Terrestrial habitat is classified into three types such as

- a. Desert b. Grassland c. Forest

a. Desert habitat

A habitat without much water is called deserts. Deserts are the driest place on earth; they get fewer than 25cm of rainfall annually. Deserts cover at least 20% of the earth. The plants which grow in this habitat have thick leaves that store water and minerals. The plants like cactus store water in their stem and the leaves are reduced to spines. They have long roots that go very deep in the soil in the search of water.

Types: (i) Hot dry deserts, (ii) Semi-arid deserts, (iii) Coastal deserts, (iv) Cold deserts.
Example: Cactus, Agave, Aloe, Bryophyllum

b. Grassland habitat

Grassland is an area where the Vegetation is dominated by grasses. Grasses range from short to tall. eg. Savanna Grassland

c. Forest habitat

Forest is a large area dominated by trees. There are three types of forests and are:- tropical forests, temperate forests and mountain forest. Annual rainfall ranges from 25-200 cm.

World habitat day is observed on 1st Monday of October.

4.2.2. Plant Adaptations and Modifications.

Adaptations are special features in plants which help them to survive in the habitats they live in over a long period. Plants in a specific environment have developed special features which help them to grow and live in that particular habitat. In this chapter, Let us study some adaptations like tendrils, twiners and thorns. These adaptations are seen in plants which live in terrestrial and desert habitat.

1. **Tendrils Climber:-** Tendril is a twining climbing organ of some weak stemmed plants like peas and bitter melon. Tendrils coil round a support and help the plant to climb.
Example:
 - a. Sweet Peas Leaflets are modified into tendrils.
 - b. Bitter Melon Axillary buds are modified into tendrils which help the plant to climb.
Bamboo is one of the fast growing plants, during active growth phase.

2. Twiners:- Some plants have weak stems. They cannot stand straight on their own. They must climb on any support to survive. Example: Clitoria and Jasmine
3. Thorns:- Leaves of some plants become wholly or partially modified into sharp pointed structures called “thorns or spines” for defensive purpose. Example:
 - a. Agave - the leaf apex and margins are modified into thorns
 - b. Opuntia - the leaves are modified into spines.
 - c. bougainvillea - the stem has sharp thorns.

Cactus plant is green in colour and performs photosynthesis. Which part of the plant does photosynthesis?



Unit 5 Livingworld of Animals

Introduction

The National School, Nallur, organised a field trip to a nearby village called Anaikkadu. The Students were so happy to see a village with ponds, streams, green fields and coconut trees. With the help of the teacher students were allowed to go around. One of them saw two birds building a nest. Where do the birds build a nest and why?

Children saw a number of butterflies fluttering near the flowers. The air was so fresh, so calm, so quiet and so relaxing. They came across a pond in the distance. It had some water. Floating on the water were dark green lotus leaves. A green frog was leaping from one lotus leaf to another making a croaking sound. A girl spotted a rabbit with a short tail. Can you make a list of the animals seen by the children? Were they all similar? In what way they were similar?

5.1 Biodiversity

In the living world, a lot of diversity is seen both in animals and plants. Every plant and animal is unique. The term biodiversity refers to the totality of species, populations, communities and ecosystems, both wild and domestic. It may also be defined as the variety and variability among living organisms and the habitats in which they live.

Biodiversity includes a variety of ecosystems such as those that occur in deserts, forests, mountains, lakes, rivers and agricultural fields. In each ecosystem, living creatures, including humans, form a community interacting with one another and with other animals, plants, air, water and soil around them. The living things form biotic community and non-living things form abiotic community.

5.1.1 Habitat

Fishes and crabs grow only in water while many animals like elephants, tigers and camels live on land. The geographical features and environmental conditions on earth differ from one place to another. Though camel can live anywhere it is able to live in deserts more comfortably. Polar Bear and Penguins dwell in cold regions. Living in such harsh conditions requires special features in these animals which help these organisms to live, breed and excel well in that particular place. Living or dwelling place of an organism is known as habitat. In Jurong Birds Park, Singapore, Penguins are kept in a big glass case with ice bergs and temperature is maintained at 0° C and below.

5.2 Unicellular and Multicellular Organisms

Living things are made of small units called cells. All the functions and processes in the body of living things are brought about with the help of these microscopic cells. Some organisms are made up of a single cell and these are called unicellular organisms, whereas, the organisms that are made of many cells are called multicellular organisms.

Amoeba, Paramecium and Euglena are unicellular while, fish, frog, lizard, bird and man are multicellular.

Unicellular organism

Unicellular organisms are small, usually microscopic, cannot be seen with naked eye. They are aquatic, simplest and most primitive of all animals. They perform all their physiological activities by the special structures present inside the body called organelles.

We know Amoeba is an unicellular organism It does all the activities like digestion, locomotion, respiration and reproduction. It swallows food from the water and the food is digested in the food vacuole. Contractile vacuoles help in excretion. Respiration is by simple diffusion through the body surface. They have finger-like structures called Pseudopodia, (false foot) which help in movement or locomotion.

Paramecium is also a unicellular organism which lives in water and move with the help of cilia.

Paramecium

Euglena is an unicellular animal which moves with a flagellum.

Euglena

Multicellular organisms:

Majority of organisms we see around us, including animals are multicellular. In such organisms, different functions are Table 2.2 The Differences between Unicellular and Multicellular Organisms.

Unicellular Organisms

They are made up of single cell.

The single cell of the organism can perform all the functions of life.

These organisms are generally very small (microscopic) in size.

They lack tissues, organs and organ systems.

Growth occurs by an increase in the size of the cell.

eg. Amoeba, Paramecium and Euglena.

Multicellular Organisms

They are organisms are made up of many cells.

Division of labour exists among cells. Different cells are specialized to perform different functions.

They are mostly large in size.

They are composed of tissues, organs and organ systems.

Growth occurs by an increase in the number of cells by cell division.

eg. Earthworms, Fish, Frogs, Lizard and human beings.

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carried out by different groups of cells or organs in their body. E.g. Jelly fish, Earth worm, snails, fish, frog, snakes, pigeon, tiger, monkey and man.

5.3 Adatptation in Animals

Animals vary in size, shape and behaviour

A Living thing can survive in a particular habitat if its body is adapted to the conditions of that habitat. Plants and animals develop special characteristics or features in their body in order to survive in their habitat (the surroundings). The presence of specific body features for certain habits which enable a plant or an animal to live in a particular habitat is called adaptation.

The fish lives in either freshwater or marine water. Let us analyse the adaptations seen in a fish for its aquatic life.

Fish

1. The head, trunk and tail of a fish merge to form a streamlined shape. The streamlined body shape helps the fish to move through the water easily.
2. The fish has special organs called "Gills" which is a respiratory organ helps to absorb oxygen dissolved in water for breathing. It is adapted to breathe in water.
3. Most of the fishes have slippery scales all over the body which protect the body.
4. The fish has fins for swimming.
5. The fish has strong tail which acts as rudder to change direction and keep its body balance in water.

Lizard

1. Lizards are scaly-skinned reptiles that are usually distinguished from snakes by the possession of legs, movable eyelids, and external ear openings.
2. They mostly inhabit warm regions. Most lizards are quadripedal (walk with four legs) and have a powerful limb.
3. Some lizards have the capacity to rotate the head around the head joint.
4. They breathe through lungs. Some lizards are able to run bipedally with two legs. In this the tail is held outbackward and upward and acts as a counterweight.
5. Most lizards eat a variety of insects like mosquitoes and Cockroaches with sharp, tricuspid, teeth adapted for grabbing and holding
6. Some lizards (Dinosaurs) have web in the toes, and few lizards are able to glide or parachute the air and make soft landings.

Birds

1. They have streamlined body covered with feathers.
2. This body shape provides minimum resistance to air.
3. They have beak instead of mouth.
4. They breathe through lungs. They have a pair of wings that are modified forelimbs.
5. They have hollow and light bones.
6. Usually we see birds fly, however they can also hop, move, run, etc., on the ground and they perch well on the branches of tree with the help of a pair of clawed feet.
7. The tail of the bird helps it to control the direction of the movements.
8. They have strong chest muscles which help them withstand the pressure of the air while flapping their wings during flight.

9. At a time, birds can see one object with one eye and another object with the other eye. (Binocular vision) When an animal moves its location as the season changes it is said to be Migration.

In Tamil Nadu Bird Sanctuaries are located at Vedanthangal, Kodiyakkarai and Koondhankulam. There are many birds from foreign countries like Siberia and Russia migrate to our Vedanthaangal. Likewise during summer and drought conditions birds from our country migrate to foreign countries. These birds are called Migratory Birds.

Adaptation in Camel:

Camel lives in hot desert where water is scarce. The body structure of a camel helps it to survive in desert because of its following special features which are listed below:

1. The camel has long legs which help it to keep its body away from the hot sand in the desert.
2. A camel can drink large amount of water (when it is available) and store it in the body.
3. A camel's body is adapted to save water in the dry desert as follows: A Camel passes small amount of urine; its dung is dry and it does not sweat. Since a camel loses very little water from its body, it can live for many days without drinking water.
4. A camel's hump has fat stored in it. In case of emergency a camel
5. can break down stored fat for nourishment.
6. camel has large and flat padded feet which help it to walk easily on soft sand. Thus it is called "The ship of the desert".
7. Camel has long eye lashes and hairs to protect its eyes and ears from the blowing dust.
8. It can keep its nostrils closed to avoid dust.

Kangaroo rat does not drink water at all. Whatever food it eats and oxygen it gets from air combine together to form water inside the body. The mountain goat namely NilgriTahr can find small spaces on rock to climb with ease and keep its balance as it feeds.

Unit 6 Health and Hygiene

Introduction

The word "health" refers to a state of complete emotional and physical well-being. Healthcare exists to help people maintain this optimal state of health.

As defined by World Health Organization (WHO), it is a "State of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity." Health is a dynamic condition resulting from a body's constant adjustment and adaptation in response to stresses and changes in the environment for maintaining an inner equilibrium called homeostasis.

Hygiene is a science of the establishment and maintenance of health conditions or practices (as of cleanliness) conducive to health. Poor personal hygiene, such as brushing your teeth regularly, is an important part of good oral hygiene. Hygiene is the practice of keeping yourself and your surroundings clean, especially in order to prevent illness or the spread of diseases.

Deepa's family was preparing their monthly provision list. When Deepa saw the list, she had some questions to ask her parents, Why do we eat, comparatively more amount of rice and wheat? Why do we consume less amount of oil and ghee? Discuss the given list with your teacher.

6.1. Components of Food

The Chemical constituents of food which give us energy, help to build our body and protect us from diseases are called Nutrients.

1. Carbohydrate
2. Proteins
3. Fats
4. Vitamins
5. Minerals
5. Water

6.1.1. Carbohydrates

Carbohydrates are energy giving component of the food. We can obtain carbohydrates in the form of Sugar, starch and dietary fibres

6.1.2. Fats

Fat is also an energy-giving food and provides more energy than Carbohydrates. Some important sources of fats are butter, ghee, milk, cheese, paneer, nuts, meat, fish, egg yolk etc. Apart from giving energy, they insulate our body and protect the cells.

6.1.3. Protein

Body Building Foods

Proteins are necessary for our growth and repair, as well as for regulating various body functions such as digestion. The sources of proteins are pulses, eggs, fish, milk, chicken, soya bean, nut, grams etc, Proteins are body building foods.

Soyabean is the highly rich source of protein.

6.1.4. Vitamins

Vitamins are required for carrying out various biochemical reactions in our body. Fruits, vegetables, grains, meat products are good sources of vitamins. Vitamins are called as protective food. There are six major vitamins A, B, C, D, E and K. Vitamins B and Vitamins C are water soluble, Vitamins A, D, E and K are fat soluble. Gooseberries contains nearly 20 times the vitamin C than Orange.

6.1.5 Minerals

Minerals are required for growth as well as for the regulation of normal body function. Green leafy vegetables like spinach, pulses, eggs, milk, fish and fruits are important sources of minerals in our diet. Minerals are also a protective foods.

80% of the world production of Moringa Leaves is in India. The Major countries which import Moringa Leaves are China, US, Germany, Canada, South Korea and European countries.

6.1.6. Water

Our body needs an adequate supply of water in order to maintain good health. Any human being should take minimum eight tumblers (2 Litres) of water every day.

6.2. Health and Nutrients

6.2.1. Health

Health is a state of complete physical, mental and social well-being and not merely absence of diseases. Eating a healthy diet keeps you physically and mentally fit. When you are physically healthy, you feel confident you are more outgoing and have a greater capacity for enjoying life.

Unhealthy food choices lead to obesity and illness, preventing you from socializing with friends and family. So choose your diet carefully.

6.2.2 Balanced Diet

A diet should contain adequate amount of all the necessary nutrients required for healthy growth and activity.

- An increased capacity to work
- Good physical and mental health

- Increased capacity to resist diseases.
- Help in proper growth of the body.

A balanced diet contains sufficient amount of various nutrients to ensure good health. Food should also provide the appropriate amount of energy and adequate amount of water.

6.2.3. Malnutrition

When your diet is not a balanced, what would be the consequences?

Observe the below picture carefully

Do these children look normal?

Guess what would be the reason?

The children are in this condition due to malnutrition.

Malnutrition: Malnutrition occurs when all the nutrients that the body needs are not obtained in the proper proportions from the diet. The word malnutrition refers to the condition that results when a person does not take a balanced diet. Malnutrition leads to deficiency disease. The diseases that are caused due to lack of Nutrients in the diet are called Deficiency Diseases.

India has the second highest number of obese children in the world after China, according to a study that has found that 14.4 million children in the country have excess weight.

6.2.4. Physical Exercise and Rest

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness. It is performed for various reasons, including

- increase in growth and development,
- strengthening muscles and the cardiovascular system,
- developing athletic skills, weight loss or maintenance, and enjoyment.
- Physical exercise may help to decrease some of the effects of childhood and adult obesity.
- Deep sleep seems to be one of the most critical time for body repair.

Rest

Proper amount of rest is essential for physical and mental health. Rest is as important as nutrition and physical activity for growth and development and good health.

6.2.5. Personal Cleanliness

Hygiene is a set of practices performed to preserve health. According to the World Health Organization (WHO), "Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases."

Personal hygiene involves those practices performed by an individual to care for one's bodily health and well-being, through cleanliness. It includes such personal habit choices as how frequently to bathe, wash hands, trim fingernails, and change clothing. It also includes attention to keep surfaces in the home and workplace, including bathroom facilities, clean and pathogen-free.

6.3. Introduction of Microbes

When you neglect personal hygiene, you are increasing the risk of falling sick. Let us name some of the diseases or conditions caused by microorganism due to the negligence of personal hygiene.

1. Diarrhoea
2. Tooth decay
3. Athlete's foot(Madurai's foot)
4. Dandruff.

Do you believe that there are some organisms which you cannot see with your naked eye? Yes. microbes cannot be seen without the help of a microscope.

Most of the microbes belong to four major groups:

- Bacteria
- Virus
- Protozoa
- fungi

6.3.1. Bacteria

Bacteria are very small prokaryotic microorganisms. Bacterial cells do not have nucleus and do not usually have membrane bound organelles.

- Bacteria can exist either as independent organisms or as parasites
- They invade tissues
- They produce pus or harmful wastes

Disease

Disease is a definite pathological process having a characteristic set of signs and symptoms.

Disorder

Disorder is a derangement or abnormality of function.

Virus

Virus is acellular agent that replicates only inside the cells of other living organisms. Virus can infect all types of life forms plant, animals and microorganisms. They invade living normal cells and use their cell machinery to multiply. They can kill damage or change the cells and make you sick.

Diseases Caused By Virus

- | | |
|----------------|----------------|
| 1. Common cold | 2. Influenza |
| 3. Hepatitis | 4. Polio |
| 5. Smallpox | 6. Chicken pox |

7. Measles

Microscopes help to study the structure of the microorganisms

Suggested project Get a Vaccination schedule from a nearby doctor or a hospital. From the list, identify the bacterial diseases and the viral diseases for which vaccination is given



5.The Cell

Introduction

Observe the two pictures given above. Do you observe any similarity between them?
Close your eyes and imagine a brick wall. What is the basic building block of the wall?
A single brick, of course.

Like a brick wall, your body is composed of basic building blocks, and are named as “Cells”.

The cell is the basic structural and functional unit of every living organism.

The cell is self-sufficient to carry out all the fundamental and essential functions of an organism.

The Cell

All living things are made of one or more cells. There are variety of cell types however, they all have some common characteristic features.

Discovery of the cell

The Englishman Robert hooke was a scientist, mathematician, and inventor. He improved microscope which was used in those days, and built a compound microscope. He placed water-lens beside the microscope to focus the light from an oil-lamp on specimens to illuminate them brightly. So that he able to see the minute parts of the objects clearly.

One day Hooke made thin sections of the cork and observed them through his microscope. He observed many small identical chambers which were hexagonal in shape. He was surprised.

After that he saw many objects like Butterfly's wings, Bee's compound eyes etc.,

Based on this observations Hooke published a book named Micrographia in the year 1665, where he first used the term Cell . He describe the structure of tissue using the term cell.

In Latin the word 'cellua' means a small chamber.

The branch of science that deals with the study of cells is called 'Cell Biology'.

The Structural Organization Of The Cell

A typical cell consists of three major parts:

- 1) An outer cell membrane.
- 2) A liquid cytoplasm.
- 3) A nucleus.

Analogous to the body's internal organ, like eyes, heart, lungs organelles are specialized structures and perform valuable functions necessary for normal cellular operation. Many of miniscule but distinct structures called Organelles lie within the cell.

Size of the cell

The size of cells may vary from a micrometer (a million of a metre) to a few centimeters. Most cells are microscopic and cannot be seen with the naked eye. They can be observed only through the Microscope.

Smallest size of the cell is present in Bacteria. The size of the bacterial cell ranges from 0.01 micrometer to 0.5 micro meter. On the other hand the largest cell is the egg of an ostrich with 170 millimeter width. We can see this with the naked eye. In Human body the nerve cells are believed to be the longest cells.

Cell size has no relation to the size of an organism. It is not necessary that the cells of, say an elephant be much larger than those of a mouse.

Shapes

Cells are of different shapes. For example some shapes are given in the below pictures.

Number

The number of cells present in different organisms may vary. Organisms may be either unicellular (single cell) or multicellular. Organisms such as Bacteria, Amoeba, Chlamydomonas, and Yeast are unicellular. On the other hand, organisms such as Spirogyra, Mango, and Human beings are multicellular. (i.e) made up of a few hundreds to million cells.

Approximate number of cells in the human body is 3.7×10^{13} or 37,000,000,000,000

TYPES OF CELL

Generally cells are classified into two types. First one is Prokaryotic cell .It has No true nucleus consisting of no nuclear membrane. Another one is Eukaryotic cell. It has True nucleus consisting of nuclear membrane.

Prokaryotic cell

The unicellular organisms like Bacteria has Prokaryotic cells. It has No true nucleus. This type of nucleus is called as nucleiod. No nuclear membrane is around this nucleiod.

These cells were the first form of life on earth. It is ranging from 0.003 to 2.0 micro meter in diameter.

Eukaryotic cell

Cells which has true nucleus is called as eukaryotic cell. It is bigger than prokaryotic cells. It's organelles bounded by membrane.

Ex. Plants, animals, most of the fungi and algae.

Differences between Prokaryotic cell Eukaryotic cell

Prokaryotic cell	Eukaryotic cell
It's diameter ranges from 1 to 2 micron	It's diameter ranges from 10 to 100 micron
Absence of membrane bound organelles	Presence of membrane bound organelles
Nucleus consisting of no nuclear membrane	True nucleus consisting of nuclear membrane
Absence of nucleoli	Presence of nucleoli

Plant cell and Animal cell

Both plant and animals are made up of cells. Both cells are eukaryotic in nature, having a well defined membrane - bound nucleus.

Plant cell

- ❖ It is usually larger in size. It is hard in nature.
- ❖ Plant cell have a cell wall in addition to their cell membrane.
- ❖ Plant cell have chloroplast which contain chlorophyll
- ❖ Plant cells have large vacuoles. Centrioles are absent.

Animal cell

- ❖ Animal cells are generally smaller than plant cells. It is not so hard as plant cell.
- ❖ A cell wall is absent.
- ❖ Chloroplast is usually absent.
- ❖ An animal cell may have many small vacuoles.
- ❖ Centrioles are found in animal cells

Dimension - cell structure

1. How does a cell look like?
2. What is its shape and size?

The above cell has a three dimensional view. We can see the three sides of the cell structure. You can also view the size, shape and location on the organelles of the cell also.

3-D view is appealing because it is more like reality

In 3-D, We can see the entire view of the cell. It exposes the accurate size and shape and shows the correct location of the cell organelles.

Cell components and their functions

S.No	Cell Components	Main Functions	Special Name
1.	Cell wall	<ul style="list-style-type: none"> • Surrounds and protects the cell • Make the cell stiff and strong 	Supporter and protector
2.	Cellmembrane	<ul style="list-style-type: none"> • Holds and protects the cell • Controls the movement of materials in and out of the cell 	Gate of the cell
3.	Cytoplasm	<ul style="list-style-type: none"> • A watery, gel-like material in • which cellparts move 	Area of movement
4.			Power house of the cell

	Mitochondria	<ul style="list-style-type: none"> • Produce and supply most of Theenergyfor the cell 	
5.	Chloroplasts	<ul style="list-style-type: none"> • Contain green pigment chlorophyll • Capture the energy of sunlight and use it to produce food for the cell by photosynthesis. 	Food producers for the cell (Plant cell)
6.	Vacuoles	<ul style="list-style-type: none"> • Store food, water, and chemicals 	Storage tanks
7.	Nucleus	<ul style="list-style-type: none"> • Acts as 'brain' of the cell • Regulates and controls all the cell activities 	Control centre
8.	Nucleusmembrane	<ul style="list-style-type: none"> • Surrounds and protects the nucleus control the movement of materials in and out of the nucleus 	Gate of the nucleus

Points to Remember

- ❖ Cells are the basic units of all living organisms.
- ❖ There are two major cell types such as prokaryotic and eukaryotic cell.
- ❖ Both plant and animal cells have unique organelles which are capable of carrying outspecialized functions.
- ❖ Plant cells have two unique components such as cell wall and chloroplasts compared toanimal cells.

6.Human Organ systems

Introduction

Organ systems are formed by the association of organs which are organized from tissues. This kind of organization helps the organism to perform various activities more efficiently. A group of organs that work together to perform a particular function is known as an organ system. The Human body has eight major organ systems. They are

- ❖ Skeletal System
- ❖ Digestive System
- ❖ Circulatory System
- ❖ Endocrine System
- Muscular System
- Respiratory System
- Nervous System
- Excretory System

In this lesson, let us study more about the structure and function of these organ systems of our body.

Skeletal System

The skeletal system consists of bones, cartilages and joints. Bones provide a frame work for the body. Bones along with muscles help in movements such as walking, running, chewing and dancing etc.,

The adult human skeletal system consists of 206 bones and few cartilages, ligaments and tendons. Ligaments help in connecting bone to bone. Tendons connect bone to muscle. The two major divisions of the skeletal system are Axial skeleton and Appendicular skeleton.

Axial skeleton forms the upright axis of the body which includes

- ❖ Skull
- ❖ Vertebral column
- ❖ Rib cage

Appendicular skeleton consist of the bones of the limbs along with their pectoral and pelvic girdles.

Skull

The skull is made up of cranial bones and facial bones. It protects the brain and the structures of the face. The hyoid bone present at the base of the buccal cavity and the auditory ossicles (Malleus, Incus and Stapes) are also included in the skull. Lower jaw bone is the largest and strongest bone in the human face.

Vertebral Column

Vertebral column extends from the base of the skull. It protects the spinal cord. It is formed by a number of serially arranged small bones called vertebrae (singular : vertebra)

Rib cage

The rib cage is made up of 12 pairs of curved, flat rib bones. It protects the delicate vital organs such as heart and lungs.

Limbs

Man has two pairs of limbs namely upper limbs (fore limbs) and lower limbs (hindlimbs). Fore limbs are used for holding, writing etc., while hind limbs are used for walking, sitting etc.,

Skeletal System

Girdles

The fore limbs and hind limbs are attached to the axial skeleton with the help of pectoral and pelvic girdle respectively.

Muscular System

In the body, muscular system along with the skeletal and nervous system, is responsible for the body movements.

Muscles can contract and therefore, help in moving other parts of the body. It maintains the posture and body position. There are three types of muscles namely

- ❖ Skeletal muscle
- ❖ Smooth muscle
- ❖ Cardiac muscle

How do muscles work?

Muscles of the body can only pull and they cannot push. Two muscles are required to move a bone at a joint. When one muscle contracts, the other muscle relaxes.

For example, to move 'the lower arm up and down two type of muscles called biceps and triceps are required. When we raise our lower hand, the biceps in front become short by contraction and the triceps at the back stretch to pull up the arm. When we lower our arm, the triceps at the back contract and biceps stretch to pull the arm down.

Skeletal Muscles

Skeletal muscles of our body are attached to the bones. They are called **Voluntary muscles** because they can be controlled by our will. Example: Muscles of arm

Smooth muscles

Smooth muscles are found in the walls of the digestive tract, urinary bladder, arteries and other internal organs. They are called '**Involuntary muscles**' because they are not controlled by our will.

Cardiac muscles

The walls of the heart is made up of cardiac muscles. They are capable of rhythmic, contraction continuously and involuntary in nature.

Digestive System

Digestive system consists of the alimentary canal and associated glands. This system is involved in the conversion of complex food substances into simple forms and absorption of digested food.

The digestive glands associated with the alimentary canal are salivary glands, liver, and pancreas. They secrete enzymes which help in the process of digestion of food in the digestive tract or alimentary canal.

The alimentary canal is about 9 meters long. Stomach is a major organ for digestion of food materials. Absorption of digested food occurs in the small intestine.

Parts of Alimentary canal	
1.	Mouth
2.	Buccal cavity
3.	Pharynx
4.	Oesophagus or Food pipe
5.	Stomach
6.	Small Intestine

7.	Large Intestine
8.	Anus

Associated glands for digestion
1. Salivary glands
2. glands
3. Liver
4. Pancreas
5. Intestinal glands

Respiratory System

Respiratory system is involved in exchange of respiratory gases and there by helps us to breathe. The human respiratory system consists of nostrils, nasal cavity, pharynx, larynx, trachea, bronchi and lungs. It helps in the movement of air in and out of the body. Exchange of O₂ and CO₂ occurs between air in the lung and blood. The entry of food into the wind pipe is prevented by a flap like structure called Epiglottis.

Lungs

Lungs are the main respiratory organ. They are located within the chest cavity. The trachea, commonly called windpipe, is a tube supported by cartilaginous rings that connects the pharynx and larynx to the lungs, allowing the passage of air. The trachea divides into right and left bronchi and enter into the lungs. They divide further and ends in small air sacs called alveoli. The lungs are covered by a double layered pleura. Diffusion of gases (O₂ and CO₂) occurs across the alveolar membrane

Each lung has about 300 million air sacs or alveoli. Yawning helps us to take in more amount of O₂ and to give out CO₂.

Circulatory system

The circulatory system is one of the important system consisting of heart, blood vessels and blood. It transports respiratory gases, nutrients, hormones and waste materials

within the body. It protects the body from harmful pathogens and also regulates the body temperature.

Heart

Heart is located in the thoracic cavity between the two lungs. The heart is four chambered and is surrounded by a double layered membrane called **pericardium**. The heart pumps blood continuously throughout our life time.

Blood vessels

Three types of blood vessels are present in the body. They are **arteries,veins and capillaries**. They form a closed network through which the blood is circulated.

Blood

Blood is a fluid connective tissue of red colour containing plasma and blood cells. There are three types of blood cells namely, Red blood corpuscles (RBCs), White Blood corpuscles (WBCs) and Blood Platelets. RBCs are produced in the bone marrow.

Donate Blood

Hospitals have blood banks where blood can be temporarily stored before it is given to the patients in need. Every healthy person over 18 years of age can donate blood. So that, it can be given to persons in need during emergencies of accidents or operations. Blood donation saves their life.

Nervous System

Nervous system is well developed in human and is composed of neurons or nerve cells. This system includes brain, spinal cord, sensory organs and nerves. The two important functions of the nervous system along with the endocrine system are **conduction and co-ordination**.

Brain

The brain is a complex organ which is placed inside the cranium. It is protected by a three layered tissue coverings called meninges. Brain has three regions namely fore brain, mid brain and hind brain. It is the controlling centre of the body.

Brain is said to store as many as 100 million bits of information in a life time.

Spinal cord

It is the extension of medulla oblongata of the hind brain and is enclosed within the vertebral column. Spinal cord connects the brain to different part of the body through nerves.

The Functions of the Nervous System

1. Sensory Input

The conduction of signals from sensory receptors.

2. Integration

The interpretation of the sensory signals and the formulation of responses.

3. Motor output

The conduction of signals from the brain and spinal cord to effectors, such as muscle and gland cells.

Sense organs

Sense organs are like the windows to the outside world. There are five sense organs in our body such as eyes, ears, nose, tongue and skin. They make us aware of our surroundings. We are able to see, hear, smell, taste and feel, only through sense organs.

Eyes

Eyes help us to see things around us i.e., their colour, shape, size whether they are near or far, moving or at rest. The eyelids and eyelashes keep the eyes safe. The eye has three main parts namely cornea, iris and pupil.

Ears

Ears help to hear and differentiate sounds around us. The ears also help us in maintaining the balance of the body when we are walking, running or climbing. The ear has three major parts, the outer ear, the middle ear and the inner ear. The outer ear in human beings is made up of an external flap called pinna.

Skin

Skin is the largest sense organ as it covers the whole body. The skin helps to feel the things around us by touching, that is whether they are hot or cold, smooth or rough, dry or wet, hard or soft. Skin covers the body and protects it from germs. It also keeps the body moist and regulates the body temperature.

Functions of the skin

1. Skin forms an effective barrier against infection by microbes and pathogens.
2. Skin helps us to synthesize vitamin D using sunlight.

Endocrine System

Endocrine system regulates various functions of the body and maintains the internal environment. Endocrine glands are present in the body, produce chemical substances called **hormones**.

Take Care of Your Sense organs

- ❖ Do not read in very bright or very dim light and also in moving vehicle.
- ❖ Avoid exposing eyes to screens of television, computer, laptop and cell phone for a long time.
- ❖ Do not rub your eyes harshly.
- ❖ Wash your eyes gently with clean water, two or three times a day.
- ❖ Ears should be protected from hard blows.
- ❖ One should never try to prick ears with toothpicks or hairpins, which are dangerous practices because it may puncture the ear drum and cause ear infection.
- ❖ One should bath at least once a day to keep skin clean and fresh.

Glands	Location
Pituitary gland	At the base of brain
Pineal Gland	At the base of brain
Thyroid Gland	Neck
Thymus Gland	Chest
Pancreas (Islets of Langerhans)	Abdomen

Adrenal Gland	Above the kidney
Gonads	Pelvic cavity

Excretory System

The nitrogenous wastes are removed from the body by the excretory system. It is composed of kidneys, ureters, urinary bladder and urethra.

Kidneys

These are bean shaped structures present in the abdominal cavity. The functional units of the kidney are called **Nephrons** which filter the blood and form the urine.

Why do we drink water? Our body contains about 70% water. Some parts have more water like the grey matter of the brain (about 85%) and some less, like fat cell (about 15%).

We normally consume 1.5 to 3.5 litres of water every day in the form of food and water.

Points to Remember

- ❖ The skeletal system gives shape to the body and protects the soft internal organs.
- ❖ There are three types of muscles - skeletal muscle (voluntary), smooth muscle (involuntary) and cardiac muscle.
- ❖ Circulatory system constitutes the heart, blood vessels and blood.
- ❖ Diaphragm - A large flat muscle forming the floor at the chest cavity.
- ❖ Digestion is the process of breaking complex food into simple and soluble substances.
- ❖ Brain is protected by the skull. It has three parts - cerebrum, cerebellum and medulla oblongata.
- ❖ The sense organs are Eyes, Ears, Nose, Tongue and Skin.

Unit 4 Our Environment

Introduction

The surroundings or space in which a person, animal, or plant lives, is known as **environment**. Environment is everything that is surround us. It can have both living (biotic) and non-living things (abiotic). **Abiotic** factors are non-living parts such as sunlight, air, water and minerals in soil. **Biotic** factors are living things of our environment such as plants, animals, bacteria and more. Organisms live, constantly interact with one another and adapt themselves to conditions to their environment.

4.1 The Ecosystem

Ecosystem is a community of living and non-living things that work together. Each part of an ecosystem has a role to play. Any changes in the environment such as increased temperature or heavy rains, can have a big impact on an ecosystem. Ecosystems can be either natural or artificial.

Natural ecosystem

Ecosystem originated without human intervention is called a **natural ecosystem**. This can be an aquatic ecosystem or a terrestrial ecosystem.

The ecosystem in water is called a **aquatic ecosystem**. Sea, river, lake, pond and puddle are some examples of natural aquatic ecosystem.

Ecosystems outside the water body and on land are called **terrestrial ecosystems**. Forests, Mountain regions, deserts etc., are examples of natural terrestrial ecosystems.

Artificial ecosystem

Artificial ecosystems are created and maintained by human. They have some of the characteristics of natural ecosystems. They are much simpler than the natural ecosystems.

These can be the terrestrial ecosystems such as paddy fields, gardens etc. or the aquatic ecosystem such as fish tank.

Aquarium:

Aquarium is a place in which fish and other water creatures and plants are maintained. An aquarium can be a small tank, or a large building with one or more large tanks.

Terrarium:

Terrarium is a place in which live terrestrial animals and plants are kept. Plants and animals are kept in a terrarium with controlled conditions that copy their natural environment. Aquariums and Terrariums are used to observe animals and plants more closely. They are also used for decorations.

Food Chain and Food Web

Living organisms need food to perform their life processes. Some organisms can produce their own food, such as plants, while other organisms cannot do this and need to feed on other organisms to obtain their energy.

We can therefore identify different feeding types in an ecosystem, based on how the organism obtain (gets) its food. They are **producers and consumers**.

Producers

Producers are organisms that are able to produce their own organic food. They do not need to eat other organisms to do this. Producers are also called **autotrophs**. Can you name an organism that prepare it's own food?

Plants are producers because they make their own food by photosynthesis.

What do plants need in order to photosynthesis?

Consumers

Organisms which cannot produce their own food, need to eat other organisms as food. These organisms are called **consumers**. All animals are consumers as they cannot produce their own food. Consumers are also called **heterotrophs**.

There are many types of consumers and we can classify them into specific groups depending on the food that they consume. These are:

❖ **herbivores**

Animals which eat plants or plant products e.g: cattle, deer, goat and rat.

❖ **carnivores**

Animals that eat other animals e.g: Lion, tiger, frog and owl.

❖ **omnivores**

Animals that eat both plants and animals e.g: Humans, dog and crow

❖ **decomposers**

Micro-organisms that obtain energy from the chemical breakdown of dead organisms (both plants and animals). They break complex organic substances into simple organic substances that goes into the soil and are used by plants. (e.g) Bacterium, Fungi

Food chain

In a forest, deer eats grass; and in turn we know tiger eats deers. In any ecosystem there is a chain like relationship between the organisms that live there. **This sequence of who eats whom in an ecosystem is called as food chain.**

It describes how organisms get energy and nutrients by eating other organisms.

A food chain shows the relationship between producers (e.g. grass) and consumers (e.g. deer, goats, cows and tiger).

Energy flow

The food chain begins with the energy given by the Sun. Sunlight triggers photosynthesis in plants. The energy from the Sun is stored in the plant parts. When the grasshopper eats the grass, the energy flows from grass to grasshopper. Frog gets energy by eating grasshopper. This energy is transferred to a crow, when the frog is eaten by a crow.

Thus we conclude the primary energy production in the world of living things is made by plants; that is by photosynthesis.

The micro organism reduce the excreta and the dead bodies of animals into primary simple components and puts them back into soil. It is this material that help the plants to grow. Thus we can see that there is a cycle of materials from primary producers to highest level predators, then back to soil.

Trophic levels

We see that the energy is passed along from the producer to the consumers. But, there are three different consumers in any food chain. How can we distinguish different consumers?

Animals that eat plants are **primary consumers**.

Animals that eat primary consumers are called **secondary consumers**.

Animals that eat the secondary consumers (mostly predators) are the **tertiary consumers**.

There may even be large predators that eat tertiary consumers. They are called as **quaternary consumers**.

Each of these levels in the food chain is called a **trophic level**.

Organism uses up to 90% of its food energy for its life processes. Only about 10% of energy goes into new body cells and will be available to the next animal when it gets eaten. This loss of energy at each trophic level can be shown by an **energy pyramid**.

A rat eats grains; and in turn we know snake eats rat. Now snake is a prey for peacock and in turn peacocks are easy prey for tigers and leopards. Now think? Do tigers have any natural predators?

In all food chain there is a top level predator that has no natural predators. In an aquatic ecosystem there are no natural predator for alligator; in a forest there are no natural predators for tigers.

Importance of food chain

1. Learning food chain help us to understand the feeding relationship and interaction between organisms in any ecosystem.
2. Understanding the food chain also helps us to appreciate the energy flow and nutrient circulation in an ecosystem. This is important because pollution impacts the ecosystem. The food chain can be used to understand the movement of toxic substances and their impacts.

Food web

Consumers have different sources of food in an ecosystem and do not rely on only one species for their food. If we put all the food chains within an ecosystem together, then we end up with many interconnected food chains. This is called a food web.

A food web is very useful to show the many different feeding relationships between different species within an ecosystem.

4.3 Waste Management and Recycling

To protect our environment, it is very important to reduce waste, manage it properly and maximise recycling. Waste is any substance or material that has been used but is not wanted anymore. This is either because it is worn out, broken or no longer has any purpose. Everyone produces waste and our waste has an impact on all ecosystems. However, most of us do not know where our garbage goes. There are many types of waste. There is liquid waste (in our drains), there are gases hiding in the air (like pollutants from factories), and there is solid waste (garbage) we put in our waste bins.

4.4 Biodegradable and Non- biodegradable Waste

Solid waste we generate can be classified into two major types:

1. Biodegradable waste
2. Non-biodegradable waste

Biodegradable waste

The term '**Biodegradable**' is used for those things that can be easily decomposed by natural agents like water, oxygen, ultraviolet rays of the sun, micro-organisms, etc.

One can notice that when a dead leaf or a banana peel is thrown outside, it is acted upon by several microorganisms like bacteria, fungi or small insects in a time period. Biodegradable waste includes vegetable and fruit peels, leftover food and garden wastes (grass, leaves, weeds and twigs).

Natural elements like oxygen, water, moisture, and heat facilitate the decomposition thereby breaking complex organic forms to simpler units. Decomposed matter eventually mixes or returns back to the soil and thus the soil is once again nourished with various nutrients and minerals.

Non-biodegradable waste

Those materials which cannot be broken down or decomposed into the soil by micro-organisms and natural agents are labeled as **non-biodegradable**. These substances consist of plastic materials, metal scraps, aluminum cans and bottles, etc.

These things are practically immune to the natural processes and thus cannot be fed upon or broken down even after thousands of years.

Rani and her garbage

Rani gets home from school. She is hungry. She eats a banana and a packet of chips. She puts the banana peel and plastic chips packet into the waste bin. In the waste bin, the waste mixes together and the banana peel makes the plastic chips packet dirty. The waste bin starts to smell and Rani's mother puts the waste outside on the street. The municipality collects the waste from outside Rani's house and many other houses in a tractor. The tractor drives to a big open dump and leaves all mixed waste there.

Sometimes, there are fires in the open dump. When waste like Rani's chips packet burns, unhealthy chemicals pollute the ecosystem. These chemicals are present in the air we breathe. The leftover ash from burning waste pollutes the soil.

When it rains, some of the dangerous chemicals goes into the ground. Some of the rain never reaches the ground as it collects in the plastic garbage at the dump. Little pools of water let mosquitoes to breed and they can spread unwanted diseases like dengue and malaria. Cows and dogs go into the open dump looking for food. As the waste is mixed, many things that are not good to eat such as plastics, smell like food. The animals get confused and eat some plastics by accident. This makes them sick.

Rani is a student like you. She does not want to make animals sick. She does not want to pollute beautiful Town. She does not like mosquitoes and wishes that no one ever gets sick from them. So Rani takes this decision "I plant trees and reduce all type of pollution".

Do you want the same as Rani does? Become a detective. Learn about the 3R's and how you can start to solve these problems.

4.5 Solid Waste Management

It is our duty to reduce creating waste and protect environment. 3R's are important in protecting environment. The first R is reduce and the second R is reuse and the last R is recycle.

The waste hierarchy or pyramid shows the best ways to manage solid waste.

1. Avoid

Avoid the usage of unwanted materials which create more debris. Before you buy anything, think that "Do I really need it?" (e.g) Avoid buying packaged foods. Refuse to buy use and throw plastic products.

2. Reduce

We can reduce the waste by using durable goods that last longer instead of things that are used once and thrown away.

(e.g) Write on both sides of papers. Instead of unnecessary printing, use electronic facilities. Share newspapers, magazines and other things with others.

3. Reuse

Reusing means using a thing again and again, rather than using and throwing after a single use. (e.g) Instead of using plastic bags, use and throw pens and batteries, use cloth bags, fountain pens and rechargeable batteries. Reuse glass bottles for other purposes. Repair foot wears and use them.

Creative reuse

Creative reuse or Up-cycling is the process of converting waste materials or useless products into new materials or products of better quality or for better environmental value. When you upcycle, you are giving an item a new purpose. (e.g) Used tyres into chairs. Used PET bottle into penstand.

4. Recycle

The process by which waste materials are used to make new products is called recycling. (e.g) Using old clothes to make paper and melting some plastics to make floor mats, plastic boards and hose pipes.

5. Compost

The process of degradation of organic wastes into manure by the action of microorganism is called **composting**. The manure thus obtained becomes natural fertilizer for the plants as well as increases the soil fertility.

6. Incinerate

The burning of solid waste in incinerator is called incineration. Human anatomical wastes (discarded medicines, toxic drugs, blood, pus) are disposed by means of incineration. During incineration, the enormous heat kills all contagious disease-causing germs. We can also produce electricity with the help of this heat.

7. Landfill

Landfilling is a method in which wastes are dumped into naturally occurring or man-made pits and covered with soil. Garbage buried inside landfills remain here for a long time as they decompose very slowly and become manure. These places can be converted into parks, gardens, etc.,

Earlier in the chapter, you learn about Rani and how she did not want to cause pollution. Simple steps in your daily life can make big differences. There are two steps you should remember.

1. The first step should always be to reduce waste. Think of the 3R's and the waste pyramid and remember the order of the levels.
2. The second step is to keep waste separate. This way the waste will remain clean and can be easily reused or recycled. Mixing different types of waste together (e.g. biodegradable and non-biodegradable) makes waste dirty. Dirty waste gets sent to a landfill or open dump.

Waste separation exercise

The Solid Waste Management (SWM) rules, 2016 say that,

1. Every Household should segregate and store the waste generated by them in **three separate streams - namely bio-degradable, non bio-degradable and domestic hazardous**

waste in suitable bins and handover segregated wastes to authorised waste pickers or waste collector as per the direction or notification by the local authorities from time to time.

2. No body shall throw, burn, or bury the solid waste on streets, open public spaces outside his premises or in the drain or water bodies.

Domestic hazardous waste means discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines, broken mercury thermometers, used batteries, used needles and syringes and contaminated gauge, etc., generated at the household level.

Learn how to separate waste correctly into 3 waste bins so you can keep Tamilnadu clean and beautiful!

How much waste does each person make around the world every day?

The average person in India produces 0.45kg of waste every day. It may be small amount of waste. But, India has a large population and imagine you collected all the waste today and put it into tractors. You would fill so many tractors that you could create a traffic jam approximately 2,800 kilometres long. Imagine, a road all the way from Kanyakumari to New Delhi completely blocked with tractors carrying garbage and no space to walk in between. This is how much waste we create in India each day! If we reduce the waste, we reduce the pollution.

India produces 532 million kilos of solid waste every day.

4.5 Pollution

Pollution occurs when the environment gets contaminated by waste, chemicals and harmful substances.

Pollution is the damage caused to the environment mainly because of human activities. Any substance that causes pollution is known as a **pollutant**. Pollution is an unwanted change in the physical, chemical and biological characteristics of our land, air and water.

4.6 Types of Pollution

There are four major kinds of pollution:

1. Air pollution
2. Water pollution
3. Land (soil) pollution
4. Noise pollution

4.6.1 Air pollution

Most air pollution is caused by the burning of fossil fuels (e.g. oil, petrol, coal and natural gas). These fossil fuels are used in factories (industries), power plants and motor vehicles. Burning these fossil fuels release toxic gases and fine particles (such as ash and soot) into the air causing air pollution. Air pollution is also caused by burning solid waste

(especially some plastics), gases or chemicals released from factories and fumes from aerosols (like deodorant spray cans) or paints.

Certain toxic gases produced by industries mix with raindrops high in the atmosphere and make rain unusually acidic. This is called acid rain. It damages plants, washes the nutrients out of soils and kills fish. Air pollution is harmful to all living organisms including humans. Polluted air affects skin, eyes and respiratory system.

How can we reduce air pollution?

1. Cycle or walk short distances instead of using a motor vehicle.
2. Travel by public transport (bus or train)
3. Do not burn solid waste.
4. Avoid fireworks.

4.6.2 Water pollution

Water pollution occurs when wastes from factories, houses and farms mixes with the water in rivers, lakes, ponds, the ocean or even groundwater. Contaminated or polluted water can spread diseases and chemicals which are not good for our health.

The most significant sources of water pollutants are

1. Sewage (water we use at home for bathing, cleaning, cooking).
2. Industrial effluents (liquid wastes from factories).
3. Agricultural pollutants (chemical pesticides and fertilisers that get washed from farms).
4. Solid waste (when waste gets dumped into water bodies).

How can we reduce water pollution?

1. Do not pour leftover oil, old medicines or waste down the drain or into the toilet.
2. Reduce the use of chemical pesticides and fertilizers to grow crops.
3. Use waste water for garden in home.
4. Do not litter or dump waste - always use a waste bin.

4.6.3 Land (soil) pollution

In the same way as water and air get polluted, land or soil pollution happens when toxic chemicals change the natural balance in soil. Land pollution comes from farming (Excess use of chemical pesticides and fertilisers), mining (digging up metals and other materials), factories (industrial waste) and the solid waste from our own homes like plastics and broken electronics. Soil pollution affects animals, humans and even plants because soil or land acts like a sponge. When it rains, pollutant sinks into the soil. If we grow plants to eat in polluted soils, these dangerous chemicals can get into our food.

How can we reduce land pollution?

1. First try to reduce waste, then recycle the rest.

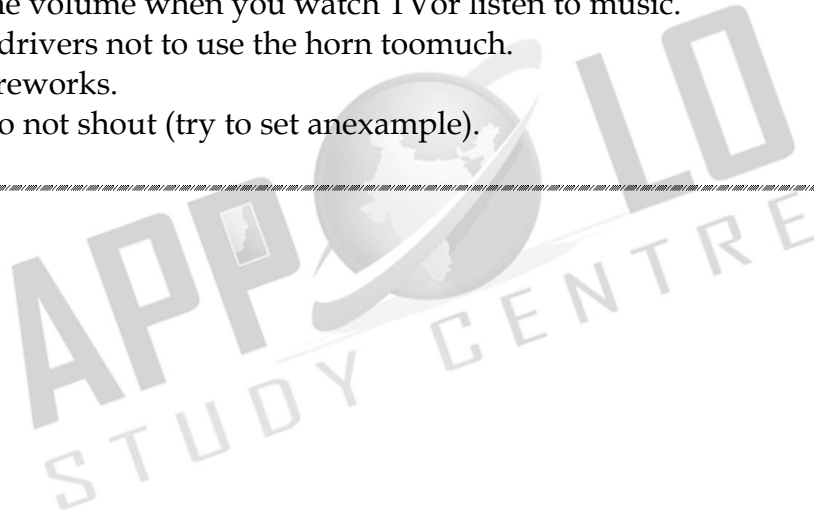
2. Always use a waste bin and never litter.
3. Do not burn waste, the ash mixeasily with soil.

4.6.4 Noise pollution

Noise pollution affects the environment. We all like a quiet and peaceful place since unpleasant or loud sounds disturb us. Loud music, the sounds of motor vehicles, fireworks and machines cause noise pollution. Continuous noise disturbs our sleep and does not let us to study. Noise pollution has been directly linked to stress and health impacts such as high blood pressure and hearing loss. Loud noise or even loud music can damage our ears. Noise pollution also disturbs animals. Birds have to communicate (talk) louder so that, they can hear each other in noisy areas. Even underwater noise pollution from ships, can make whales lose their way as they use sounds to navigate.

How do we reduce noise pollution?

1. Turn off your electronics when you do not use them.
2. Lower the volume when you watch TV or listen to music.
3. Remind drivers not to use the horn too much.
4. Avoid fireworks.
5. Speak, do not shout (try to set an example).



Unit 5 - Plants in Daily Life

Introduction

We are living in a green planet. Plenty of natural plant resources are around us. Economic botany basically deals with all pervading plants in relation to human welfare as food, clothing, shelter and medicine either directly or indirectly.

Indirect usage includes the needs of man's livestock and the maintenance of the environment; the benefits may be domestic, commercial, environmental, or aesthetic.

Plants bring about economy to the country in large extent and it is a fact that the wealth of any country largely depends upon its agriculture and plant products.

Economic botany is the study of relationship between people and plants and the uses of plants in economy.

From the earliest time rice, wheat and millet have been the staple food of a vast population of India as indicated by the presence of charred grains in most of the excavation sites. In addition, references are abundant in ancient literature about the existence and usage of several crops of economic importance.

1. Why are the farmers harvesting paddy?
2. A woman makes rope using coir. Where does the raw material come from?
3. Neem leaves are collected in a plate. Do you know the uses of neem leaves?
4. What is the material used by the manto to make a chair?

In this lesson let us discuss about the different crop plants of economic uses in relation to mankind. Based on their economic values and uses, plants may be broadly classified as follows.

1. Plants as Food
2. Spice yielding plants
3. Medicinal plants
4. Fibre yielding plants
5. Timber yielding plants
6. Ornamental plants

Plants as Food

Plants are the main source of food for humans. These plants are known as food plants.

Do you have a vegetable garden in your house? Have you ever seen harvesting of ripened vegetables?

Which part of the plants is used as food for us?

We eat different parts of plants such as root, stem, leaf, seed unripe and ripe fruits. We can classify the food plants as following.

1. Vegetables
2. Cereals
3. Pulses

Plants also give us coffee, tea, sugar and raw materials for oil.

Vegetables

We get vegetables from different parts of the plants.

Roots: eg: Beetroot, Carrot.

Leaves: eg: Curry Leaves, Cabbage.

Stems: eg: Potato, Yam.

Flowers: eg: Banana flower, Cauliflower.

Fruits: eg: Amla, Guava.

Cereals

Cereals are edible components of grain of cultivated grass. Example Rice, Wheat, Bajra, Millet.

Pulses

Pulses are edible seeds of plants legume family. Pulses are secured in pods. eg: Bengal gram, Green mung bean.

5.2 Spices

Spices are aromatic parts of tropical plants traditionally used to flavour the food. Spices come from the bark or roots of certain plants, leaves, flowers, or stems of plants primarily used for flavoring, coloring or preserving food.

India is the second largest producer of fruits and vegetables in the world.

Spices used in India

Following spices are included in a variety of Indian dishes: Cardamom, black pepper, curry leaves, fenugreek, fennel, ajwain, bay leaves, cumin, coriander seeds, turmeric, cloves, ginger, nutmeg, and cinnamon.

World Food Day, October-16.

The aim of celebration of this day is to promote worldwide awareness and action for those who suffer from hunger and for the need to ensure food security and nutritious diets for all.

Each year, World Food Day is celebrated by the Food and Agriculture Organization of the United Nations (FAO). World Food Day adopts a different theme each year. Ask your teacher about the theme of this year.

5.3 Medicinal plants

Some of the plants around us are good in healing our diseases. We call these plants as medicinal plants. They alleviate burns, cut, cold, fever, sneezes and more. Some chemical compounds in the medicinal plants act against insects, fungi and certain germs. Medicinal plants are considered as rich resources of ingredients which can be used in drug preparation.

Here is a list of plants that have the highest medicinal value.

Plant name	Parts used	Medicinal use
Amla	Fruit	Cure Vitamin 'C' deficiency diseases like Scurvy. Improve immunity.
Tulsi	Leaves, seed	Cough, cold, bronchitis, expectorant.
Aloe	Leaves	Laxative, wound healing, skin burns and ulcer.
Neem	Bark, leaf and seed	Skin diseases
Turmeric	Rhizome	helps body to fight foreign invaders,

Fibre yielding plants

Plants which give us fibres necessary for our uses are called as Fibre yielding plants. The fibre from these plants can be spun into thread, rope, and cloth. These fibres are called as natural fibres.

We can classify the Fibre yielding plants into two types based on the uses and the parts of the plant from where we get the fibre.

Based on Use

1. Textile Fibres (making cloth), eg: Cotton
2. Cordage Fibres (making rope) eg: Coconut Fibre
3. Filling Fibres (making mattresses). eg: Silk cotton

Based on the plant parts

1. Plant Fibres include seed hairs eg: cotton;
2. Stem (or bast) Fibres eg: flax, jute;
3. Leaf Fibres eg: Agave,
4. Husk Fibres eg: coconut.

In India, Jute crop is grown in seven states – West Bengal, Assam, Odisha, Bihar, Uttar Pradesh, Tripura and Meghalaya. West Bengal alone accounts for over 50% of raw jute production.

Timber yielding plants

The wood needed for the construction of buildings and making of furniture are obtained from certain plants. We use wood for these purposes due to their features like durability, stylish finishing and resistance to temperature changes.

All commercial timbers are classified into two classes as Hardwoods and softwoods based essentially on their structure.

Hardwoods

Hardwoods are angiosperms (flowering plants), the largest group of land plants. High-quality furniture, decks, flooring, and wooden construction are being made only using hardwood. eg. Teak, Jackfruit.

Softwoods

Softwoods come from gymnosperm (non-flowering plants) trees. Certain angiosperms also yield softwood

Softwoods have a wide range of applications such as making plywood, wooden boxes, medium-density Fibreboard (MDF) and paper making. eg: katampu, Pine.

The finely cut wooden boards from the wood are layered one above the other to make plywood. This is a kind of composite wood.

Ornamental plants

Plants which are grown for aesthetic reasons are called as ornamental plants. Producing flowers from floral plant is the important section of horticulture. eg: Jasmine, Rose, Chrysanthemum, Carnation, Jerbara

To decorate houses, gardens and parks we are planting shrubs such as Hibiscus, Crape Jasmine and Crotons and climbers like Mullai, Allamanda and Bougainvilleam, trees such as Golden shower tree, Mandarai, Delonix tree (Flame of the forest).

Interrelationship between plants and animals

Animal-plant Interactions

Animals rely on plants for their food and shelter. This relationship benefits not only animals but also plants. Such relationship is economically significant.

For example, silkworms feed on mulberry leaves and live of mulberry plants. This relationship between a worm and a plant is economically useful for us in silk production.

Animals, pests, and birds are essential for cross-pollination of plants.

Bright colours of flowers, smell and honey attract insects. As the insects go from one flower to another, they leave the pollen grains from their body. This results in cross-pollination and the formation of vegetables and fruits.

These insect pollinators and birds need to be protected to produce the best yield.

Bees are the best pollinators. They also give us honey. Plants and algae living in coral reefs are the food for variety of fishes. Fisheries work is done in these areas. Animals and birds play an important role in spreading seeds of various plants. The digestive enzymes in the digestive system of the birds soften the protective layer of the seeds and make it easier to germinate. If these natural relationship between animals and plants are affected, it shows its impact on economy too. Other uses of plants

1. Maintain soil fertility

Plants

maintain soil fertility. Their droppings and shedding of leaves, fruits and other parts degrade in the soil to form humus. This humus increases soil fertility. Eg. Plants like blue green algae and bacteria like Pseudomonas are also extensively used to fix nitrogen in the soil for agriculture.

2. Prevent soil erosion

Plants when grown in dense will prevent soil erosion (ie) in times of wind or flood, the fertile top layer of soil is carried away by air or water. This is prevented by plants if grown around.

3. Bio - fuels

Some plants are also grown for the sake of bio - fuels. Plant fuel is less toxic as it does not emit harmful gases and also less expensive. Eg. Jatropha. Even the plant waste is used to generate electricity. eg: Sugar mills

Pala spinach

Osteoarthritis is a joint disease affecting joints and knee in old age and any age people. Currently Indian scientists at CDRI (Central Drug Research Institute - Lucknow) have made a nano formulation from the Palak (Pala spinach) to cure this disease..

4. Rubber and Natural plastic

We obtain rubber for tyre, wiring, seats etc from plants. Natural plastics are also produced from plants which are biodegradable. So it does not do harm to our environment.

5. Neem Oil coated Urea

Farmers in India used urea as a fertilizer to increase the agricultural productivity. Indian Scientists made Neem Coated urea which released nitrogen gradually and helps the plants to absorb maximum nitrogen. It reduces the impact of urea on an environment.

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5. Reproduction and Modification in Plants

Introduction

Already we know that flowering plants have root, stem and leaves. They are called vegetative organs. Flowers, fruits and seeds in a plant are called reproductive organs. In earlier classes we have seen new plants can be grown from seeds. In this lesson, we are going to know about how a flower changes itself into a fruit and the modifications of root, stem and leaves of a plant.

Reproduction

The process by which plants and animals produce young ones and increase their number is known as 'reproduction'. Drumstick tree can be grown from both seeds and stem cuttings. When plants reproduced from seeds we call that process as sexual reproduction. All other ways of reproduction without seed are called as asexual reproduction.

Sexual reproduction

Seed is produced from a flower by the process of pollination and fertilization. This is known as sexual reproduction. To understand how seeds are formed in a flower, first we need to understand parts of a flower.

Parts of flower

Collect few buds and opened flowers of Hibiscus and Datura. With the help of your teacher, perform the following steps.

- i. Observe and compare bud and opened flower of Hibiscus and Datura.
- ii. Tabulate the characteristics

In a bud, we can see a green colour, leaf like structure which cover the whole bud or flower, Each of these green like structure present as an outermost layer is called as sepal. This outer most ring of sepals is known as calyx.

Petals are the largest part of flowers. They are often attractive, brightly coloured, sometimes sweet scented and attract the insects. This ring of petals together is called corolla.

Inner to this corolla, in Hibiscus, we can observe a long tube on which many stamens are arranged. But in Datura, we can see only five stalked structures, stamens. This ring or whorl of a flower is called androecium. Each stamens consists of two parts – a stalk called filament and a lobe called anther. If you touch these lobes in a mature flower, we can get a powdery substance called pollen grains, male reproductive part.

Inner to this androecium whorl, we can find a female reproductive part of the flower, called Gynoecium. You will find this part with a swollen bottom part. This is the ovary.

Seeds are produced in this part. On top of the ovary there is a slender tube like structure called style. The top most sticky tip of the style is stigma. Pollen grains are received by the stigma. This is the fourth whorl of a flower.

Types of flowers

Now we shall learn some important terms to understand flowers and their role in reproduction. .

- ❖ If all the four whorls- calyx, corolla, stamens and pistil are present, then it is called as complete flower. .
- ❖ Complete flowers are bisexual flowers. .
- ❖ If any of these four whorls is missing, then it is called as an incomplete flower.
- ❖ Incomplete flowers are unisexual flowers. There are two types of unisexual flowers, male flower and female flower.
- ❖ The one with androecium and without gynoecium is called as male flowers and the one with gynoecium and without androecium is known as **female flowers**.
- ❖ These are called **unisexual flowers**.

Do You Know?

The sunflower is not a single flower. It is a group of flowers clustered together. A group of flowers arranged together is called inflorescence. *Tridax procumbens*, looks like a single flower, but is an inflorescence. Leaf juice of this plant is used to cure wounds and cuts.

Flower to fruit

To understand how a flower develops into fruit, let us perform an experiment on pumpkin plant. We know from our earlier explorations that flowers of pumpkin are unisexual- that is some of the flowers are male while many are female flowers.

We can easily identify the male and female flower buds of pumpkin, even before they bloom. Once flower buds appear, immediately identify ten female flower buds. Tie a plastic bag around each bud so that no outside material can enter.

Ensure to make small holes with a pin to allow air flow. Wait for two to three days to bloom.

Choose three to four male flowers. Pluck the stamens of these flowers and dust the the pollen grains in a sheet of paper and collect it. Open five out of ten bags containing female flowers. Brush the collected pollen grains on the stigma with a soft paint brush. Take care not to damage the stigma. After few days we can see that flower in all bags that were not opened at all would wilt without forming a fruit, while most of the flowers to which pollens have been applied for fruits.

The process by which pollen grains reach stigma is called as pollination. The flower that receives pollen grains is called pollinated flower while the one that did not receive pollen grains is called as unpollinated flower.

Pollination

In the above experiment we transferred the pollen grains from male flower to the female flower. This is called as an artificial pollination. However in nature there are many ways in which pollen grains reach the stigma of the flower and is called as **natural pollination**.

In some plants like grasses, pollen grains are light. Stamens shed pollen grains, and are carried by wind to other flower. Insects, birds are also other agents of pollination. Bees, butterflies and variety of birds hover around flowers. They help to carry pollen from one flower to another. Pollen grains stick to their legs, wings or abdomen when they move from one flower to another. This is called as Cross pollination

When you shake stamens, pollen grains fallout. Thus when a wind shake the flower or when a butterfly agitate the flower, pollen grains could fall onto the stigma of same flower. Some plants that have both the male and female parts within a single flowers(bisexual) pollinate by this means. This is called as Self pollination.

Beans (Fabaceae), tomatoes (Solanaceae) are commonly self-pollinate. Even though, for example tomato, self pollinate, they need the help of the insects to create vibrations within the flowers that will effectively loosen the pollen. Paddy is mostly self pollinating using just gentle wind as the pollinating agent. The agents that are helping in pollination are called **pollinators**.

Differences between Self / Cross Pollination.

Self Pollination	Cross Pollination
Pollen grains are transferred from the anther to the stigma of the same flower or to another flower of the same plant.	Pollen grains are transferred from the anther of one flower to the stigma of another flower of the same kind or different plant.
Plants do not need to produce pollen grains in a large quantity for self pollination	Plants need to produce pollen grains in larger quantities to increase the chance of pollination.
It does not produce changes in the characteristics of new plants.	Cross pollination does introduce variations in characteristics of new plants.

In many plants, pollens have to come from some other flowers. This is obvious in case of plants which have distinct male and female flowers like pumpkin. In some flowers the

gynoecium matures first before the androecium shed pollens. Plants such as apples, plums, strawberries, pumpkins use insects for cross-pollination.

Fertilization

Through pollination, pollen grains reach stigma. What happens to them after this? Substances produced on the stigma causes the pollen grain to germinate. During the germination a tube develops from the pollen grain that carries male gametes that ultimately reaches female gamete inside the ovary through the style. Male gamete fuses with the female gamete to form zygote. This process is known as fertilization.

Life cycle of a plant

Where is this female gamete? Inside the ovary, small rounded structures, ovules are present. In these ovules, female gamete is present. To know more about this, we should cut ovary of a flower in longitudinal and transverse ways.

Cut a ovary of a flower both vertically and horizontally. Observe the ovules. Compare the ovary and ovules from few different flowers. Are there one or more ovules? Can you see any connection between the number of ovules in the ovary and number of seeds in each fruit?

Collect some fruits – Tomato, Brinjal, Lady’s finger (vegetable), mango, peas and custard apple and observe. You can see some green part above brinjal and lady’s finger. what are they?

Compare mango, custard apple and peas. All these are single fruits but custard apple has many small parts in it, each with a seed. Mango has a single seed and pea has many seeds. What do you understand from the above observations?

i. A green part above fruits of brinjal and lady’s finger are sepals of a flower. In some, after fertilization, sepal will not fall from fruit and remain or persist with fruit.

ii. **Custard apple:** It is made up of many fruits, aggregated together. Each fruit part is thin, membraneous with some granule like, which is edible.

iii. **Mango:** Outer skin and middle pulpy are edible and sweet. Inner most is with single seed.

iv. **Pea:** Fruit is not fleshy, but forms a covering pouch for many seeds.

In all above fruits, ovary, a lower most swollen part of pistil develops into a fleshy fruit. Ovules present inside the ovary gets transformed into a seed.

Hence, now with these observations, shall we list the changes taken place in a flower after fertilization. These are collectively said to be post fertilization changes and are:

- ❖ Calyx sometimes persist with fruit
- ❖ Petals wither / fall off
- ❖ Androecium fall off.

- ❖ Pistil remain and develops into a fruit.
- ❖ Style and stigma fall off
- ❖ Ovary enlarges to store food materials and develops into a fruit.
- ❖ Ovules present inside the ovary develops into seeds.

Do You Know?

The world's largest and heaviest seed is the double coconut. The seed looks like two coconut fused together. It only grows in two islands of the Seychelles. A single seed may be 12 inches long, nearly 3 feet in circumference and weighs about 18 kg.

2. Orchids have the smallest seeds in the plant kingdom. 35 million seeds may weight only about 25 gram.

Asexual reproduction

Earlier we saw that plants reproduce not only from seeds but by other processes as well. The production of new plants without the involvement of pollination and fertilization is known as asexual reproduction. Let us know the types of asexual reproduction.

Vegetative Propagation

In potato, shoot arise from eyes. Sugarcane, yam are also grown like this. Vegetative parts of the plants such as root, stem and leaves can help to propagate the plant.

Budding

When we go to a bakery we see so many types of cakes and breads. These are very soft in nature. This is due to the presence of Yeast. Single yeast undergoes asymmetric division. It produces a small protuberance which gradually grows and detaches from the parent cell. This process is called budding.

Fragmentation

In a pond we see so many algae. Spirogyra is a filamentous alga, when it matures, the filament divides into pieces. Each fragment or piece of a filament will grow into a new filament or individual. Likewise Spirogyra produces so many young ones and this process is known as fragmentation.

Spore Formation

What do you mean by unfavourable conditions? Scarcity of water, high temperature, nutrient deficiency in soil etc., are unfavourable conditions. During these conditions non-flowering plants like Algae, Fungi, Moss and Ferns produces spores. They germinate into a new plant when favourable conditions are returns.

Modifications of plant parts

Compare the given plants and discuss with your teacher.

Carefully remove a fresh carrot plant from the soil. Observe it. Look at the part we usually consume as 'carrot vegetable'. However it is not a unripe fruit, but the tap root of the carrot plant. We can see that the tap root of the carrot is swollen. In the case of the carrot plant, the tap root has a different characteristics than the usual plants. Normally, each plant organ, originally evolved to meet certain needs of the plant. For example, roots evolved primarily to anchor the plant and also absorb water and mineral nutrients from soil. Leaves were adapted to optimize photosynthesis.

Stems evolved to reach out to sunlight and also served to conduct water from roots to leaves. However in certain plant species, specific parts have evolved further in unusual and surprising ways to meet certain other specific needs, In some plants root, stem, and leaves change their shape and structure to perform special functions like storage of food, mechanical support, protection and other vital functions. This is known as modification.

What appear as the 'leaf' of a cacti are actually their stem and what appear as 'spine' on them are actually leaf. Its leaves are modified into spines, an adaptation to reduce transpiration. Photosynthesis is performed by the stem part of the plant. In this lesson let us study about the modification of root, stem and leaves.

Modification of Root Roots for storage

Look at a radish, turnip, beet root, and carrot. They all grow under the soil. As soon as you pluck it from the ground if you wash them gently, you will notice small roots dangling from their surface. All these vegetables are in fact roots of the plant. Instead of thin slender roots, in case of such plants, the roots have become a place to store the food produced by them.

Hence they are thick and swollen. One can notice that the tap root of radish is in the shape of spindle, swollen in the middle and tapering at both ends. Such type of modified roots are called spindle shaped root. Example : Radish

At times, like in the case of turnip, and beet root the tap root can acquire a shape of top, that is spherical at the base and tapering shortly towards the apex. They are called as Top shaped root.

In case of carrot, the shape is conical, broad at the apex and tapering gradually towards the base and such modified roots are called Conical shaped root.

Mechanical Support

Look at a banyan tree. It seems to have many trunk supporting it. However many of them are actually roots. As the banyan tree is large and huge, it needs support not to tilt and fall down. Many plants require such additional support. Such plants develop roots on their aerial parts to provide mechanical support. These roots grow downward and act as supportive organs. There are three types of modified roots for support.

i. Prop roots: Roots are modified to provide mechanical support as seen in Banyan tree. These roots grow vertically from horizontal branches of a tree.

ii. Stilt roots: In sugar cane, and maize adventitious roots arise from the nodes in cluster at the base of the stem. These roots are called stilt roots which gives additional support.

iii. Climbing roots: In betel and black pepper, nodes or internodes bear roots which help in climbing.

Gaseous Exchange:

Avicennia is a tree which grows in mangroves or swamps. They have roots which are seen above the ground for the purpose of gaseous exchange. These roots are erect, peg like structures with numerous pores through which air circulates. These roots are called breathing roots, or pneumatophores.

Roots for other vital function

Roots may also be perform special function. Haustoria or Sucking roots, are one such example. Cuscuta a parasite plant, climb the trees and other vegetation and use the haustorial roots to penetrate the tissue of the host plant and suck nutrients from them. They are usually found in parasitic plants that depend on the host plants for nutrients.

Modification of stems

Can you guess what is common between ginger, onion bulb, potatoes. All three are stems. Some plants have their stems modified for storing food and for vegetative propagation. Modified stem may be aerial, subaerial or underground stems.

Aerial Modifications

Phylloclade: In dry climate, conserving water is a challenge. Water evaporates from the surface. If the surface area is larger, evaporation would be more; and if the surface area is smaller, the evaporation will be less. Plants with many leaves have more surface area. Cactus hence has a thick stem which does most of the food production through photosynthesis and leaves are reduced to small spines with less surface area.

Sub - aerial Modifications

Stem of some plants remains sub - aerial which grow horizontally on the surface of the soil for the purpose of reproduction. There are four types.

i. Runner: The stem grows laterally on the surface of the soil, breaks up to produce roots where it touches the ground to give rise to new plants. E.g: Centella (Vallarai)

ii. Stolon: Stolon is a slender branch of the stem that grows upwards to some distance and then bends towards the ground. Upon touching the ground, it gives rise to a new plant. E.g: Wild strawberry.
Wild strawberry

iii Sucker : Sucker is a short and weak lateral branch that grows diagonally upwards and directly gives rise to a new shoot. E.g : Chrysanthemum.

iv Offset: An offset is a short and thick branch that arises from the axial part of a leaf. It has thick internodes. It produces a tuft of leaves and cluster of small roots below. E.g: Eichhornia.

Underground modifications

In aerial and sub aerial modifications, stem has indefinite growth. In underground modified stem, whole stem is buried under the ground and it has definite growth. Usually stem grows above the ground, but there are some stems that grow under the ground to store food. These underground stems swell and become thick.

There are four types of underground stems:

1. Rhizome; 2. Corm; 3. Tuber; 4. Bulb

i. Rhizom: It is an underground thick stem with nodes and internodes with scale leaves at the node. It grows horizontally and has an irregular shape. Rhizome have buds. If give rise to new stem and leaves. E.g: Ginger and Turmeric.

ii. Corm: This underground stem is round in shape and flat at the top and bottom. It is a condensed form of rhizome and bears one or more buds in the axils of scale leaves. Daughter plants arise from their buds. E.g: Colocasia.

iii. Tuber: It is an enlarged, spherical underground stem that stores food. It has many dormant buds on its surface known as "Eyes". If we plant a part of tuber with the bud, it grows into a new plant. E.g. Potato.

iv. Bulb: It is a condensed stem which is disc like and stores food in the fleshy leaves. The bulb has two types of leaves.

1. Fleshy Leaves

2. Scaly Leaves

The upper part of the stem has a terminal bud and it is covered by many scaly leaves. The inner fleshy leaves store food as seen in Garlic and Onion.

Modifications of Leaf

Plants have changed themselves to adapt to the environment they grow. One of them is the modification of leaves. Leaves of several plants get modified into different form based on the purpose and environment

i. Spines: Leaves are reduced to spines, and the stem is modified into green succulent part to perform photosynthesis. Eg: Opuntia.

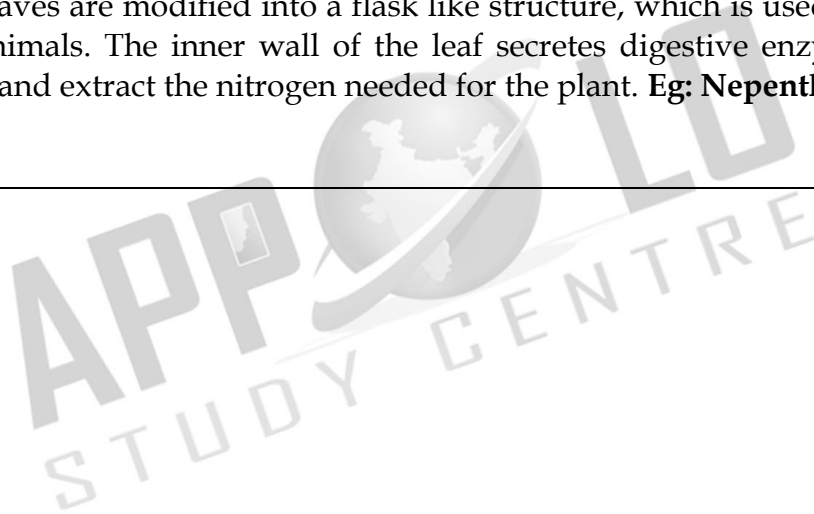
ii. Tendrils: In climbers, the leaf of plant would be modified into elongated structure to help the plants climb efficiently.

Gloriosa superba – Leaf tips are modified into tendrils

Pisum sativum (pea) –Terminal leaflets are modified into tendrils.

iii. Phyllode: In *Acacia auriculiformis*, petioles expand to form leaf like structure. They carry out the function of leaf (Photosynthesis)

iv. Traps: Plants that grow in nitrogen deficient places adapt themselves well to get it. In *Nepenthes*, the leaves are modified into a flask like structure, which is used to attract insects and other tiny animals. The inner wall of the leaf secretes digestive enzymes that help to digest the insects and extract the nitrogen needed for the plant. Eg: *Nepenthes*.



6. Health and Hygiene

Introduction

1. Have you ever taken leave from the school due to sickness?
2. What happens exactly when we become sick?
3. Sometimes, we feel good even without taking any medicines and sometimes we need to consult doctor and take regular medicines in sickness. Why is it so?

What causes sickness?

Persons from different countries or backgrounds have different ways to explain what causes sickness.

A baby gets diarrhoea. Why?

Some people may say that parents did something wrong, or perhaps because they made a God or Spirit angry. A doctor may say it is because the child has an infection. A public health officer may say it is because the villagers do not have a good water system or proper sanitation. A teacher may say that they need to be educated about health and sanitation. People see the cause of sickness in terms of their own experience and point of view. Who then is right about the cause? Possibly everyone is right, or partially right.

This is because...

Each of the causes seen above may be a part of the reason why a baby gets diarrhoea. To prevent and treat sickness successfully, it is necessary to have complete understanding of the common sicknesses in the area and the combination of things that caused them. Reading this lesson may help to understand the various causes of sickness.

Health is the best wealth. If you have good health, you will have a sound mind and you will gain good knowledge and wealth also. To maintain good health, you should follow good hygiene, eat nutritious food, do exercise, take rest and have a sound sleep.

It is also refers to a state of a sound mind and body free from any sickness or ailment, stress and problems. In simple words, health refers to the physical, emotional and psychological well-being of a person.

Hygiene refers to the good habits and their practices which is followed to prevent diseases, maintain good health, especially through cleanliness, consumption of safe drinking water and proper disposal of sewage. It refers to all those activities that are done for improving and maintaining good health and sound mind.

Cleanliness

Observe the following picture discuss with your teacher and write few lines about the transmission of disease producing pathogens through oral and faecal route.

Cleanliness refers to the maintenance of personal and environmental hygiene. In simple words, It refers to the state of being clean which is essential for good health. To protect us from diseases it is essential to maintain good health by taking regular bath, cleaning the clothes and surroundings and also avoiding unhygienic food consumption.

Tue Faecal-Oral Route of Disease Transmission

Colds and the flu are common communicable diseases. It is caused not only by bacteria but also by virus. When you have cold and flu, you may also have running nose, cough, sore throat, and sometimes fever or pain in the joints. For some, this condition may also lead to mild diarrhoea.

Secretions oozing out from the nose may contains the bacteria or virus. When the patient touch the nose and some other object or someone else the virus is transferred. When the patient sneezes or coughs the virus comes out with the droplets and become airborne. Hence it is a good practice for the patientwith cold and flu to use a handkerchief to blow the noses and also wash the hands often to ensure that they do not accidentally spread the virus to others.

Community Hygiene

A community is formed by a group of people living together in a particular area. If the people in a community wish to lead a healthy life, they should maintain basic community hygiene. It can be done by adopting the following measures.

- The surroundings should be kept clean.
- Drains should be covered properly.
- The domestic wastes should be segregated and properly disposed off safely in separate dust bins provided by the Government (Green and Blue).
- Used water from houses should not be let out into open drains or open areas.

Care of the body

A human body is a massive miracle. It consists of organs and systems, which functions day in and out. Our body in compared to a machine. The human body systems work well with proper maintenance and guidance. For smooth functioning, all the parts of the body should work in unison. The digestive system, circulatory and muscular system is the core systems that should be in synchronization and functioning well. So keep them well by proper care.

Dental Care

Dental care or broadly speaking oral hygiene is an important aspect of the personal health of an individual. Good oral hygiene implies sound teeth and healthy gums with healthy surrounding tissues. The physical act of chewing food promotes saliva and gastric secretions which helps digestion. The act of chewing and tasting is called 'mastication'. It

gives pleasure and emotional satisfaction of eating food. Teeth is essential for good appearance and clear speech also.

When you brush two times a day, it will prevent the formation of tartar and plaque on your teeth and gums.

When you Floss, it will remove food particles, plaque, and bacteria which build up between your teeth. When you start flossing, your gums may bleed a little bit, but after few days that will be stopped. It should be started only with proper medical guidance.

Diseases affecting the teeth

Diseases affecting the teeth and gums, their causative agents and remedial measure are given below:

Sl. No	Name of the Diseases	Causative Agents	Impacts/ Consequences	Remedial measures
1.	Bleeding gums	Vitamin C deficiency	Bleeding of the gums	Eating citrus fruits
2.	Tooth decay	Bacteria in plaque	Bacteria produce acids	Brushing and flossing the teeth can prevent decay.
3.	Periodontitis	Tobacco chewing	Severe form of gum Disease ruin the bones, gums, and other tissues	Chewing type of tobacco should be avoided. Eat a well-balanced diet.

Eye Care

Eyes are an important organ of our body. They are considered as “windows to the world”. Eyesight is the most important sense. 80% of what we perceive comes through the sense of sight. The protection of the eyes, can reduce the odds of blindness and vision loss. We protect our eye from the diseases, surroundings, climate condition.

Diseases affecting Eye

Disease affecting the eye and their remedial measure are given below:

Hair Care

The condition of the hair reflects to some extent the nutritional status and general health of the body. Thin, sparse hair and the loss of hair indicates a poor nutritional status.

The deficiencies in diet, physical and mental illness of various kinds may also leads to premature graying of hair.

The hair follicles from which the hair grows] produce oil which keeps the hair smooth. The sweat and the dead skin cells come off the scalp.

S. No.	Name of the Disease	Causative Agents	Impacts/Consequences	Remedial measures
1.	Night Blindness	a lack of vitamin A , a disorder of the cells in your retina	makes it hard to see well at night or in poor light..	Eat foods rich in antioxidant, vitamins and minerals.
2.	Conjunctivitis (Pink eye)	Caused by a virus and bacteria	One or both eyes can be affected. Highly contagious; can be spread by contamination and sneezing.	Antibiotic eye drops or ointments, home remedy
3.	Color blindness	Genetic condition	<ul style="list-style-type: none"> • Difficulty distinguishing between colours • Inability to see shades known as the same colour 	<ul style="list-style-type: none"> • Contact lenses and glasses

To keep the hair clean and healthy:

The regular hair wash and massage of the scalp will remove the dead skin cells, excess oil and dust.

Rinsing the hair well with clear water and using good toothed comb for hair dressing is highly essential for their maintenance.

Diseases

A disease is the functional or physical change from a normal state that affects the health of a person by causing disability or discomfort. The following are reasons that could leads to the development of disease in an individual.

1. Infection caused by disease-causing microbes
2. Lack of balanced diet
3. Poor lifestyle and unhealthy habits
4. Malfunctioning of one or more body parts or organs

Different kinds of sickness and their causes

The prevention and treatment of sickness can be considered in two groups for their better understanding. They are, communicable and non-communicable disease.

Communicable Diseases

Communicable diseases are those that spread from one person to another. Healthy persons must be protected from people with communicable diseases. Diseases spread through contaminated air, water, food or vectors (insects and other animals)

Diseases Caused by Bacteria

In this lesson, you will study about some communicable disease (like tuberculosis, Cholera and Typhoid), which are caused by microbes and spread through air, water and some other organisms also.

Tuberculosis:

TB is caused by *Mycobacterium tuberculae* and spreads from one person to another person through air by spitting and prolonged contact with sharing materials of the patient. The symptoms are fever, weight loss, chronic cough, bloody spitting and difficulty in breathing.

Prevention and treatment

- BCG vaccination,
- Giving special attention to the patient,
- Regular medication like DOT

Cholera:

Cholera is caused by *Vibrio cholera* and spread through the consumption contaminated food or water. The symptoms of Cholera is Vomiting, severe diarrhea and cramps in legs.

Prevention and treatment

- Good hygienic practices like, washing hands before eating.
- Avoid eating uncovered food from street vendors.
- Drinking boiled water.
- Getting Vaccination against cholera

Typhoid:

Typhoid is caused by *Salmonella typhi* and spreads by contaminated food and water. The symptoms are Anorexia, headache, rashes on abdomen, dysentery and high fever up to 104°F.

Prevention and treatment

- Drinking boiled clean water
- Proper disposal of sewage
- Vaccination

Disease Caused by Virus

Viral diseases are extremely widespread infections caused by many type of viruses. In this lesson you will learn about some disease caused by viruses like, Hapatitis, Chickenpox and Rabies.

Hepatitis:

Hepatitis is one of the most dangerous and fatal diseases caused by Hepatitis virus- A, B, C, D, E. Its mode of transmission is Contaminated water, sharing of needles and blood transfusion. The symptoms of hepatitis is loss of appetite, (Anorexia), vomiting, eyes and urine in yellow color.

Prevention and treatment

- Drinking boiled water,
- Proper cleaning of hands

Chickenpox:

Chickenpox (chicken pox), also known as varicella, is a highly contagious infection caused by the varicella zoster virus. . This disease spreads through air and contact with an infected person. Its symptoms is appearance of rashes on the whole body, fever, headache and tiredness.

Prevention and treatment

The chickenpox (varicella) vaccine is the best way to prevent chickenpox Special attention should be given to the infected persons.

Rabies:

Rabies is a fatal disease. Which is transmitted by the bite of the infected dog, rabbit, monkey, cat etc. The virus present in the saliva of dog enters the brain via neurons. Th e symptoms of rabies is hydrophobia (extreme fear for water), fever for 2 - 12 weeks and exaggerations in behavior.

Prevention and treatment

- In early stages rabies is very difficult to detect
- After an animal is bitten it usually takes two to twelve weeks to shows any symptoms and it may take as long as two years also.
- Fatality can be prevented by timely vaccination before the onset of symptoms.

Do You Know?

Vaccine

A vaccine is a biological preparation that provides active acquired immunity to a particular disease. Vaccines like (BCG, Polio, MMR) are given at early childhood to protect from other diseases.

Non-Communicable diseases

Communicable diseases do not spread from person to person. They are caused by other factors. Therefore, it is important to know which sicknesses are communicable and which are not. They are never caused by germs, bacteria, or other living organisms that infect the body. Antibiotics, or medicines that fight against germs do not help to cure non-communicable diseases.

Problems caused by wearing out of body parts:

- ❖ Rheumatism, heart attack, epileptic seizures, stroke, migraine, headache. Cataract and cancer

Problems caused by external harmful agents entering the body:

- ❖ Allergies, asthma, poisons, snakebite, cough from smoking, stomach ulcer, alcoholism.

Problems caused by a lack of trace elements in the body:

- ❖ Anemia, pellagra, night blindness and xerophthalmia, goiter and hypothyroidism.

Problems caused by Malnutrition.

- ❖ Nutritious food is needed for a person to grow well, work hard, and stay healthy. Many common sicknesses are caused by malnutrition.

Do You Know?

Leucoderma is a non-communicable disease caused by partial or total loss of pigmentation in the skin. (**melanin pigment**). This condition affects any age, gender and ethnicity. There is no cure. It does not spread by touching, sharing food and sitting together.

Specific
health

Health problems of children

Anaemia

It is caused by eating food with less iron content and can also be caused due to feeding some other foods instead of breast milk. Severe anemia in children may lead to hookworm

infection, chronic diarrhoea and dysentery. In recent day school going children, especially the girls are affected by anemia. The Government of Tamil Nadu provides weekly iron folic tablets to all the girls in the schools of all areas.

The signs of anemia are:

- ❖ Pale or transparent skin, The inner surface of eye lids are pale, white fingernails, pale gums, weakness and fatigue.
- ❖ In severe cases, face and feet may be swollen, the heartbeat is rapid and with shortness of breath.
- ❖ Children and women who eats mud are usually anemic.

Consuming iron containing food Sources

- ❖ Food - Moringa leaves, Dates, Liver (Sheep and Chicken), Green, green leafy vegetables like beans, peas, lentils and Greed banana.
- ❖ Pills - Cod liver oil tablet, Ferrous sulfate.

Safety and First Aid

First aid is the immediate treatment given to the victim of trauma or sudden illness before medical help is made available.

The first aid is

- ❖ To save the life
- ❖ To prevent further bleeding and determine the condition of the patient
- ❖ To relieve the pain
- ❖ To provide a medical care available at the earliest

Burns

The tissue damage caused by heat, chemical, electricity, sunlight or nuclear radiation is known as Burns. Mostly burns are caused by scalds, building fires, flammable liquid and gases. There are three types of burns, according to degree of burning.

- First-degree burns affect only the outer layer (called the epidermis) of the skin
- Second-degree burns damage the epidermis and the layer beneath it (called the dermis)
- Third-degree burns involve damage or complete destruction of the skin to its full depth and damage to underlying tissues also. People who experience such burns often require skin grafting.

First Aid for Burning

In case of minor burns, the affected area should be washed with cold water and an antiseptic cream should be applied. In case of severe burns, where deeper layers of tissues get destroyed and blisters appear, use of water should be avoided. The burnt area should be covered with a clean non- sticking cloth or bandages. Larger burns need immediate medical attention.

It is very important to keep a fire extinguisher readily available.

Cut and Scratches

Cuts and scratches are areas of damage on the surface of the skin. A cut is a line of damage that can go through the skin and into the muscle tissues below, whereas a scratch is surface damage that does not penetrate the lower tissues.

Cuts and scratches may bleed or turn red, become infected and leave scars.

First aid for cuts

For minor cuts, the affected area should be washed with cold running water and cleaned with an antiseptic liquid. Then apply an antiseptic cream on the wound and sterilized bandage should be tied to prevent infection. If the cut is deep, a clean cotton pad should be placed on the cut and pressed, and the injured person should be taken to a doctor immediately.

Basic cleanliness and protection.

1. The most important thing is to help anybody, but you must also protect yourself from HIV and other blood-borne diseases when you help someone who is bleeding. You should wear gloves or a clean plastic bag on your hands.

2. Be careful not to prick yourself with needles or other sharp objects around the person you are helping.

Points to remember

Health

A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Communicable diseases

Diseases that are caused by pathogens and can be transmitted from an infected person to a healthy person directly or indirectly.

Non - Communicable diseases

Diseases that are not caused by pathogens and cannot be passed on by a sick person to a healthy person.

First aid

The immediate care given to a patient before a medical person arrives.

UNIT 5 Cell Biology

Introduction

Sona had a dinner, some hour later; she experienced a stomach pain and went to a clinic. After examination, the Doctor told Sona that she had eaten food contaminated with a type of bacteria which might have caused food poisoning. Bacteria are micro-organisms that can be seen only under microscope and not seen through naked eyes. Salmonella species is a bacterium that can cause food-borne infection.

Our earth is a beautiful place where indifferent types of organisms happily coexist. From minute mosses to huge conifers, invisible bacteria to huge blue whale, all have a basic unit called Cell. Let us study about the cell.

Cell as a fundamental unit of life:

The building wall is made up of numerous bricks. In the similar manner, a beehive is composed of numerous hexagonal units. Some of the organisms are represented by a single cell. Therefore, they show a simple organization. The basic functional unit of an organism is called, a cell. Structures of a cell represent the arrangement of parts or organelles in a cell. Function is the activity of each part or organelle in a cell. Cells are the basic building blocks of an organism. You learnt that atoms are the basic building blocks of matter in chapter three. Likewise, human body is made up of animal cell and plants made up of plant cell.

Unicellular organisms

Some simple organisms are made up of only one cell. They are called unicellular organisms, which can be seen with the help of a microscope. There are many single-celled microscopic organisms.

Have a look at the image. Chlamydomonas and an Amoeba, a single cell organism which carry out entire functions the body of all organisms are made up of tiny building blocks called, cells. Bacteria are also one-celled unicellular organisms.

Multicellular Organism

The cells are organized into tissues, organs and organ systems in a multicellular organism. Macroscopic organisms are visible and consist of many cells. The body of macroscopic organisms involves various functions. You can see cells of onion and human through a microscope. Onion and man are examples for multicellular organism.

Cell to organism

Many cells function together to form tissues, different tissues combined together to form an organ and different organs to form an organ system, which leads to form an organism.

Organisms

Many types of organ systems function together in a body, e.g. respiratory system, digestive system, excretory system, circulatory system etc.

Organ System

Many organs together form an organ system, which is concerned with a specific function. For example, Respiratory system, which has organs like nostrils, nasal chamber, wind pipe and lungs that helps in the process of respiration. In a plant, the root system consists of primary root, secondary root and tertiary root, which does the function of conduction of water, mineral and also fixation.

Organ

A collection of different tissues worked together to perform a specific function or functions is called an organ. Human body has different organs like stomach, eye, heart, lung etc., are made up of different type of tissues. Plants have organs such as leaves, stems, and roots.

Tissue

Tissue is a group of cells, organized for a specific function. Tissues have following features like same shaped cells or different shaped cells to perform a common function. Human and other animals are made up of nervous, epithelial, connective and muscle tissues. Plants have transport, protective and ground tissues.

Cell

The cell is a basic structural and functional unit of life. Cell is the building unit of living organisms. You can see in a hand, how many types of cells are there to work together to perform its functions. So, cell is known as the basic unit of life.

Plant and Animal cell comparison

Why do plant cells differ from animal cells? They differ from each other because they have to perform different functions. Now you know that there are many main similarities between plant and animal cells. Let us see how they differ from one another as given in the picture.

Human cells related to functions Different types of cells

Our body is made up of many different kinds of cells. Each type of cell is specialized to perform a specific function. Depending on the function, cell has specific shape, size and may have some components which other type of cells do not have. Have a look at the differences between nerve cells and red blood cells in the images. Even though there are many

different types of cells, there are some components common to all type of cells. Let us take a look at this in the next section.

What's inside a cell?

Inside a cell, there are many tiny structures called cell organelles. These organelles are responsible for providing needs of the cell. They work to bring in food supplies, get rid of waste, protection and repair of the cell, and help it to grow and reproduce. Each one has a specific function to do for the cell. And, if any one organelle stops its function, then the cell is programmed to die.

Cell Structure

As we have mentioned before, all cells have some common structure.

These are

1. Cell membrane
2. Cytoplasm, and
3. Nucleus (In most eukaryotic cells).

The structure of a typical plant and animal cell shows following peculiarities:

Cell membrane

The boundary of an animal cell is the plasma membrane, which is also called as cell membrane

Cell wall - "Supporter and Protector"

All animal and plant cells are enclosed or surrounded by a cell membrane as you learned before. However, as you might have noticed previously that, animal cells often have an irregular shape, whereas plant cells have a much more regular and rigid shape.

Plant cells have an additional layer on the outer side of the cell membrane. This is called as the cell wall that provides a frame work for support and stability. The cell wall is formed from various compounds, the main one being cellulose. Cellulose helps to maintain the shape of the plant cell. This allows the plant to remain rigid and upright even if it grows to great heights. Each cell is interconnected with its neighbouring cells through openings called Plasmodesmata.

Do you know?

Stem Cells

Stem cells are quite amazing as they can divide and multiply while at the same time with their ability to develop into any other type of cell. Embryonic stem cells are very special as they can become absolutely any type of cell in the body, for example, blood cell, nerve cell, muscle cell or gland cell. So they are utilized by the Scientist and Medicos, to cure and prevent

somediseases like Spinal cord injury.

Cytoplasm - I am the "Area of Movement".

When you look at the temporary mounts of an onion peel, you can see a large region of each cell enclosed by the cell membrane. This region takes up very little stain. It is called the cytoplasm.

The cytoplasm includes all living parts of the cell within the cell membrane, excluding the nucleus. The cytoplasm is made up of the cytosol and cell organelles. The cytosol is a watery, jelly-like medium made up of 70% - 90% water and usually colourless.

Cell organelles and structures present in a cell are endoplasmic reticulum, vacuole, ribosome, Golgi body, lysosome, mitochondria, centriole, chloroplast, surrounded by plasma membrane and cell wall.

Protoplasm vs. Cytoplasm

In particular, the material inside and outside the nuclear membrane is known as Protoplasm. The fluid inside the nucleus is known as the nuclear fluid or nucleoplasm and outside the nucleus is called as cytoplasm.

Inside the cytoplasm Mitochondria - "Power house of the Cell"

Do you remember learning about the food as the energy source for the body? Just as wood is burnt to release the stored potential energy to make a fire to heat some water. The food that you ate to be broken down in order to release the energy which can be used by your body to function. Mitochondria are responsible to do this function.

Very active cells have more mitochondria than cells that are less active. Which type of cell, do you think, will have more mitochondria, a muscle cell or a bone cell?

Mitochondrion is an oval or rod shaped double membrane bounded organelle. Aerobic respiratory reactions take place within the mitochondrion to release energy. So it is known as "the Power House" of the cell. The energy produced within the mitochondrion is used for all the metabolic activities of the cell.

Chloroplast- "Food Producers"

Do you notice the green organelles present in plant cells and absent in animal cells. Chloroplasts are the only cell organelles that can produce food from the sun energy. Only plants with chloroplast are able to do photosynthesis because they contain the very important green pigment, chlorophyll. Chlorophyll can absorb radiant energy from the Sun and convert it to the chemical energy which can be used by the plants and animals. Animal cells lack chloroplasts and are unable to do photosynthesis.

Golgi complex- I need a break

Membrane bounded sacs are stacked on top of the other with associated secretory vesicles are collectively known as Golgi complex. Functions of Golgi complex are the production of secretory substances, packaging and secretion. This is the secret behind the change in the colour and taste of fruits

Lysosome- “Suicidal Bag” Everything I touch, I destroy

You will find organelles called as lysosomes, which are very small to view using a light microscope. They are the main digestive compartments of the cell. They lyse a cell, hence they are called “suicidal bag” .

Centrioles

They are generally found close to the nucleus and are made up of tube-like structures. Centrioles or centrosomes are present only in animal cells and absent in plant cells. It helps in the separation of chromosomes during cell division.

Endoplasmic reticulum - You guys, be quiet, I have so much work to do

It is an inter membranous network made up of flat or tubular sacs within the cytoplasm. Endoplasmic reticulum is of two types. They are rough endoplasmic reticulum and smooth endoplasmic reticulum.

Rough endoplasmic reticulum: are rough due to the ribosomes attached to the membrane, which helps in the synthesis of protein.

Smooth endoplasmic reticulum. It is a network of tubular sacs without ribosomes on the membrane. They play a role in the synthesis of lipids, steroids and also transport them within the cell.

Nucleus - Everyone do what I say. Acting like the “Brain” of the cell

- Plant and animal cells have a nucleus inside the cytoplasm. It is surrounded by a nuclear envelope. One or two nucleolus and the chromatin body are present inside the nucleus. During cell division, the chromatin body is organised into a chromosome. Storage of genetic material and transfer of hereditary characters from generation to generation are the functions of chromosome.

Functions of Nucleus

- In controls all the processes and chemical reactions that take place inside the cell
- Inheritance of character from one generation to another

Do you know?

Red blood cells

Red blood cells do not contain a nucleus. Without a nucleus, these cells die quickly; about two million red blood cells die every second! Luckily, the body produces new red blood cells every day.



UNIT - 6 Basis of Classification

Introduction:

When you get ready to go to school, all your things – Uniform, lunch box, water bottles, shoes etc..., to be kept ready. Just imagine if all these things are not ready you will need to spend too much time to collect them. Likewise, in a grocery shop, Medical shop and bakery all the items are systematically arranged. Sorting of things is very much required and important for all living beings. We see various plants and animals around us. It is estimated that about 8.7 million species of living organisms have been identified and named till now. However many scientists believe that, only a small portion of the total species existing on earth has been identified. In order to know about the behaviour and relationship among organisms, that are known, biologists have classified them into two broad groups, plants and animals. Grouping of living organisms based on their common features is known as biological classification.

List out things found in your class room

Chair, Table, Black board, Chalk piece, Cupboard, Fan, Light, Switches, Schoolbag, Lunch bag, Text book, Note book, Water bottle, Pencil box, Pencil, Pen, Rubber, Ruler, Door, Window, Writing pad, Colour pencil, Eraser, Sharpener, Compass, and Chart papers.

1. Find out one common difference among these materials to classify the above things into two Wooden / Non Wooden
2. Find out another difference to classify each group into two sub groups wooden sitting materials / wooden writing materials and Non-wooden sitting material / Non wooden writing materials.
3. Continue to identify differences to classify each small subgroup into two Fixed / Portable, with arm / without arm there are some similarities and differences exist among these materials. So we need to observe and identify those similarities and differences to construct a dichotomous key. The dichotomous key allows us to make quick reference and identify a particular thing. Classification provides scientists a systematic easy way of studying organisms. Classification is done using this dichotomous key. What is dichotomous key? It is a tool used to classify organisms based on their similarities and differences.

Features of dichotomous key

- A single feature that differentiates a group easily
- One character selected to separate the group, as present or absent.
- Continue the 2nd step until only one item will remain at the end.

Dichotomy of Animals

Using a dichotomy pattern, classify the given list of animals: Ostrich, peacock, monkey, frog, toad, turtle, snake, shark, goldfish, ant, tapeworm, earthworm and leech.

1. Presence or absence of back bone, we can classify them into two groups.
2. Animals with back bone can be divided into its subgroup based on its body temperature.
3. Further classification can be done based on its difference like presence of feather or hair, scales etc.

Basics of Classification:

Living organisms are so large in number that they need to be classified into smaller groups. Classification of living organisms is made on the basis of their characteristics, similarities and differences.

Based on the special features and characters, the students identify each button, according to its size, hole and colour. This is known as identification. The teacher shall ask students to separate the buttons according to the size, hole and colours. This is known as assortment. After assorting the buttons the teacher asks the students to gather the buttons according to their size, hole and colours. This is termed as grouping. Identification, assortment and grouping, which results in classification.

Do you know?

Aristotle was a Greek philosopher and thinker who lived about 2400 years ago. Aristotle came up with the following grouping system that was used for almost 2000 years after his death!

- He classified all organisms into either animals or plants.
- Then he classified into those 'with blood' and those 'without blood'.
- Then the animals are classified into three groups based on their method of movement: walkers, flyers or swimmers.

Classification:

The method of arranging the organisms into groups is called classification. When we classify things we put them into groups based on their characteristics.

Why do we classify things?

- Classifying things makes it easy for us to know their similarities and differences.
- Things with similar characters are classified into same group. These things are usually similar in at least one characteristic.
- Things with different characteristics are classified into different groups. These things are usually different in at least one characteristic.

- Classification helps us to understand, living and non - living things in better way. For example, we can classify a newly discovered organism, we would come to know, how it relates with other.

Need for Classification

- Classification is needed to identify an organism correctly.
- It helps to know the origin and evolution of an organism.
- To establish the relationship among different organisms
- It provides the information about living things in different geographical regions.
- It helps in understanding how complex organisms must have evolved from simpler ones.

Scientists have been able to discover and classify more than 2 million organisms on the earth ranging from tiny bacteria to the largest blue whales. Each organism has been classified in a category based on its evolutionary relationship with other group of organisms. We can define hierarchy of organisms as:

“The system of arranging taxonomic categories in a descending order based on their relationships with other group of organism is called hierarchy of categories”. This system was introduced by Linnaeus and is called Linnaean hierarchy. There are seven main categories of hierarchies namely, Kingdom, Phylum, Class, Order, Family, Genus and Species. Species is the basic unit of classification

Based on the above classification the following table shows different phylum, with general features and examples of different phyla and classes

S.No	General Characters	Division
1.	Microscopic unicellular, Pseudopodia, Flagella and Cilia for locomotion, reproduce by fission or conjugation	Phylum Protozoa E.g. Amoeba, Euglena and Paramecium
2.	Multicellular organisms with holes in the body. Skeleton formed of Spicules, asexual and sexual reproduction.	Phylum Porifera E.g. Leucosolenia, Spomgilla, Sycon.
3.	Multicellular organisms Diploblastic, sessile or free swimming, solitary or colonial, asexual and sexual reproduction	Phylum Coelenterata E.g. Hydra, Sea anemone, Jelly fish, Corals
4.	Acoelomates, parasites inside the body of animals and human beings,	Phylum Platyheminthes E.g. Planaria, Liver Fluke, Blood Fluke,

	mostly hermaphrodites (Bisexual)	Tapeworm
5.	Unsegmented body, mostly parasites in human beings and animals, causing disease, asexual reproduction	Phylum Aschelminthes or Nematoda E.g. AscarisLumbricoides
6.	Triploblastic, segmented body, mostly hermaphrodite (Bisexual and unisexual)	Phylum Annelida E.g. Earth worm, Nereis Leech
7.	Segmented body, thick chitinous cuticle forming an exoskeleton, paired and Joined legs, unisexual exhibits sexual dimorphism	Phylum Arthropoda E.g. Crab, Prawn, Millipede, Insects, Scorpion, spider
8.	Soft bodied, unsegmented, Muscular head, foot and visceral mass, a calcareous shell, sexual reproduction	Phylum Mollusca E.g. Cuttle fish, Snail, Octopus
9.	Exclusively marine, spines and spicules over the body, water vascular system, tube feet, for feeding, respiration and locomotion, sexual reproduction	Phylum Echinodermata E.g. Starfish, Sea-Urchin, Brittle star, sea cucumber and sea-lily
Phylum- Chordates		
10.	Aquatic, cold blooded vertebrates with boat shape body and jaws, locomotion, sexual reproduction	Class Pisces Shark, Catla, Mullet, Tilapia
11.	Amphibious, cold-blooded, two pairs of limbs, sexual reproduction	Class Amphibia E.g. Frog, Toad, Salamander, Caecilian
12.	Cold-blooded, lung breathing, scales over the body, pentadactyl limb, adapted for climbing, running and padding, oviparous	Class Reptilia Garden lizard, House lizard, Turtles, Tortoise, snakes, crocodile
13.	Warm blooded, exoskeleton of feathers, flight adaptation, spongy bones with air cavities, powerful eyes, sexual reproduction, oviparous	Class Aves Wader bird, Roller bird, Hoopoe bird, Parrot, Sparrow, Hen, Ostrich, Kiwi

14.	Terrestrial warm blooded, external ear or pinna, muscular diaphragm, non-nucleated RBC, hetrodont and diphodont dentition, viviparous give birth to young ones.	<p>Class Mammalia</p> <p>Duck bill Platypus, Kangaroo, Cat, Dog, Tiger, Zeebra, Man</p>
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Classification of Plants

Based on dichotomy, plants also can be classified into two main groups Flowering and Non - flowering. Non - flowering plants do not produce seeds and flowering plants produce seeds. Based on their nature of plant body, non-flowering plants are classified into three types: algae, mosses and ferns. Based on their fruit body, flowering plants are classified into two types: gymnosperms and angiosperms.

Algae

- ⊕ Plant is thallus, not well-differentiated into root, stem, and leaves.
- ⊕ They are predominantly aquatic.
- ⊕ They are unicellular or multicellular - filamentous. Example - Chara

Mosses

- ⊕ Plant body is not differentiated into true root, stem and leaves.
- ⊕ They are water living plants, needs moisture to complete its life cycle. Hence they are referred to as amphibious plants.
- ⊕ They do not have any specialized vascular tissues for conduction of water and food.
- ⊕ Examples: Funaria

Ferns

- ⊕ Plant body is well-differentiated into root, stem, and leaves. Leaves may be large or small.
- ⊕ Specialized vascular tissues are found for the conduction of water and food.
- ⊕ Basically they are the first land plant which grows well in shady, moist, and cool places.
- ⊕ (Examples: Adiantum)

Gymnosperms

- ⊕ Plants are perennial, woody, evergreen with true root, stem and leaves.
- ⊕ They possess vascular tissues, xylem without vessels and phloem without companion cells.
- ⊕ Ovules are naked, without ovary. Hence they do not produce fruits. Seed are naked.
- ⊕ (Examples: Pinus, Cycas)

Angiosperms

- ⊕ Plant body is well differentiated into true root, stem, and leaves.
- ⊕ They produce flower with four whorls (calyx, corolla, androecium and gynoecium), hence known as flowering plants.
- ⊕ Female reproductive organ, ovary is present inside the flower which develops into fruit and ovule develops into seed.
- ⊕ Plants possess well developed vascular system with xylem vessels and phloem - companion cells.

Angiosperms are the dominant plant forms of present day. Based on the number of cotyledons, angiosperms are broadly divided into two groups. a. Monocotyledons b. Dicotyledons. Plant seeds which have only one cotyledon are said to be monocots. Plant seeds which have two cotyledons are known as dicots. Example- Paddy (monocot), tamarind (dicot).

The Five Kingdom Classification

The five kingdom classification was proposed by R.H. Whittaker in 1969. Five kingdoms were formed on the basis of characteristics such as cell structure, mode of nutrition, source of nutrition and body organization.

Monera

Kingdom Monera - Bacteria

All prokaryotes belong to the Kingdom Monera, which do not possess true nucleus. Cells of prokaryotes do not have a nuclear membrane and any membrane bound organelles. Most of the bacteria are heterotrophic, but some are autotrophs. Bacteria and Blue green algae are examples for monera.

Kingdom Protista:

The Kingdom Protista includes unicellular and a few simple multicellular eukaryotes. There are two main groups of protists. The plant like protists are photosynthetic and are commonly called algae. Algae include unicellular and multicellular types. Animals like protists are often called protozoans. They include amoeba and paramecium.

Kingdom Fungi:

Fungi are eukaryotic, and mostly are multicellular. They secrete enzymes to digest the food and absorb the food after digested by the enzymes. Fungi saprophytes as decomposers (decay -causing organisms) or as parasites. Kingdom Fungi includes molds, mildews, mushrooms and yeast.

Kingdom Plantae:

Plantae (plants) are multicellular eukaryotes that carry out photosynthesis. Reserve food materials are starch and lipids in the form of oil or fat. Plant cells have cell walls and specialized functions, such as photosynthesis, transport of materials and support. Kingdom Plantae includes ferns, cone bearing plants and flowering plants.

Kingdom Animalia:

Animalia (animals) are multicellular, eukaryotic and heterotrophic animals. Cells have no cell wall. Most members of the animal kingdom can move from place to place. E.g. Invertebrates like sponges, hydra, flatworms, round worms, insects, snails, starfishes. Vertebrates like Fish, amphibians, reptiles, birds, and mammals including human beings belong to the kingdom Animalia.

Characterises	Monera	Protista	Fungi	Plantae	Animalia
1. Cell type	Unicellular, Prokaryotic.	Unicellular, Eukaryotic	Multicellular, Non-green and Eukaryotic	Multicellular, Eukaryotic	Multicellular, Eukaryotic
2. Nucleus	Absent	Present	Present	Present	Present
3. Body Organism	Cellular level of organization	Cellular level of organization	Multi cellular with loose tissue	Tissue level and organ level	Tissue, organ and organ system
4. Mode of Nutrition	Auto (or) Heterotopic	Auto (or) Heterotopic	Saprophytic, Parasitic sometime symbiotic	autotrophic	Heterotopic

Merits of five kingdom classification:

- ⊕ This system of classification is more scientific and natural
- ⊕ This system of classification clearly indicates the cellular characters for early evolution of life
- ⊕ It is the most accepted system of modern classification as the different groups of organisms are placed phylogenetically
- ⊕ It indicates gradual evolution of complex organisms from simpler one.

Demerits of five Kingdom Classifications

- ⊕ In this system of classification of viruses have not been given a proper place
- ⊕ Multicellular organisms have originated several times from protists.
- ⊕ This type of classification has drawn back with reference to the lower forms of life.
- ⊕ Some organisms included under Protista are not eukaryotic.

Binomial Nomenclature

Gaspard Bauhin in 1623, introduced naming of organisms with two names which is known as Binomial nomenclature, and it was implemented by Carolus Linnaeus in 1753. He is known as 'Father of Modern Taxonomy'.

Binomial nomenclature is an universal system of naming organisms. As per this system, each organism has two names - the first is the Genus name and the second is the Species name. Genus name begins with a capital letter and Species name begins with a small letter. Example: The nomenclature for onion is *Allium sativum*. Genus name is *Allium*, species name is *sativum*.

Vernacular name is a local name that is familiar for a particular place. Binomial name is a universal name which never changes. Binomial nomenclature and classification helps scientists to identify any organisms and to place them at a particular hierarchy.

Did you Know?

S.No	Common Name	Scientific Name
1.	Human Being	<i>Homo Sapiens</i>
2.	Onion	<i>Allium Sativum</i>
3.	Rat	<i>Rattus rattus</i>
4.	Pigeon	<i>Columba livia</i>
5.	Tamarind	<i>Tamirindus indica</i>
6.	Lime	<i>Citrus aurantifolia</i>
7.	Neem Tree	<i>Azadirachta indica</i>
8.	Frog	<i>Rana hexadactyla</i>
9.	Coconut	<i>Cocos nucifera</i>
10.	Paddy	<i>Oryza sativa</i>

11.	Fish	CatlaCatla
12.	Orange	Citrus Sinensis
13.	Ginger	Zingiberofficinale
14.	Papaya	Carica Papaya
15.	Date	Phoneixdactylifera



7th std term 3

lesson 5 - Animals in Daily life

Life Introduction

In earlier class you have studied how plants are used in our daily life. Now you are going to learn how animals are useful in our daily life.

Animals are closely associated with human beings in their daily life. They are the greatest gift of nature. They are of great economic importance to our nation. Animals contribute many things for our use, as food, clothing and transportation. Let us learn the importance of animals and how to protect and maintain them.

Animal Products used as food

Milk

Milk is white liquid food produced by the mammary glands of mammals. It is the primary source of nutrition for infant mammals. We use milk in our daily life for the following.

Milk is the daily essential product which is obtained from animals like cows, buffaloes, goats and camels.

Milk is necessary in our daily diet to prepare tea, coffee, ice creams, chocolates, sweets and other related products.

Highly recommended nutritive food containing protein and calcium are made from milk like, Paneer, Cheese, Cream, Butter, Ghee and curd.

Eggs

Eggs are laid by female birds of many different species to produce their young ones like hen, duck, turkey and ostrich. We use these in our daily life for the following.

They are used in our daily diet to get energy and good health.

It is highly nutritious and rich in protein.

Eggs have 6 grams of high-quality protein. A protein packed breakfast helps to sustain mental and physical energy throughout the day. Consuming egg daily is good for any age people.

Meat

Meat is animal flesh that is eaten as food. Most often it is used to describe skeletal muscle and fat that is found with it. Some people eat the flesh of animals such as chicken, sheep, rabbit, pig, goat, camel, buffalo (beef), fish, crab, prawn, lobster and many more.

Animal meat is considered as the part of diet by most of the people.

Meat consumption is considered essential for its nutritive values. Especially chicken breeding is done in large scale in the form of poultry farming for economic purpose.

Poultry Farming

Poultry farming is the process of raising domesticated birds such as chicken, duck, turkey and geese for the purpose of getting meat and egg for food. Poultry are reared in large numbers and chickens being the most common one. Chickens are broadly of two types.

Layers (egg laying chickens)

Broilers (one's that are reared for meat)

Poultry farming requires safe and sufficient space (wired cages) for the birds. Plenty of water, proper ventilation and regular feed that is rich in proteins, fats and vitamins. Poultry feed is comprised of maize, wheat, millet and rice bran in mashed form and ground nut cakes.

Diseases Poultry birds suffer from various diseases caused by some microbes. It is important to keep their shelters clean and get the birds vaccinated against common diseases. Some of the common diseases of poultry birds are the following.

Animal products used as clothing

Animal hair has a great demand. The hair from goat and sheep is used for manufacturing woollen clothes, shawls and blankets, mufflers and socks. Similarly horse hair is used as bristles in small painting brushes. Even fur of animals including the skin is used to make warm and modern style clothes.

Animal Fibres

Some fabric fibres such as cotton, jute, silk are called natural fibres. Cotton and jute are examples of plant fibres. Wool and silk fibres are examples of animal fibres. Wool is obtained from the fleece of sheep or goat. It is also obtained from the hair of rabbit, yak and camel. Silk fibre is obtained from the cocoon of silkworm.

Wool

What type of clothes are being used by people of snow capped region?

Why such kind of clothing is preferred by them?

Wool is the fibre derived from the fur of animals of the Caprinae family principally sheep. The hair of other mammals like goat, yak, alpaca and rabbit may also be called wool. Mostly, wool is produced from the outer coat of sheep. The processing of wool involves five major steps. They are as follows Shearing, Grading (or) Sorting, Washing (or) Scouring, Carding and Spinning.

Shearing

The flesh of the sheep is removed from its body. This is called shearing.

Grading (or) Sorting

The fleece from the same sheep may be different from different parts of the body. It is sorted out into separate piles of similar nature. This is known as Grading (or) Sorting.

Washing (or) Scouring

The sheared skin is washed thoroughly with soap (or) detergents to remove dirt, dust and grease.

Carding

The dried wool is carefully removed. These fibres then passed through the rollers which are covered with fine sheet of thin wire teeth. This process arranges the wool into a flat sheet called a web.

Spinning

The web is drawn into narrow strand and then passed through spinning machines. The spinning machines twist the strands into yarn. The yarn is wound to form balls of wool. This yarn is either weaved into fabric (or) retained for knitting.

Characteristic features of wool

It is resistant to heat, water, wear and tear.

It absorbs moisture.

Wool insulates against cold. So wool is a good insulator.

It does not wrinkle easily.

Uses of wool

Wool is a multifunctional fibre with a range of diameters that makes it suitable for clothing, household fabrics and technical textiles. Two third of wool is used in the manufacture of garments including sweaters, dresses, coats and active sportswear. Blended with other natural (or) synthetic fibres wool used as adds drape and crease resistance blankets, anti-static and noise absorbing carpets.

Silk

Have you ever attended marriage functions? What type of dresses the bride and bridegroom wear? What is it made up of?

Silk is the secretions of the silk moth. Silk is obtained from the cocoon of silk worms, which feed on the mulberry leaves. Silk worms live for a very short time, only about two months. During this period they pass through four stages of development. They are eggs, caterpillars, cocoon and adult moth. These stages are called as life cycle of a silk worm.

The cultivation and production of silk is known as Sericulture. An adult female silk moth lays about 500 eggs. The eggs are then kept in cold storage for six weeks. The eggs are placed in the incubator. After about ten days, the eggs hatch out and the larvae spend the next 35 days eating mulberry leaves.

The silk worms spend about five days producing silk and spinning its cocoon of a single long thread. The cocoons are boiled to make it easier to unwind the silk and kill the pupae inside. If the silk moths were allowed to hatch, the long silk fibres will get turned by the hatching of moth. Cocoons are unwind and then the individual silk filament is reeled together to form a thread large enough for weaving. The silk thread is cleaned, dyed, woven into fabric.

Characteristic features of Silk

It is very soft , comfortable and versatile
It can be easily dyed.
It is the strongest natural fibre.
It has a poor resistance to sunlight exposure.

Uses of Silk

Silk has natural beauty and elegance. It gives comfort in warm weather and warmth during colder months. It is used in the manufacture of classical and high fashion clothes, modern dresses particularly silk sarees, the elegant of beautiful dresses. It is also used in household for making wall hangings, curtains, rugs and carpets. It is also being used in the manufacture of surgical threads for sutures.

Hazards in Silk and Wool Industry

Hazard is any industry has the potential to cause injury, ill health or damage to human being and their property or the environment.

Hazards in Silk Industry

Generally, the workers in silk industry affected with arthritis is they stand for a long time reeling the silk into yarn. They also develop back pain and visionary problem and skin injuries. Some time they may suffer from respiratory problem like asthma and bronchitis due to poor ventilated area of their work.

Similarly, hazards in wool industry the workers are exposed to various chemicals and detergents which causes allergies of the skin. They also get infected to anthrax bacterium which leads to fatal dead disease called the sorters disease.

Anthrax is caused by *Bacillus anthracis* by handling contaminated animal hair and contact with the live stock during hair processing. The symptoms are fever, cough and shortness of breath, similar to a typical pneumonia. Sometimes it may lead to nausea, vomiting and diarrhoea.

Treatment

Penicillin or Ciprofloxacin is given as the best medicine for treatment of anthrax. The spread of the disease is controlled by vaccination of animals and by burning or burial of infected animal's carcasses. It is the duty of the employer to take care of the industrial workers by providing hygienic and well ventilated work place.

Sericulture and Ahimsa silk (Peace silk)

Sericulture or silk farming is the cultivation of silk worm to produce silk. It is the rearing of silk worms to obtain silk.

Ahimsa silk

It is also known as Peace silk. In 1992, Kusuma Rajaiah, a Government officer from Andhra Pradesh state of India proposed ahimsa way of silk production for the making silks without killing the silkworm. It involves a humane method specifically letting the worm hatch and then using the vacant cocoons.

Traditional silk manufacturing methods involve boiling the cocoons of the silk worms and then sorting out the threads, which is used later in silk production. It has been supported by many people who are interested in the welfare of animals.

Animal protection and maintenance

Protecting animals is like protecting our own children or parent. They are living things similar to human beings. As an elite, most intelligent and responsible human being on the planet, it is our duty to protect all the living organisms on earth. The human tendency and conscience towards the animals should be considerate to protect and safe guard the animals, hence as human it becomes a great responsibility and obligatory to protect the animals.

The Ministry of Environment, Forest and Climate change has released four New Gazette Notifications under the Prevention of Cruelty to Animals Act 1960 to regulate dog breeders, animal marketers, aquarium and pet fish owners. This progress has come about as a joint effort by animal protection groups. With the protection of animals we actually protect ourselves and protect the environment. So we have to love and protect the animals and treat them as our family members.

8th Science
Unit 16 – Microorganisms

Introduction

- Microorganisms are too small in size that they cannot be seen through naked eye. These organisms can be seen only with the help of a microscope, therefore they are also known as microbes. The science that deals with the study of microorganisms is known as microbiology.
- Microorganisms occur everywhere. They are found in air, water (ponds, lakes, rivers and oceans), soil and even inside our bodies. Some of them can even survive in severely adverse conditions, such as hot springs, deserts, snow and deep oceans. They remain inactive under unfavourable conditions and become active during favourable conditions.

Microorganisms can be studied under five categories. They are:

- **Virus**
- **Fungi**
- **Protozoa**
- **Bacteria**
- **Algae**

Virus

- A virus is a tiny, particle made up of genetic material and protein. They are intermediate between living and non living things. Virus means 'poison' in Latin. Viruses are intracellular obligatory parasites. The study of virus is called 'virology'. Viruses are 10,000 times smaller than bacteria. Viruses have different shapes. They can be rod shaped, spherical or of other shapes.

Virus structure

- A virus contains a core DNA or RNA. Surrounding that core is a protein coat. In some viruses, the protein coat is covered by an envelope made of proteins, lipids, and carbohydrates. The envelope has spikes that help the virus particles attach to the host cells.

Virus shows both living and non living characters:

Living characters

- They respond to heat, chemicals and radiations.

- They reproduce inside the host cells and produce copies of themselves.
- They show irritability

Non-Living characters:

- They are inactive when present freely in the environment.
- They can be crystallized and stored for a very long time, like other non-living things.
- The metabolic machinery, cytoplasm is absent.

Viruses cause many diseases to plants, animals and human beings.

Bacteria

- Bacteria are single-celled prokaryotes (cells without nuclei). They are considered to be the first living organisms on earth. Bacteria are grouped under the kingdom Monera. The study of Bacteria is called Bacteriology. The size of bacteria range from $1\mu\text{m}$ to $5\mu\text{m}$ (micrometer). Bacteria are of two types based on respiration.
 - Aerobic bacteria (requires oxygen).
 - Anaerobic bacteria (Does not requires oxygen).

Cell structure:

- A bacterium has an outer covering known as the cell wall. Nuclear material is represented by a nucleoid without nuclear membrane. An extra chromosomal DNA called plasmid is present in the cytoplasm. Protein synthesis is carried out by 70S ribosomes. Other cell organelles (mitochondria, Golgi body endoplasmic reticulum etc.,) are absent. Flagella aids in locomotion.
- Bacteria are described according to the shape of their cells. They are:
 - Bacilli - Rod shaped bacteria. Eg. Bacillus anthracis
 - Spirilla - Spiral shaped bacteria. Eg. Helicobacter pylori
 - Cocci - Spherical or ball shaped bacteria. They can stick together in pairs (diplococcus); form a chain (streptococcus) eg. Streptococcus pneumoniae or occur in bunches (staphylococcus).
 - Vibrio - comma shaped bacteria. Eg. Vibrio cholera

- Bacteria are also classified according to the number and arrangement of flagella, which are as follows:
 - **Monotrichous - Single flagella at one end. Eg. Vibrio cholera**
 - **Lophotrichous - Tuft of flagella at one end. Eg. Pseudomonas.**
 - **Amphitrichous - Tuft of flagella at both ends. Eg. Rhodospirillum rubrum.**
 - **Peritrichous - Flagella all around. Eg. E.coli.**
 - **Atrichous - Without any flagella. Eg. Corynebacterium diptherae**
- Bacteria get their food in many ways. Photosynthetic bacteria make their own food. (Eg. Cyanobacteria). Bacteria that live in harsh environment use chemicals (Ammonia, hydrogen sulphide) to produce their food instead of utilizing energy from the sun. This process is called chemosynthesis. Some bacteria exhibit symbiotic relationship (eg. E.coli lives in the intestine of man). Bacteria reproduces by fission (binary and multiple fission).

Fungi

- Fungi are group of eukaryotic organisms that lack chlorophyll. They grow in dark environments. They may be either unicellular (eg. Yeast) or multicellular (eg. Penicillium). They are found in all kinds of habitats. They are included under kingdom Fungi. The study of fungi is called mycology. Some fungi are macroscopic (eg. Mushroom). There are around 70,000 species of fungi, living in the world.

Cell structure:

Unicellular fungi (eg. Yeast)

- Yeasts are found freely in the atmosphere. Yeast grows in all kinds of media containing sugar. The cell is ovoid in shape, containing cell wall and a nucleus. The cytoplasm is granular, and has vacuoles, organelles, glycogen and oil globules. Yeast aids in fermentation with the help of the enzyme zymase. Yeast respire anaerobically. Yeast reproduces by budding.

Multicellular fungi (eg. Mushroom)

- Mushrooms are found growing on wet soil in shaded places during the rainy season, such as at the roots of the trees. The umbrella shaped structure that grows above the soil is known as the fruiting body. There are small slit like structures under the umbrella which are known as gills. The gills contain spores.
- The mycelium is located underneath the fruiting body, in the top layer of the soil. Mycelium in turn is made up of thread-like structures called hyphae. Walls of the hyphae are made up of chitin and cellulose. Hyphae help in transport of nutrients for the growth of mushroom. Reproduction is by the method of fragmentation and spore formation.

- Fungi are either saprophytes (i.e., derives nutrition from the remains of dead and decomposing plants and animals) eg. Rhizopus, Penicillium, Agaricus, or parasites (ie. derives nutrition from the living cells of the host) eg. Puccinia, Albugo, Ustilago, or symbionts (ie., fungus in the roots of vascular plant) eg. Mycorrhiza.

Algae

- Algae are very simple plant like eukaryotic organisms. Algae are found in moist habitats. Algae are rich in chlorophyll and can be seen as thin film on the surface of lakes and ponds, therefore they are known as 'grass of water'. They are autotrophic and manufacture their own food with the help of chloroplast. Chloroplast contain chlorophyll (green) pigments for photosynthesis. The study of algae is called algology (phycology).
- Their size varies from 1 micron to 50 meter. Algae may be unicellular, microscopic (eg. Chlamydomonas) or multicellular and macroscopic (eg. Sargassum). Unicellular algae exhibits variety of shapes (i.e., spherical, rod, spindle), where as multicellular algae are in the form of filaments and branches.

Cell structure

(Eg. Chlamydomonas)

- Chlamydomonas is a simple, unicellular, motile fresh water algae. They are oval, spherical or pyriform in shape. The pyriform (pear shape) is a common one found in ponds, ditches and water tanks. They have a narrow anterior end and a broad posterior end.
- The cell is surrounded by a thin and firm cell wall made of cellulose. The cytoplasm is seen in between the cell membrane and the chloroplast. The cell contains large dark nucleus lying inside the cavity of the cup shaped chloroplast. The anterior part of the cell bears two flagella which helps in locomotion. Two contractile vacuoles are seen at the base of each flagellum. The anterior side of the chloroplast contains a tiny red coloured eyespot. Chlamydomonas exhibits sexual and asexual modes of reproduction.

Some algae have other photosynthetic pigments like fucoxanthin (brown), xanthophylls (yellow), phycoerythrin (red), phycocyanin (blue).

Protozoan

- A protozoan (in Greek protos = first and zoon = animal) is a single-celled eukaryote. They are included under the kingdom Protista. The study of protozoa is called Protozoology. They are found in ponds, ocean, in moist soil, and in the cells and tissues of plants and animals causing diseases. They range from 2-200 microns. Protozoans have specialized organelles. These organelles are used for movement, feeding, and other functions. The types of protozoans are as follows

- **Ciliates - presence of cilia for locomotion (eg. Paramecium)**
- **Flagellates - presence of flagella for locomotion (eg. Euglena)**

- Pseudopods - presence of pseudopodia for locomotion (eg. Amoeba)
- Sporozoans - parasites(eg. Plasmodium)

Cell structure (Eg. Amoeba)

- Amoeba is a unicellular microscopic organism. It is found in ponds. Amoeba is irregular in shape. It has cell membrane, cytoplasm and nucleus. It is a protozoan that move by means of pseudopodia (in Latin, "false feet.") Pseudopodia are the extended part of cell membrane. It helps to catch its prey (algae). The body 'flows' around the food particle and engulfs it forming food vacuoles. Contractile vacuoles are seen in the cytoplasm that help in excretion. Amoeba reproduces by means of fission and sporulation.

Uses of Microorganisms in Medicine, Agriculture, Industry and Daily Life

Medicine

We obtain antibiotics and vaccines from microbes.

Antibiotics

- The word 'Anti' means 'against'. Antibiotic is a substance produced by living organisms which is toxic for other organisms. Sir Alexander Fleming was the first person to discover the antibiotic Penicillin in the year 1928. The antibiotic Penicillin was obtained from the fungi *Penicillium chrysogenum*. It is used to treat diseases such as tetanus, diphtheria. Antibiotic Streptomycin is obtained from *Streptomyces* bacteria to cure various bacterial infections eg. Plague.

Vaccines

- Vaccines are prepared from dead or weakened microbes. Edward Jenner was the first person to discover small pox vaccine. He coined the term vaccination. When the vaccine is injected to the body of a patient, the body produces antibodies to fight against the germs. These antibodies remain inside the body and protects from future invasion of the germs. Therefore vaccination is otherwise called as immunization.

Eg.MMR vaccine for Measles, Mumps, Rubella. BCG (Bacille Calmette Guerin) vaccine for Tuberculosis

Agriculture

Natural Fertilizer

- Microorganisms are called as decomposers because they act upon degradable wastes. During the process, nitrates and other inorganic nutrients are released into the soil, making the soil fertile. This compost is called as natural fertilizer.

Nitrogen Fixation:

- Rhizobium bacteria living in the root nodules of leguminous plants enrich the soil by fixing the atmospheric nitrogen as nitrates which are essential for the growth of plants. Some free living bacteria in soil, cyanobacteria Nostoc can also fix nitrogen biologically.

Biocontrol Agents:

Microbes are used to protect the crops from pests. For example,

- **Bacillus thuringiensis (Bt cotton) helps to control insects.**
- **Trichoderma (Fungi) helps to protect roots and control plant pathogens.**
- **Baculoviruses (Virus) attack insects and other arthropods.**

Industry

Sewage Treatment

- Aerobic microbes are allowed to grow in the primary effluent during the secondary stage of waste water treatment. These microbes consume the major part of the organic matter in the effluent eg. Nitrobacter sps. In the anaerobic treatment of sewage Methanobacterium is used.

Production of Biogas

- Human and animal faecal matter and plant wastes are broken down by anaerobic bacteria to produce methane (biogas) along with carbon dioxide and hydrogen. These bacteria are called as methanogens.

Production of Alcohol and Wine

- Alcoholic drinks are prepared by fermentation process using yeast. Sugars in grapes are fermented by using yeast. Beer is produced by the fermentation of sugars in rice and barley.

Microbes in Retting and Tanning Process

Retting

- Flax plants are tied in bundles and kept in water. Bacteria loosen the supporting fibres of the stem by acting on the stem tissues. This process is known as retting. Linen thread is made from these fibres eg. Pseudomonas aeruginosa.

Tanning

- In Tanning industry bacteria act upon the skin of animals and makes it soft and therefore it becomes pliable.

In Daily Life

Making of Bread

- Yeast is used in bakeries to make bread and cakes. They are added to the dough to produce carbon dioxide which makes the dough rise. Bread and cakes are soft due to carbon dioxide gas. Chlorella (green algae) is rich in proteins and vitamins is added to the dough which enrich the bread with nutrients.

Preparation of Curd and Cottage Cheese

- Lactose in the milk gets turned into Lactic acid by the action of Lactobacillus (bacteria). Therefore the milk becomes thick (curd). It gives the sour taste. When curd is processed cottage cheese (panner) is obtained.

In Human Intestine

- Lactobacillus acidophilus that lives in the human intestine helps in digestion of food and fight against harmful disease causing organisms.
- E.coli bacteria in human intestine help in synthesizing vitamin K and vitamin B complex.

Harmful Microorganisms

- A few microorganisms are harmful to humans, animals and plants. They cause diseases and hence they are called as pathogens. Pathogens enter into the body through cuts and wounds in the skin, mouth or nose and cause diseases. Viruses causing 'flu' are spread through air. When the patient sneezes droplets containing viruses spread in air and it gets entered to another person when he breathes.

Diseases Caused By Microorganisms In Humans

S.N O	Human Diseases	Causative microorganisms	Mode of Transmission	Symptoms	Preventive measures/Treatment
1	Tuberculosis	Mycobacterium tuberculosis (Bacteria)	Through air and sputum of infected person	Persistent cough, blood mucus, loss of weight, breathlessness	BCG Vaccine
2	Cholera	Vibrio Cholera (Bacteria)	By flies and by contaminated food and water	Water diarrhea, vomiting, rapid dehydration.	Anticholera vaccine, maintaining personal hygiene.
3	Common Cold	Influenza (virus)	Through Air	Running nose, sneezing	Isolation of patient.
4	Rabies	Rhabdoviridae	Animal bite	Fever, hallucination,	Anti - rabies vaccine.

		(virus)		Paralysis inability to swallow	
5	Amoebic dysentery	Entamoeba histolytica (protozoa)	Food water and flies	Severe diarrhea and blood in stool	Proper sanitation to be followed and metronidazole antibiotic to be administered
6	Malaria	Plasmodium (protozoa)	Female Anopheles mosquito	Nausea, vomiting High Fever	Antimalarial drugs like quinine, chloroquine to be taken and also usage of mosquito repellents and nets.

Diseases Caused By Microorganisms in Animals

Animal Diseases	Causative microorganisms	Mode of transmission	Symptoms	Preventive measures / Treatment
Anthrax (Cattle) also affects humans	Bacillus anthracis (Bacteria)	Through contaminated soil and food.	Difficulty in breathing, unconsciousness, loss of appetite	Anthrax Vaccine
Food and mouth disease	Aphthovirus (virus)	Through air and animal vectors	Fever, blisters in mouth, weight loss, decreased milk produced.	FMD Vaccine

Diseases Caused By Microorganisms in Plants

Plant Diseases	Causative microorganisms	Mode of transmission	Symptoms	Preventive measures / Treatment
Citrus Canker	Xanthomonas axonopodis (Bacteria)	Air, water	Lesions on leaves, stems and fruit	Copper based bactericides can be used.
Potato blight disease	Phytophthora infestans (Fungi)	Air	Brown lesions on the surface of tubers	Fungicides are used

MICROBES IN FOOD PROCESS

- For food processing, commonly used microorganisms are yeast, bacteria, and moulds. Fermentation process which is carried out by microorganisms results in the production of

organic acids, alcohol and esters. They help to preserve food and generate distinctive new food products.

Food Preservation:

Two techniques are followed in food preservation. They are;

- Traditional techniques
- Modern techniques

Traditional techniques:

- **Fermentation:** Fermentation is the microbial conversion of starch and sugars into alcohol. It makes foods more nutritious and palatable.
- **Pickling:** Pickling is a method of preserving food in an edible antimicrobial liquid. It is of two types:
 - **Chemical pickling:** Food is placed in an edible liquid that kills bacteria and other microorganisms. Eg. Vinegar, alcohol, vegetable oil. (pickling agents)
 - **Fermentation pickling:** Bacteria in the liquid produce organic acid as preservation agent that produces lactic acid due to the presence of Lactobacillus.
- **Boiling:** Boiling liquid food items kill all the microbes. Eg. Milk and Water.
- **Sugaring:** Sugar is used to preserve fruits in an antimicrobial syrup with fruit such as apples, pears, peaches, plums or in a crystallized form, therefore the product is stored in dry condition.

Modern techniques:

- **Pasteurization:** It is a process for preservation of liquid food. This method was invented by Louis Pasteur in 1862. Milk is heated up to 70°C to kill the bacteria and it is cooled to 10°C to prevent the growth of remaining bacteria. Then milk is stored in sterilized bottles in cold places.

Food Production:

- **Probiotics:** Probiotics are live food supplements used in yoghurt and other fermented milk products. Eg. Lactobacillus acidophilus and Bifidobacterium bifidum. These bacteria improve the microbial spectrum in the gut and thus contribute to the following effects:
 - Decrease the risk of colon cancer
 - Decrease cholesterol absorption
 - Prevent diarrheal diseases by increasing the immunity power

RELATIONSHIP BETWEEN MAN AND MICROBES-BALANCES, IMBALANCES AND USES

- Thousands of bacteria, fungi and other microbes that live in our gut are essential contributors to a good health. They break down toxins, manufacture some vitamins and essential amino acids and form a barrier against invaders. Gut microbes are the bacteria in human gut. It is one of the most important allies in our overall health and well being. Gut ensures that the body is absorbing all the important nutrients, to function at its highest level. Many different aspects of health are attached to it.

PRIONS

- The word prion is derived from “proteinaceous infectious particle”. Prions have neither DNA or RNA to transmit infection. A prion is a mutated form of a usually harmless protein. Prions cause diseases by affecting brain or neural tissue. Eg. Creutzfeldt-Jacob disease. Another example is Kuru- associated with cannibalism.

VIRIONS

- Virion is an entire virus particle consisting of an outer protein shell called a capsid and an inner core of nucleic acid (RNA or DNA). If the virus is found outside the cell (extracellular) it is known as virion. Virion has the capacity to infect the living tissue.

8thstd
Unit: 7. Plant Kingdom

Introduction

- The living organisms found on the earth are different in their structures, habit, habitat, mode of nutrition and physiology. The estimated number of species on the earth is 8.7 million. Among them 6.5 million (1 million =10 lacks) species are living on land, 2.2 million species in the ocean. In these 4,00,000 species are flowering plants. The living organisms show lot of similarities and differences so that they can be arranged into many groups systematically. The plant kingdom includes thallophytes, bryophytes, pteridophytes, gymnosperms and angiosperms.

Taxonomy

- Taxonomy is the branch of biology that deals with the study of identification, classification, description and nomenclature of living organisms. The word taxonomy is derived from two Greek words (**Taxis:** arrangement and **Nomos:** laws.) The word 'Taxonomy' was first coined by Augustin-Pyramus de Candolle.

Classification:

- Plants are arranged into different groups and categories on the basis of similarities and differences are called classification.

Types of classification:

There are four types of classification.

1. Artificial system of classification
2. Natural system of classification
3. Phylogenetic system of classification
4. Modern system of classification

Artificial system of classification

- This is the earliest system of classification in plants. Plants are classified on the basis of one or few morphological characters. The most famous artificial system of classification is Linnaeus classification which was proposed by Carolus Linnaeus in Species plantarum.

Natural system of classification

- In this system, plants are classified on the basis of several characters. Bentham and Hooker's classification is an example of Natural System of Classification. This system of classification is based on morphological and reproductive characters of the seeded plants.
- This classification is widely used in many Herbaria (herbarium is defined as the collection of pressed, dried plants pasted on a sheet and arranged according to any one of the accepted systems of classification) and botanical gardens all over the world.

Bentham and **Hooker** published their Natural system of Classification in their book named Genera Plantarum in 3 volumes.

OUTLINE OF BENTHAM AND HOOKER'S SYSTEM OF CLASSIFICATION

The division spermatophyta are divided into 3 classes:

- **Dicotyledonae**
- **Gymnospermae**
- **Monocotyledonae**

Class I - Dicotyledonae

- **Seed has two cotyledons.**
- **Leaves have reticulate venation**
- **Tap root system is present.**
- **Flowers are tetramerous or pentamerous.**

Class II - Gymnospermae (Naked seed plants)

- **Plants of this class have no fruit.**
- It has three families, they are

1. Cycadaceae
2. Coniferae
3. Gnetaceae

Class III - Monocotyledonae

- **Seed has single cotyledon.**
- **Leaves have parallel venation.**
- **Fibrous root system is present**

- Flowers are Trimerous

Binomial Nomenclature

- The naming of an organisms with two words are known as Binomial Nomenclature. For example, the binomial name of mango is *Mangifera indica*. Here the first word *Mangifera* refers to the genus name and the second word *indica* to the species name.
- Binomial system had been properly made used by Linnaeus in his book, "Species Plantarum."
- The system of naming the plants on scientific basis is known as Botanical nomenclature. Binomial name was first introduced by Gaspard Bauhin in the year of 1623.

Salient features of Algae

- Algae are chlorophyll bearing simple, primitive plants and are autotrophs.
- Algae belongs to thallophyta, and the plant body of algae are called thallus. i.e. the plant body is not differentiated into root, stem and leaf.
- Most of the algae are living in aquatic region. It may be fresh water or marine water. Very few algae can survive in terrestrial conditions.
- Some algae are very minute and float on the surface of the water. These algae are called Phytoplankton.
- Some of the algae are symbionts (algae living with fungi and they both are mutually benefitted.) e.g. Lichen.
- A few species of them are epiphytes (growing on another plants).

Various forms of Algae:

- Plant body of the algae are unicellular or multicellular
- Unicellular motile (*Chlamydomonas*), non-motile. (*Chlorella*)
- Multicellular unbranched filaments (*Spirogyra*) and branched filaments (*Cladophora*).
- Some algae are giant kelp – *Macrocystis*.
- Some algae are living as colonial form – *Volvox*.

- Alga like Chara resembles largest plant body and it possess well developed sex organs.

Reproduction of Algae:

- Three types of reproduction are seen in algae.
- Vegetative reproduction by fragmentation e.g. Spirogyra.
- Asexual reproduction by spore formation e.g. Chlamydomonos.
- Sexual reproduction by mean of fusion of gametes e.g. Spirogyra, Chara

S. No.	Class	Types of Pigments	Reserve food matrial
1.	Bluegreen algae (Cyanophyceae)	Phycocyanin	Cyanophycean Starch
2.	Green algae (Chlorophyceae)	Chorophyll	Starch
3.	Brown algae (Phaeophyceae)	Fucoxanthin	Laminarian starch and Manitol
4.	Red algae (Rhodophyceae)	Phycoerythirin	Floridian Starch

Economic Importance of algae:

1. Food:

- Algae are consumed as food by the people in Japan, England and also in India. e.g. Ulva, Spirulina, Chlorella etc..
- Some algae are used as a food for domestic animals. e.g. Laminaria, Ascophyllum.

2. Agriculture

- Some of the blue green algae are essential for the fixing of atmospheric nitrogen into the soil, which increases the fertility of the soil. e.g. Nostoc, Anabaena.

3. Agar Agar

- Agar Agar is extracted from some red algae, namely Gelidium, Gracillaria, etc., which is used to prepare growth medium in laboratories.

4. Iodine

Iodine is obtained from brown algae like Laminaria (kelp).

5. Algae in space Travel

- Chlorella pyrenoidosa is used in space travel to get rid of CO₂ and decompose human wastes.

6. SCP (Single Cell protein)

- Some of the single cell algae and blue green algae are used to produce protein. e.g. Chlorella, Spirulina.

Fungi

General characters of fungi

- Fungi (singular - fungus) belongs to thallophyta because the plant body is not differentiated into root, stem, and leaves.
- The plant body of fungus consists of filament like structures called as hyphae. Several hyphae arranged in the form of network called mycelium. There are two types of mycelium found in fungi, namely septate mycelium and aseptate mycelium. If the cross wall is seen between the cell, it is called septate mycelium. If the cross wall is not seen, it is called aseptate mycelium. When aseptate mycelium contains many nuclei it is called as coenocytic mycelium.
- The cells of fungi are multicellular and eukaryotic organisation. Some species of fungi like yeast is unicellular and eukaryotic cell. Cell wall of fungi is made up of a chemical substance called chitin. The reserve food materials of fungi are glycogen and oil. They have no starch because they have no chlorophyll pigments. So, they are heterotrophs. Heterotrophs are of three types called parasites, saprophytes and symbionts.

Parasites

- Parasites absorb food from the living organisms with the help of special root called haustoria. e.g. Cercospora personata. It affects groundnut plants and cause Tikka disease.

Saprophytes:

- Saprophytes grow up on the dead and decay matters and get food from them. e.g. Rhizopus.

Symbionts:

- Some species of fungi living with algae and are mutually benefitted. e.g. Lichen.
- Some fungi live symbiotically with higher plants roots called Mycorrhizae

Classification of fungi (W.Martin 1961)

Economic Importance of Fungi:

1. Antibiotic:

Penicillin (*Penicillium notatum*), Neomycin, Gentamycin, Erythromycin are some antibiotics obtained from fungi, which cure variable diseases.

2. Food:

Mushroom contains rich protein and minerals. The most common edible mushroom is *Agaricus*. (Button mushroom).

3. Vitamins:

Fungus like *Ashbya gossypii* and *Erythrocium ashbyii* are used to produce vitamin B2 (riboflavin).

4. Alcohol:

Fungus like yeast contain enzymes invertase and zymase, which ferment the sugar molasses into alcohol.

Harmful Effects of Fungi

Diseases caused by Fungi in Plants

S. No.	Pathogen	Name of the Disease
1.	<i>Fusarium oxisporum</i>	Wilt disease of cotton
2.	<i>Cercospora personata</i>	Tikka disease of ground nut
3.	<i>Colletotrichum</i>	Red rot of sugar cane
4.	<i>Pyricularia oryzae</i>	Blast disease of paddy
5.	<i>Albugo candida</i>	White rust of radish

Bryophytes

General Characters of Bryophytes

- Bryophytes are the primitive and simplest group of land plants.
- These are terrestrial and non-vascular cryptogams (they have no vascular tissues like xylem, phloem).

Differences between algae and fungi

S. No.	Algae	Fungi
1.	Algae are autotrophs.	Fungi are heterotrophs.

2.	It has pigments.	It has no pigments
3.	Reserve food material is starch.	Reserve food materials are glycogen and oil.
4.	Some algae are prokaryotic in nature eg. Cyanobacteria (Nostoc, Anabena)	All are eukaryotic nature.eg. Agaricus

• Water is essential to complete their life cycle, so these plants are called amphibians of the Plant Kingdom.

• Bryophytes have distinct alternation of generation. gametophytic is dominant and sporophytic generation is small and depends on the gametophytic generation.

- The gametophytic plant can be either thalloid (liverworts) or leafy (mosses).
- The plant remains fixed to the substratum with the help of root like structure called rhizoid.
- Sexual reproduction is oogamous type
- They have well developed sex organs like antheridia and archegonia.
- The male sex organ is antheridium, which produces antherozoid. The female sex organ is archegonium which contains an egg.
- Antherozoid swims and reaches the archegonium, fertilizes the egg and form zygote (2n).
- Zygote is the first cell which develops into sporophytic generation and produce haploid spore (n) by meiosis.
- Spore is the first cell of the gametophytic generation. Class I Hepaticae (e.g. Riccia)
 - Protonemal stage is present.
 - Sporophytes is differentiated into foot, seta, and capsule

Economic Importance of Bryophytes:

- 1. Bryophytes prevent the soil erosion.
- 2. Sphagnum can absorb large amount of water. Hence, it is used by the gardeners in nursery.
- 3. Peat is a valuable fuel like coal obtained from Sphagnum.

Class I Hepaticae (e.g. Riccia)

- These are lower forms of bryophytes. They are simple in structure than moss.
- Protonemal stage is absent. Sporophyte is very simple and short lived.

Class-II Anthocerotae (e.g. Anthoceros)

- Gametophyte is undifferentiated thallus, rhizoids are unicellular and unbranched.
- Protonemal stage is absent. Sporophyte is differentiated into foot and capsule only.

Class-III Musci (e.g. Funaria)

- These are higher forms in which the gametophytes is differentiated into stem like, leaf like parts.
- Protonemal stage is present.
- Sporophytes is differentiated into foot, seta, and capsule

Pteridophytes

General Characters of Pteridophyte:

- Pteridophytes are the first true land plants with xylem and phloem. Hence it is called vascular cryptogams.

Pteridophytes also exhibit alternation of generation. The diploid sporophytic phase

alternates with the haploid gametophytic phase.

- The main plant body is sporophytes, which is the dominant phase, differentiated into true root, stem and leaves.
- Sporophytes reproduce by means of spores. Spores are produced in sporangium.
- The sporangia bearing leaves are called sporophyll.
- Most of the plants produce only one type of spore, it may be either microspore or megaspore (homosporous).
- In some plants two types of spores are produced. They are microspore and megaspore(heterosporous).
- Spores give rise to gametophytic generation called prothallus, which is short lived and independent.

- The gametophytes produce the multicellular sex organs, Antheridium which produces antherozoid (male gamete) and archegonium which contains an egg. (female gamete)
- The antherozoid fertilizes with egg and form diploid zygote. It develops into an
- embryo which grow differentiate into sporophyte.

Economic Importance of Pteridophytes:

- Ferns are used as ornamental plants.
- The rhizome and petioles of the Dryopteris yield the vermifuge drug.
- The sporocarp of Marsilea (water fern) is used as food by tribal people.

Differences between Bryophytes and Pteridophytes

S. No.	Bryophytes	Pteridophytes
1.	Plant body cannot be differentiated into root, stem and leaf	Plant body can be differentiated into root, stem and leaf.
2.	Bryophytes are amphibian	Pteridophytes are land plants.
3.	Vascular tissues are absent.	Vascular tissues are present.
4.	The dominant phase of the plant body is gametophyte.	The dominant phase of the plant body is sporophyte.
5.	Sporophytic generation depends on the gametophytic generation e.g. Riccia	Gametophytic generation does not depend on sporophytic e.g. Selaginella

Gymnosperms

General Characters of Gymnosperms

- Gymnosperm are naked seed plant, i.e. the ovule is not enclosed by ovary.
- Gymnosperms have two phases in its life cycle. (Sporophytic and Gametophytic)
- Plant body is sporophyte dominant which is differentiated into root, stem and leaf.
- They have well developed vascular tissues. (xylem and phloem)
- The water conducting tissue is tracheid. Food conducting tissue is sieve cell.
- They have cone on which sporangia and spores are produced.

Economic Importance of Gymnosperms

- Woods of many conifers are used in the paper industries. e.g. Pinus, Agathis
- Conifers are the sources of soft wood for construction, packing and plywood industry e.g. Cedrus, Agathis
- Turpentine is an essential oil used for paint preparation extracted from the resin of Pinus. It is also used medicinally to get relief from pain and bronchitis etc.,
- Seeds of Pinus gerardiana are edible.
- Ephedrine is an alkaloid extracted from Ephedra. It cures asthma and respiratory problems.
- Araucaria bidwillii is an ornamental plant.

Classification of Gymnosperms

Cycadales e.g Cypas sps	Ginkgoales eg. Ginko biloba	Coniferales eg. Pinus sps	Gnetales
Palm like small plants (erect and unbranched)	Ginko biloba is the only living species in the group.	Evergreen trees with cone like appearance.	Small group of plants.
Leaves are pinnately compound forming a crown.	It is a large tree with fan shaped leaves.	Needle like leaves or scale leaves.	It posses advanced characters like Angiosperm
Tap root system and Coralloid root.	They produce unpleasant smell.	Seeds are winged and produced in female cone.	Ovules are naked but developed on flower like shoot.

Angiosperms (Closed seeded plants)

General Characters of Angiosperms

- The term 'Angiosperm' is derived from two Greek words, i.e. 'Angio' which means box or closed and 'sperma' which means seed.
- Angiosperms are called flowering plants. In this group more than 4,00,000 living species are found.
- They occupy every habitat on earth except extreme environment. (extreme hot and cold conditions).
- Habit of the plants may be herb, (Solanaum melongena) shrub, (Hibiscus rosasinensis) and tree - Mangifera indica (Mango)

- They have well developed conducting tissues. (Vascular bundles)
- Xylem contains vessel, tracheid, xylem parenchyma and xylem fibre.
- Phloem contains sieve tubes, phloem parenchyma, companion cells and phloem fibres.

Classification of Angiosperms

Angiosperms are divided into two classes, They are:

- **Monocotyledons**
- **Dicotyledons**

Characteristic features of monocotyledons

- Seed has only one cotyledon.
- Plants have fibrous root system, leaves with parallel venation.
- Flowers are trimerous and not differentiated in to calyx and corolla.
- Pollination occurs mostly by wind.
- E.g. Grass, Paddy, Banana.

Characteristic features of Dicotyledons

- Seed has two cotyledons.
- Plants have tap root system, leaves with reticulate venation.
- Flowers are tetramerous or pentamerous. Calyx and corolla are well differentiated.
- Pollination occurs mostly by insects.
- E.g. Bean, Mango, Neem

Uses of Medicinal plants

Acalypha indica (Kuppaimeni)

- It belongs to the family Euphorbiaceae.
- The paste obtained from the leaves of this plant is used to cure the burns on the skin.

- The juice of this plant leaves is mixed with lemon juice to cure ringworm

Aegle marmelos (Vilvam)

- It belongs to the family Rutaceae.
- The unripe fruit of this tree is used to treat indigestion.
- It is used to cure chronic, diarrhoea and dysentery.

Solanum trilobatum (Thoodhuvalai)

- It belongs to the family Solanaceae.
- The leaves and fruits of this plant cure cough and cold.
- It is widely used in the treatment of tuberculosis and bronchial asthma.

Phyllanthus amarus (Keezhanelli)

- It belongs to the family Euphorbiaceae.
- The entire plant is used for the treatment of jaundice.
- It gives additional strength to human liver and used to treat other liver disorders.

Aloe vera (Sothu Katrazhai)

- It belongs to the family Liliaceae.
- Leaves of this plant is used to cure piles and inflammations on the skin.
- It cures peptic ulcer

8th Term I

Unit - 8 Organization of Life

- There are animals like amoeba which cannot be seen by our naked eye. There are animals like blue whale and elephants which are of huge size. The variations are not only seen size but also in the complexity of their, cells, tissues of the body structure. This is called organization of life.
- The biological organization are arranged from cellular level to organism level. It goes like tissue, organ, organ system and organisms. Each of this represents a level of organization and hierarchy. This organizations are of two levels, they are lower levels and higher levels of organism.
- Irrespective of the level, they exhibit and can perform all the life activities like growth, metabolism, reproduction etc., In this lesson, let us learn different levels of organizations of living organism with suitable example

Organisation of Cells and Tissues

- Cell is the smallest structural and functional unit of living organisms and it is capable of performing specific function. It is also called the building blocks of life. Single-celled organisms like Amoeba are able to carry out all the processes of life, like higher organisms. The body of Amoeba looks like a single cell, while higher animals are made up of billions of cells. Bacteria, yeasts and Amoeba have a single cell body and are called as unicellular organisms. Organisms such as human beings, cows and trees are made of a large number of cells and are called multicellular organisms. Thus the body has different levels of organisation. Cells make up tissues, tissues make up organs, and organs make up organ systems.

Prokaryotes and Eukaryotes

- Based on the structural organization, organism can be classified into prokaryotes and eukaryotes. In some of the organism like bacteria, cyanobacteria and mycoplasma, no true nucleus is seen. These organisms are called prokaryotes. However in the cells of amoeba, animals and plants, a well-defined nucleus, covered by membrane is seen. These organisms are called eukaryotes.

Biological levels of organization

- The biological organization shows the hierarchy in organization levels from simplest to more complex: atoms, to molecules, cells, tissues, organs, organ systems, organisms, populations, communities, ecosystem and finally biosphere. The pictorial representation of biological organization is given below. Though atoms and molecules make up the cells, they are considered as non living. Where as population, community, ecosystem and biosphere are of ecological importance. Hence we restrict our study from cells to organism.

CELL

- Cell is the structural and functional unit of life. Cells are often called as "building blocks of life". The study of cells is called cell biology. Cells consist of cytoplasm enclosed within a membrane, which contains many biomolecules such as proteins and nucleic acids. Cells vary widely in shape and size. There is a central spherical nucleus and a variety of cytoplasmic living cell organelles like the endoplasmic reticulum, mitochondria, golgibodies, centrioles, ribosomes, lysosomes, etc., present in an animal cell. Each cell organelle performs a specific function.
- The size of cells varies in different animals which are measured in units of micron (μm). (1cm =10 mm: 1 mm = 1000 microns.) The average cell size varies from 0.5 to 20 μm in diameter. The cells of bacteria are the smallest in size (1-2 μm). In human body, the smallest cell is RBC (7 μm in diameter), the longest one is the nerve cell which reaches a length of about 90 -100 cm and the human egg (ovum) is 100 μm in size . Among multicellular animals, the largest cell is, egg of an ostrich. It measures about 170 mm \times 180mm in diameter. It is about 25,000 times bigger than a red blood cell. Mycoplasma with a diameter of 0.0001 mm is the smallest bacterium.

Stem cell

A stem cell is essentially a 'blank' cell, capable of becoming another more differentiated cell type in the body, such as a skin cell, a muscle cell, or a nerve cell. They are microscopic in size. Stem cells can be used to replace or even heal the damaged tissues in the body. They can serve as a built-in repair system for the human body, replenishing other cells as long as a person is still alive.

Shape

- Cells are of different shapes. Normally they are correlated with their functions. Some cells are oval or round, while certain others are elongated. Some cells are long and pointed at both ends. They exhibit a spindle shape. Cells are sometimes quite long. Some are branched like the nerve cell or a neuron. Some of our WBC cells are Amoeba like with irregular boundaries.

Our body is developed from a single cell called zygote. The zygote undergoes continuous mitotic division and forms the foetus consisting multitude of cells of different shape, size and content. Foetal cells gradually attain change in structure and function. This process is known as cell differentiation

Tissues

- Tissues are groups of cells that have a similar structure and act together to perform a specific function. They are of two types simple and complex tissues. Simple tissues are made up of cells of same type or kind e.g. glandular tissue and complex tissues are made up of different kind of tissues e.g. tissues of dry skin. Hence, simple tissue is homogeneous and complex tissue is heterogeneous.

Types of Tissues

- Depending on the basis of their structure and function, tissues can be classified into four types - Epithelial (covering) tissue for protection, Muscular (contractile) tissue for movements and locomotion, Connective (supporting) tissue for binding different structures of body and Nervous tissue for conduction of nerve impulses. All the complex organisms consist of only four basic types of tissues.

Organ

- Organs are structures made up of two or more types of tissues, organized to carry out a particular function. Example: Brain, heart, lungs, kidney, liver etc., each of which has specific functions. Most organs are made of all four types of tissue. The intestine, for example, is made of epithelial tissue as the inner lining, which helps in enzyme secretion and nutrient absorption. Epithelial tissue is covered by layers of muscle tissue, which help in peristaltic movements to move the food. The intestine is also supplied by blood tissue (connective tissue) which helps in transporting nutrients absorbed by the intestine, and is connected to the brain through the nerve tissue, which conveys instructions from the brain.

The eyes - Photoreceptor

- The eye is one of the important sensory organs in the human body. It is composed of muscular tissue, connective tissue, neural tissue and mainly responsible for vision, differentiation of color (the human eye can differentiate approximately 10 - 12 million colors) and maintaining the biological clock of the human body. The human eye can be compared to a camera as both functions by gathering, focusing, and transmitting the light through the lens for creating an image of an object.

Structure and Functions of Human Eye

- The human eyes are the most complicated sense organ in the human body, with several parts fixed together form a spherical structure. Every part of the human eye is mainly responsible for a certain action. The structure of a human eye can be broadly classified into the external structure and internal structure.

The External Structure of an Eye

The parts of the eye that are visible externally comprise of the external structure of the eye-

- ❖ **Sclera:** It is a tough and thick white sheath that protects the inner parts of the eye. We know it as the 'White of the eye'.
- ❖ **Conjunctiva:** It is a thin transparent membrane that is spread across the sclera. It keeps the eyes moist and clear by secreting small amounts of mucus and tears.
- ❖ **Cornea:** It is the transparent layer of membrane that is spread over the pupil and the iris. The main role of the cornea is to refract the light that enters the eyes.
- ❖ **Iris:** It is a pigmented layer of tissues that make up the colored portion of the eye. Its primary function is to control the size of the pupil, depending on the amount of light entering it.
- ❖ **Pupil:** It is the small opening located at the middle of the Iris. It allows light to come in.
- ❖ **The Internal Structure of an Eye**

- The internal structure of the eye includes the following parts:

- ❖ **Lens:** It is a transparent, biconvex, and an adjustable part of an eye, made up of protein. The lens with the help of the cornea refracts light focused on the retina, therefore creating images on it.
- ❖ **Retina:** It is the layer present at the back of the eye where all the images are formed. It is the third and inner most coat of the eye which is very sensitive to light because of the presence of Photoreceptors (rods and cone cells). The retina functions by converting the light rays into impulses and sending the signals to the brain through the optic nerve.
- ❖ **Optic nerve:** It is located at the end of the eyes, behind the retina. The optic nerve is mainly responsible for carrying all the nerve impulses from the photoreceptors to the human brain, without which vision would not be possible.
- ❖ **Aqueous Humour:** It is a watery fluid that is present in the area between the lens and the cornea. It is responsible for the nourishment of both the lens and the cornea.
- ❖ **Vitreous Humour:** it is a semi-solid, transparent, jelly-like substance that covers the interior portion of the eyes. It plays an important role in maintaining the shape of the eye and also causes refraction of light before it reaches the retina.

Organ system

- A group of organs form the organ system, and together they perform a particular function. The heart and the blood vessels together make the cardiovascular system. Organs such as nose, pharynx, trachea, lungs and diaphragm work together as the respiratory system. The mouth, esophagus, stomach, duodenum, and the intestines together form the

digestive system. Other examples of organ system include the endocrine system, integumentary system, muscular system, reproductive system, skeletal system, urinary system, immune system, etc.

The Respiratory System

- Our respiratory system consists of organs like trachea, bronchus and lungs which are responsible for exchange of air between the atmosphere and the blood. Together, these organ form what is called the respiratory tract. Let us see the organs of the respiratory tract in detail.

The nose

- We inhale air through the nostrils, which lead to the nasal cavity. The inner surface of this cavity is lined with cilia and mucus producing cells, which make it sticky and moist. The cilia and mucus trap dust and germs and prevent them from going deeper into the respiratory tract. The blood vessels in the nose help to warm the inhaled air.

The windpipe

- After passing through the nasal cavity, the air enters the pharynx. Then it goes into the trachea or the windpipe which is an elastic tube extending down the length of the neck and partly into the chest cavity. Between the pharynx and the trachea lies a small air passage called the larynx commonly known as the “voice box”. The larynx has fold of tissue which vibrate with the passage of air to produce sound.

Bronchi

- The trachea divides into two branches called bronchi (singular: bronchus). Each bronchus leads to a lung, where it divides and redivides to finally form air passages called bronchioles.

Lungs

- The lungs are organs in the chest cavity that allow our body to take in oxygen from the air. They also help to remove carbondioxide from the body. The lungs lie on either side of the breast bone and fill the inside of the chest cavity. The left lung is slightly smaller than the right lung to allow room for the heart. Within the lungs, each bronchiole leads to a bunch of air sacs called alveoli (singular: alveolus).
- The lungs are two spongy elastic bags, on each side of the thoracic cavity. The thoracic cavity is bound dorsally by the vertebral column and ventrally by the sternum, laterally by the ribs and on the lower side by the dome shaped diaphragm.

Alveoli

- Alveoli are tiny air sacs in the lungs that take up the oxygen we breathe in and keep your body going. Although they are microscopic, alveoli are the workhorses of your respiratory system. You have about 480 million alveoli, located at the end of bronchial tubes. The total area of the airsacs in the lungs above 2000 square feet or more than one hundred times the body's surface area. Alveoli, is meant for the exchange of oxygen and carbondioxide.

On an average, an adult human being at rest breathes in and out 15 - 18 times in a minute. During heavy exercise, the breathing rate can increase upto 25 times per minute

Smoking damages lungs. Smoking is also linked to cancer. It must be avoided.

When you sneeze, you should cover your nose so that the foreign particles you expel are not inhaled by others.

Mechanism of Breathing

Inspiration (Inhalation)

- The process of taking air into the lungs is called inspiration or inhalation. During inspiration, the sternum is pushed up and outward and the diaphragm is pulled down. This increases the volume of the thoracic cavity and the pressure decreases. The air outside the body flows into the lungs. Here exchange of gases takes place between the air and the blood.

Expiration (Exhalation)

- The process of expelling air from the lungs is called expiration or exhalation. Upon exhalation, the lungs recoil to force the air out of the lungs. The intercostal muscles relax, returning the chest wall to its original position. During exhalation, the diaphragm also relaxes, moving higher into the thoracic cavity. This increases the pressure within the thoracic cavity relative to the environment. Air rushes out of the lungs due to the pressure gradient. This movement of air out of the lungs is a passive event.

Exchange of gases in the Alveoli:

- The content of oxygen in the inhaled air in alveoli is more than the blood flowing through the capillaries. So, the oxygen moves into the blood by simple diffusion. Haemoglobin in the blood combines with oxygen to form oxyhaemoglobin. The blood carrying oxygen reaches the heart through blood vessels. The heart pumps it to all the tissue in the body. The tissue releases carbon-dioxide which is carried back to alveoli by the blood. Carbon-dioxide diffuses from the blood to the air in the alveoli and is sent out of the body when the air is exhaled.

Differences between inhalation and exhalation

Inhalation	Exhalation
The Muscles of the diaphragm contract	The muscles of the diaphragm relax.
The diaphragm goes downward	The diaphragm goes upward
The ribs move upwards and Outwards	The ribs move downwards.
The Volume of thoracic (Chest) cavity increases	The Volume of thoracic (Chest) cavity decreases
Air enters the lungs through the nose	Air goes out of the lungs through the nose.

Homeostasis

- Homeostasis is a property of a human biological system where the self-regulating process tends to maintain the balance for the survival. The regulation takes place in a defined internal environment. Mammals are capable of maintaining a constant body temperature despite the changes in the external temperature. Behavioural and physiological responses are two important regulating mechanisms that maintain the stability of Homeostasis.
- In simple terms, it could be referred as a balance in a system to maintain a stable internal environment for the survival of the animal. If the homeostasis regulates successfully, life continues or if unsuccessful, death or disaster occurs.
- All the processes of integration and co-ordination of function are mediated by nervous and hormonal system. The liver, kidneys, and brain (hypothalamus), autonomic nervous system and the endocrine system help to maintain homeostasis.
- Maintenance of body fluid concentrations, body temperature are done by various bio-physical and bio-chemical methods. Human beings are warm blooded in nature i.e, they maintain their body temperature as constant. When the body temperature raises sweat is produced to bring the temperature down. When the body temperature lower heat is produced by the muscular work by shivering. This is an example for homeostasis.
- The control of blood glucose level is another example in which insulin hormone is secreted whenever the blood glucose level raises and glucagon hormone is secreted whenever the blood glucose level reduces.

Diffusion

- Diffusion is the movement of particles from an area of higher concentration to lower concentration. The overall effect is to equalize concentration throughout the medium.
- Examples for diffusion include, perfume filling a whole room and the movement of small molecules across a cell membrane. One of the simplest demonstrations of diffusion is adding a drop of ink to water.

Osmosis

- Osmosis is the movement of solvent particles across a semipermeable membrane from a dilute solution into a concentrated solution. The solvent moves to dilute the concentrated solution and equalize the concentration on both sides of the membrane.
- The movement of liquids in and out cells is dependent on the concentration of the solution surrounding it. There are 3 types of situations in which this could vary:
- **Isotonic:** Here the concentration of external and internal solution of the organism are the same.
- **Hypotonic:** Here the external solution concentration is less compared to the concentration of the inner solution of an organism. In this case water will rush into the organism.
- **Hypertonic:** Here the external solution concentration is greater than the concentration of the inner solution of an organism. In this case the water will rush out of the organism.

Osmoregulation

- The term osmoregulation was coined by HOBBER in 1902. Osmoregulation is the process by which an organism regulates the water balance in its body and maintains the homeostasis of the body. It includes controlling excess water loss or gain and maintaining the fluid balance and the osmotic concentration, that is, the concentration of electrolytes. It ensures that the fluids in the body do not get too diluted or concentrated

There are two major types of Osmoregulation:

- **Osmoconformers** These organisms try to maintain the osmolality of their body matching with their surroundings. Most of the invertebrates, marine organisms are osmoconformers.
- **Osmoregulators** These organisms maintain their internal osmolality, which can be extremely different from that of the surrounding environment, through physiological processes.

Cellular respiration

- Cellular respiration is the process by which organisms break down glucose into a form that the cell can use as energy. This energy is then made available to living cells in the form of ATP. Cellular respiration takes place in the cytoplasm and mitochondria of the cells. Cellular respiration is classified into two types: aerobic respiration and anaerobic respiration.

Aerobic respiration

- In this type of respiration, the food substances are completely oxidized into H₂O and CO₂ with the release of energy. It requires atmospheric oxygen and all higher organisms respire aerobically. This reaction releases a large amount of energy.

It can be written as the following equation:



Anaerobic respiration:

- In this type of respiration, partial oxidation of food takes place and the organisms release energy in the absence of oxygen. This type of respiration occurs in organisms like yeast. Ethyl alcohol and carbon dioxide are the by-products of this process. This reaction releases very little energy because glucose is not completely oxidized.

For example: yeast cells convert glucose into carbon dioxide and ethanol, with the release of energy, without using oxygen.



Differences between Aerobic and Anaerobic respiration

Aerobic	Anaerobic
Aerobic respiration takes place in the presence of oxygen	Anaerobic respiration takes place in the absence of oxygen
The end products of aerobic respiration are Carbon dioxide and water	The end Products of anaerobic respiration are CO ₂ and ethanol or lactic acid
Common in all higher plants and animals	Common in certain microorganisms and human muscle cell

Metabolism

- Metabolism is the sum of chemical reactions by which living organisms sustain their life.

- Metabolism consists of anabolism (the buildup of substances) and catabolism (the breakdown of substances). The term metabolism is commonly used to refer specifically to the breakdown of food and its transformation into energy, cellular products and waste elimination.

Anabolism

- Anabolism or constructive metabolism, is all about building and storing: It supports the growth of new cells, the maintenance of body tissues, and the storage of energy for use in the future. During anabolism, small molecules are changed into larger, more complex molecules of carbohydrate, protein, and fat.

For example,

Glucose → Glycogen and other sugars

Amino acids → Enzymes, hormones, proteins

Fatty acids → Cholesterol and other steroids

Catabolism

- Catabolism or destructive metabolism, is the process that produces the energy required for all activity in the cells. In this process, cells break down large molecules (mostly carbohydrates and fats) to release energy. This energy release provides fuel for anabolism, heats the body, and enables the muscles to contract and the body to move. As complex chemical units are broken down into more simple substances, the waste products released in the process of catabolism are removed from the body through the skin, kidneys, lungs, and intestines. The following are examples for catabolism.

Carbohydrates → Glucose

Glucose → CO₂, Water and heat

Protein → Amino acid

- The repeated anabolism and catabolism reactions maintain the homeostatic condition in the organism. The metabolic process is the cause for maintaining ionic balance in the body. It is also responsible for movement, growth, development, maintenance and repair of the cells, tissues and the human body. These metabolic reactions occur in different organs of living species.

Unit - 6 REACHING THE AGE OF ADOLESCENCE

Introduction

- Growing up is a natural process that takes place in all living organisms. All living organisms grow up to maturity which is the ability to respond to a particular environment. Maturity along with experiences produces a progressive series of changes in an organism. These series of changes are called development. Different phases of human development are called developmental stages. Human developmental stages include infancy, childhood, adolescence, adulthood, middle age and old age. Among all these stages, adolescence is the most crucial and significant period in an individual's life. It is the period of transition from childhood to adulthood. This period starts at the age of about 10 to 13 and ends at the age of 19 (commonly known as teenage). Almost all of you would have entered this period now. In this lesson you are going to study about the changes that take place in you (which are normal) as you enter the age of adolescence. You will also study about the reproductive phases of human life, reproductive health, nutritional needs of adolescents and personal hygiene during adolescence.

Adolescence and Puberty

- The term adolescence is derived from the Latin word 'adolescere' meaning 'to grow' or 'grow to maturity'. During this period changes occur in height, weight, sex organs, muscle mass as well as in brain structure and function. Biologically it is a physical transition marked by the onset of puberty and termination of physical growth in an individual.

Puberty

- Puberty is a period of few years in which rapid physical; physiological and psychological changes occur resulting in sexual maturity. We can predict the sequence of physical changes that will take place but the age of beginning of puberty varies from individual to individual. The average age for the onset of puberty is 10 or 11 for girls and 12 or 13 for boys. But, factors like genetic and biological influences, life events, socioeconomic status, nutrition and diet and the amount of body fat also affect the onset and progression of puberty.
- Hormones play an important role at the time of puberty. Changes in hormones during this period trigger physical and behavioural changes. Sex hormones secreted at the time of puberty activate the male and female sex glands to produce necessary secretions in the body. The male sex glands, testes release the testosterone and the female sex gland, the ovaries release the estrogen. These result in changes in the primary and secondary sexual characteristics of the male and female.

Body changes at Puberty

- Four important changes that occur during puberty transform the body of a child into that of an adult. These changes are:
 - Changes in body size
 - Changes in body proportion
 - Development of primary sex characteristics
 - Development of secondary sex characteristics

a. Changes in body size

- The first major change at the time of puberty is growth which is the increase in body height and weight. It usually begins at the age of 10 to 12 in girls and 12 to 13 in boys. It is almost complete at around 17 to 19 in girls and 19 to 20 in boys. During adolescence both boys and girls add around 23 cm to 26 cm in the height. In addition to height, they also experience significant increase in weight. But increase in weight is influenced by various factors like diet, exercise and life style. The average weight gain during this period is about 17 kg to 19 kg. During this period, increase in fat is seen in girls in contrast to muscle development in boys.

b. Changes in body proportion

- Certain body areas which are small proportionately grow big. This can be seen in feet and hands. During childhood, legs grow proportionately more than the trunk. But at the time of puberty trunk also lengthens. Also, trunk broadens at the hip and shoulder thus giving the adult proportion to the body

c. Primary sex characteristics

- Reproductive organs of boys and girls become fully functional at the time of puberty. In boys, testes grow larger followed by that length and size of the reproductive organ increase. Similarly, female reproductive organ also grows during puberty. Thus, the size of the uterus and the weight of the ovaries increase during this time.

Testes and ovaries are called primary sex organs of the male and female respectively.

Secondary Sex Characteristics

- Secondary sex characteristics are the physical features which distinguish male from female. After the progression of puberty, boys and girls become dissimilar in appearance. The secondary sex characters are regulated by the hormones the testosterone or androgen secreted by the testes of the males and estrogen secreted by the ovaries of the females. Androgens cause the growth of the larynx, muscle development, skeletal size and distribution of body and pubic hair, and stimulation of sweat glands. Estrogen and progesterone are the female sex hormones. Estrogen stimulates the development of the breast, the external genitalia, pubic and axillary hairs, and the distribution of body fats.

Secondary Sex Characteristics of Boys

- The following are the secondary sex characteristics of boys.
 - a. **Hair**
Immediately after the development of primary sex characteristics, pubic hair appears followed by axillary and facial hair.
 - b. **Skin**
The skin becomes coarse and the pores in the skin enlarge.
 - c. **Glands**
The oil producing glands in the skin enlarge and due to this acne may appear on the faces.

The secretions of sweat and sebaceous or subcutaneous glands (Oil glands) are very active during adolescence. Many adolescent boys and girls get pimples on face because of increased activity of these glands in the skin. Owing to extra secretions sometimes a distinctive odour is also produced from the bodies.

- d. **Muscle**
The strength of the muscle increases and it gives shape to arms, legs and shoulders.
- e. **Voice**
During this period voice changes occur and the voice becomes husky. Then its pitch drops and the volume increases.

Secondary Sex Characteristics of Girls

- Girls show the following secondary sex characteristics at the time of puberty.
 - a. **Hips**
Due to the enlargement of the pelvic bone and the development of subcutaneous fat, the hip becomes wider and rounder.
 - b. **Breast**
After the enlargement of hips, the breasts begin to develop during this time.
 - c. **Hair**
Pubic hair appears followed by axillary and body hair on the limbs.
 - d. **Skin**
The skin becomes coarser and the pores enlarge as in the case of boys.

e. Gland

Oil producing glands become active causing acne on the face.

f. Muscles

Increase in muscles takes place which gives shape to shoulders, arms and legs.

g. Voice

Voice becomes shrill and voice breaks are rare among girls.

At puberty, the growth of the larynx is larger in boys than that of girls. The growing voice box in boys can be seen as a protruding part of the throat called Adam’s apple, so that the voice becomes deep and harsh. This is caused mainly by male hormone (regulatory chemicals) during adolescence. As a result of this, muscles (chords) attached to the cartilage get loosened and thickened. When air passes through these loosened and thickened chords a hoarse sound is produced. In girls larynx is hardly visible from outside because of its small size and the voice becomes high pitched.

Secondary sex characteristics in boys and girls.

Girls	Boys
Height and weight increase	Height and weight increase.
Fatty and subcutaneous tissues develop	Muscles develop.
Hip broadens	Shoulder broadens.
Hair grows in arm pits and pubic area	Hair grows in the arm pits and pubic area, and facial hair also appears
Voice becomes shrill	Voice break takes place due to lengthening of vocal cord and enlarging of larynx.
Breast develops.	Size of the penis increases

Role of Hormones in Reproduction

- The primary hormones that regulate reproduction are the steroids such as androgens, estrogens and progesterone which have masculinizing, feminizing and gestational effects respectively. These hormones are secreted from the gonads which are regulated by the

anterior pituitary (adenohypophysis). In male and female, reproductive behavior and reproduction are mainly under the control of LH (Luteinizing Hormone) and FSH (Follicle Stimulating Hormone). LH stimulates the testes to produce androgens, the male sex hormone. Sperms are then actively produced. In man sperm production starts at sexual puberty and may continue throughout his life.

Follicle Stimulating Hormone (FSH)

- FSH in the female influences the development of the Graafian follicle and secretion of estrogens. In the male it is necessary for the development of seminiferous tubules, and for spermatogenesis.



Luteinizing Hormone (LH)

- In the female, it is the hormone necessary for ovulation, and the secretion of the luteal hormone progesterone, and for the final maturation of the Graafian follicle. In the male it stimulates the interstitial (Leydig) cells of testes and the secretion of testosterone, and is referred to as the Interstitial Cell Stimulating Hormone (ICSH).

Estrogen is not a single hormone but a collection of related steroid hormones.

Prolactin (PRL) or Lactogenic Hormone

- The main function of this hormone is milk secretion during lactation.

Oxytocin Hormone

- Oxytocin causes expulsion of milk from the breast and it is also involved in the contraction of smooth muscles of uterus during child birth

Reproductive phase of life in Human

- Reproduction is more important for the continuation of human race. The phase in an individual's life during which there is production of gametes is called reproductive phase. In females, the reproductive phase of life begins at puberty (10 to 12 years of age) and generally lasts till the age of approximately 45 to 50 years, and in males, it is from the age of 13 to life long. The reproductive age may vary from person to person. The following are the reproductive phases in the life of a female

Menarche

- The first menstrual flow begins at puberty and is termed menarche. The ova begin to mature with the onset of puberty. It is the beginning of adolescence, during which mental and emotional maturation occurs and physical growth becomes pronounced.

Ovulation

- Ovulation occurs approximately 14 days before the next ovarian cycle commences. Thus in a 28 days cycle ovulation occurs about day 14. One ovum matures and is released by one of the ovaries once in about 28 to 30 days. The release of ovum from the ovary is called ovulation. During this period, the wall of the uterus becomes thick so as to receive the fertilized egg. This results in pregnancy.

Pregnancy

- After ovulation the ovum reaches the fallopian tube and fertilization takes place. The fertilized egg undergoes development and it is implanted in the uterus. The corpus

luteum continues to grow and produces large amount of progesterone. This results in pregnancy. Normally, it lasts for 280 days, at the end of which parturition takes place.

Menstruation

- If the ovum is not fertilized, the corpus luteum begins to degenerate and the production of hormones progesterone and estrogen ceases. The unfertilized egg and the thickened lining of the uterus along with its blood vessels are shed off. This causes bleeding in woman's reproductive tract which is called menstruation. Menstruation occurs once in about 28 to 30 days. It takes about 3 to 5 days. In some cases, initially menstrual cycle may be irregular. It takes some time to become regular. If it remains irregular for over a year, then it is better to consult a doctor.

Menopause

- Menopause marks the end of the reproductive phase of a woman's life. At 45 to 50 years of age, the menstrual cycle stops. Stoppage of menstruation is termed as 'menopause'. During menopause psychological symptoms such as anxiety, irritability, fatigue and loss of concentration may occur. Menopause may be induced by surgical removal of the ovaries, or by pelvic irradiation in a woman of any age.

Now-a-days girls attain puberty at very early age. This is due to food habits. As you eat lot of junk food, the body growth increases and it look like adults.

Menstrual Cycle

- The beginning of the menstrual cycle marks the onset of puberty in human females. The menstrual cycle begins with the casting off of endometrial lining of the uterus and bleeding. The casting of endometrium can be considered as periodic preparation for pregnancy. Menstruation occurs if an ovum released by the ovary of a woman is not fertilized during ovulation. This is described below.
 1. When a girl reaches puberty at the age of about 10, the sex hormones released into her blood cause some of the ova (or egg cells) in her ovaries to become mature (or ripe).
 2. Usually one mature ovum (or egg) is released from one of the ovaries into the oviduct once in every 28 days. This is called ovulation.
 3. Before ovulation (or release of ovum), the inner wall of uterus becomes thick and spongy, and full of tiny blood vessels (or blood capillaries). It prepares itself to receive the fertilized ovum.
 4. If the ovum does not get fertilized then the thick and soft inner lining of uterus is no longer needed and hence it breaks. So, the thick and soft inner lining of uterus along

with the blood vessels and the dead ovum comes out of the vagina in the form of a bleeding called menstruation.

5. Menstruation usually occurs 14 days after ovulation and usually lasts for about 3 to 5 days.
 6. After menstruation is over, the inner lining of the uterus starts building up again so that it may become ready to receive the next ovum.
 7. If the ovum does not get fertilized even now, then menstruation takes place again. This cycle of menstruation is repeated again and again in women after every 28 days. The menstrual cycle is controlled by hormones.
- Menstruation stops temporarily when the ovum gets fertilized and the women gets pregnant. This is because, in this case the thick and soft lining of the uterus containing lot of blood vessels is needed for the growth and development of the fertilized ovum to form a baby. Menstruation restarts after the birth of the baby. Menstruation also stops due to nutritional deficiencies, low body weight, stress, eating disorder, excessive weight gain etc.

Reproductive Health

- The physical and mental well-being of an individual is regarded as an individual's health. The World Health Organisation (WHO) has defined the reproductive health as the total well-being of behavioural, emotional, physical and social aspects of adolescence. To keep the body healthy, every human being, at any age, needs to have a diet, exercise and personal hygiene. The following are some of the measures that girls and boys need to take.

Cleanliness

1. Have a bath once or twice a day, paying special attention to underarms, groins and genitals.
2. Change the underwear daily. It should be made of cotton and washed and cleaned everyday.
3. For teenagers, the increased activity of sweat glands sometimes enhances body odour. If cleanliness is not maintained there are chances of having fungal, bacterial and other infections.

Menstrual Hygiene

- Girls should take special care of cleanliness during the time of menstrual cycle. Making use of disposable napkins or tampons may reduce chances of infections. First of all, girls should realize that menstruation is as natural as any regular physiological activities like

breathing, drinking, eating, urinating and defecation. Girls are advised to use sanitary napkins or tampons rather than cloth. It should be changed frequently depending upon the menstrual flow. If a cloth is being used repeatedly, it should be cleaned with soap and hot water and dried in sunlight for reuse.

Sleep is vital to the well-being of adolescents. It can even help you to come out of the stress you experience during this period. During this period about 8 to 10 hours of sleep each night is necessary. But most teens do not get enough sleep.

Physical Exercise

- Walking and playing in fresh air keeps the body fit and healthy. All young boys and girls should take a walk, exercise and play outdoor games. Physical activity leads to the conditions of better health, sound sleep and thereby mental peace. Mental peace promotes happiness in day to day existence.

Nutritional needs of Adolescents

- Adolescence is a stage of rapid growth and development. Hence a diet with proper calories and other nutrients is needed for proper growth and physical activity. Balanced diet is very much important during adolescence. Balanced diet includes proteins, carbohydrates, fats and vitamins in requisite proportions. Our Indian meal of roti / rice, dal (pulses), milk, fruits and vegetables forms a balanced food.
- The nutritional deficiencies during this period not only retard the physical growth, but also impair the intellectual development and may also delay sexual maturation. A very good amount of proteins and carbohydrates is necessary during this growth period. Apart from that, adolescents need the following dietary components.

Minerals

- Since there is an increase in skeletal mass and blood volume during adolescence, the body needs calcium, phosphorus and iron.

Calcium

- Calcium intake needs to be increased to prevent osteoporosis in later life. It is present in milk and milk products or other equivalents.

Iodine

- It helps to prevent thyroid gland related diseases.

Iron

- Iron builds blood and iron-rich foods such as green leafy vegetables, jaggery, meat, dates, fish, chicken, citrus, Indian gooseberry (Nelli) and whole pulses are good for adolescents. Lack of iron in the diet results in anemia. To make up for the loss of iron,

adolescents need to have a diet rich in iron. In boys, iron deficiency occurs due to muscle spurt whereas in girls it occurs due to menstruation in addition to the muscular growth.

Women should take in more iron in their diet regularly to make up for the loss of blood during menstruation.

Personal hygiene for Adolescence

- During adolescence, growing children need special attention towards diet, exercise and personal hygiene. Personal hygiene is a clear indicator of man's personality. Personal hygiene starts from the hair tip and ends down at the toes. Personal hygiene habits for the adolescence are as follows.
 1. Shower or bath daily.
 2. Always wash your hands before and after meals.
 3. Keep fingernails clean and dipped.
 4. Wash your teeth and mouth before and after each meal.
 5. Avoid touching your face, nose or mouth while preparing food.
 6. Avoid coughing or sneezing around food and close your mouth by using handkerchief while you cough in public places.
 7. If you want to taste the food, use a clean spoon.
 8. Change your clothes regularly and wash them cleanly, especially undergarments.
 9. Do not defecate in open field. Use clean toilets for defecation.
 10. If you are not well, avoid self-medication, consult a doc

CROP PRODUCTION AND MANAGEMENT

Introduction

All over the human history, we have been motivated to search and seek food. Green plants make their own food using a process called photosynthesis. Animals and humans cannot make their own food, Thus, humans and animals are directly or indirectly dependent on plants. Energy from the food is used by the organisms for carrying out their various body functions. Plants and animals are the main source of food for all the organisms. In order to provide food for a larger population production, proper planning, management and distribution is needed. Farmers are faced with the challenge of producing sufficient crops to meet the growing demand while maintaining the quality and quantity of resources for future generations. Agriculture research institutions are developing new technologies to help the farmers to increase productivity both in terms of quality or quantity. In this lesson we are going to learn about agricultural practices, rotation of crops, seeds, bio-fertilisers and the functions of agricultural research institutions.

Agricultural Practices

Agriculture has always been the backbone of our country's economy. Ever since the Green Revolution, we have been cultivating different types of crops to cater the increasing demand. In our country the following three categories of crops are grown.

- ❖ Kharif Crops: The crops which are sown in the rainy season (i.e., from June to September) are called kharif crops. Paddy, maize, soya bean, groundnut, cotton etc., are kharif crops.
- ❖ Rabi Crops: The crops grown in winter season (i.e., from October to March) are called rabi crops. Examples of rabi crops are wheat, gram, pea, mustard, linseed.
- ❖ Zaid Crops (Summer Crops): The crops which are grown in summer season are called zaid crops. Muskmelon, watermelon and cucumber are examples for zaid crops. According to utility, crops are classified as below.
- ❖ Food crops - Paddy and maize are cultivated for human consumption.
- ❖ Fodder crops - These are useful for livestock consumption. E.g. Sorghum, millets
- ❖ Fabre crops - These crops are used for cordage and textile. E.g. Cotton, hemp
- ❖ Oil crops - Oil crops are useful in a large scale for consumption or industrial uses. E.g. Ground nut, sesame.
- ❖ Ornamental crops - These are utilized for landscape gardening. E.g- Croton, Euphorbia.

Our country is the largest producer of bananas and mangoes in the world. It is also the second largest producer of wheat and rice.

Basic Practices of Crop Production

Growing crops in the field is a skilful job. Physical and mental skills are involved in this practice. Different activities in crop production are ploughing, sowing, applying fertilizers, harvesting and seed storage. All these activities collectively have an effect on the yield of crops.

Soil preparation

Soil preparation is the first step in the crop production practice. The most important aspect in agricultural process is to loosen the topsoil. The loosened soil helps in the growth of earthworm and soil microbes. These organisms add humus to the soil and are friendly to farmers. Plants absorb water, minerals, nutrients and air from the soil through their roots. Hence it is essential to prepare the soil in a proper way before starting the cultivation practice. The soil is prepared by the following methods.

- a. Ploughing
- b. Levelling
- c. Basal manuring

Ploughing

Ploughing or tilling is the process of loosening and turning the soil up and down to facilitate the availability of nutrients in the root zone of the cultivating crop.

The following are the few important agricultural implements generally used in the field preparation.

Plough

Plough is mainly used for tilling the soil, to add fertilisers to the crop, remove weeds and other waste materials from the field and also to turn the soil. A plough is made of wood and is drawn by a pair of bulls or horses. It contains a strong and a sharp triangular iron strip known as ploughshare. The main part of the plough is a long log of wood which is called plough shaft. The other end is attached to a beam which is placed on the bull's neck.

Hoe

It is a simple agricultural tool which is used to till the land, remove weeds and dig up soil. It has a long wooden rod with a bent iron plate at one end. The other end may be attached to an animal.

Cultivator

It involves the use of a tractor to drive the cultivator. Cultivators also kill weeds and dig up unwanted vegetation available in the field. Nowadays ploughing is done by tractor-driven cultivator. The use of cultivator saves labour and time.

Levelling

Once the field is ploughed, the topsoil is quite loose. The levelling of soil is done with an implement called the leveller, which is a heavy wooden or iron plank. Levelling of the field also helps in uniform distribution of water during irrigation.

Basal Manuring

Manuring means adding manure to the soil. Manure contains many nutrients required for the growth of crop plants. To increase the fertility of the soil, we add manure to the soil even before we begin the sowing because it gets properly incorporated into the soil. Application of green manure and farm yard manure will always enhance the growth and yield of the crops.

Sowing of Seeds

This is the second step in crop production. Once the soil preparation is over, sowing of the seeds can be done. Sowing is the actual process of planting the seeds in the soil. The seeds that are sown have to be selected very carefully to have high quality. Various methods are followed for sowing the seeds.

Sowing by hand

The scattering of seeds by hand is the simplest method of sowing seeds. This method is also called broadcasting. This is the most economical method of sowing seed.

Seed Drill

This is a modern method of sowing seeds. It is a better and more efficient method than sowing by hand. It is usually done by attaching iron drills to a tractor. Seed drills ensure that the seeds are planted at equal intervals and at the correct depth in the soil.

Dibbling

It is the placement of seed material in a furrow, pit or hole at predetermined spacing with a dibble, more commonly by hand. Soil around the hole is pressed with hand or leg for moist soil contact.

Sowing seeds is essentially the most important part of crop production. The following precautions should be taken while sowing seeds.

- ❖ Seeds must be sown in proper distance and the distance is varied from one crop to other crop. This is to ensure that all plants get their fair share of light, water and nutrients for the growth and development. Planting seeds at equidistance have been proved to increase the yield of the farm.
- ❖ If seeds are simply scattered on the top they are likely to be blown away or eaten by animals or birds. At the same time, if we sow them too deep into the ground, they will not germinate due to lack of air. So, seeds must be sown at the correct depth in the soil.
- ❖ The seeds that are sown should be of the highest quality. They should be free from all diseases.

Adding Manure and Fertilisers

The substances which are added to the soil in the form of nutrients to enhance the growth of plants are called manure and fertilisers. The term fertility refers to the inherent capacity of a soil to supply nutrients to crop plants in adequate amounts and in suitable proportions. These nutrients are essential for the growth of plants.

Manure is an organic substance obtained from the decomposition of plants or animal wastes. Farmers dump plant and animal waste in pits at open places and allow it to decompose. The decomposed matter is used as organic manure. Regular addition of organic manures helps to maintain the soil fertility, protecting them from wind and water erosion and preventing nutrient losses through runoff and leaching. This also increases water-holding capacity, soil aggregation, soil aeration and permeability.

Fertilizer is a substance which is added to the soil to improve plants' growth and yield. Fertilizers are composed mainly of urea, ammonium sulphate, super phosphate, potash, NPK (Nitrogen, Phosphorus, Potassium). The use of synthetic fertilizers has significantly improved the quality and quantity of the food available today, although their long-term use is debated by environmentalists.

Irrigation

Water is important for the proper growth and development of plants. Plants absorb water from their surrounding with the help of the root system. The supply of water to crops at regular intervals is called irrigation. The time and frequency of irrigation varies from crop to crop, soil to soil and season to season. Fertilizers can also be applied through the irrigation. The various sources of irrigation are wells, tube wells, ponds, lakes, rivers, dams and canal. Effective irrigation is the controlled and uniform supply to water to crops in the required amount at the right time with the minimum expenditure. Irrigation can be carried out by two different methods.

- ❖ Traditional Methods
- ❖ Modern Methods

Traditional Methods

In these methods, irrigation is done manually. Here, a farmer pulls out water from wells or canals by himself or using cattle and carries to farming fields. Pumps are also commonly used for lifting water from various sources. Diesel, biogas, electricity and solar energy are the few important sources of energy needed to run these pumps. The method of pulling water may vary from one place to other place. The main advantage of this method is that it is cheaper. But its efficiency is poor because of the uneven distribution of water. It also leads to heavy water loss.

Modern Methods

The modern irrigation methods help to overcome the problems exist in the traditional methods. It also facilitates the even distribution of moisture in the field.

The modern methods involve two systems.

- ❖ Sprinkler system
- ❖ Drip system

Sprinkler System

A sprinkler system, as its name suggests, sprinkles water over the crop and helps in an even distribution of water. This method is much advisable in areas facing water scarcity. Here a pump is connected to pipes which generate pressure and water is sprinkled through the fine nozzles of pipes.

Drip System

In drip system, water is released drop by drop exactly at the root zone using a hose or pipe. This method is considered as the effective one in regions where the availability of water is less.

The global population is expected to be 9 billion by the year 2050. So, efficient and sustainable water use is needed for our own generation and future generations. Agriculture activities alone utilize 70% of the available fresh water resources. So, drip irrigation is a better solution for economical use of water.

Weeding

In an agriculture field many other undesirable plants may grow naturally along with the main crop. These undesirable plants are called weeds. The removal of weeds is called weeding. Weeding is an important process because weeds compete with the crop plants for the nutrients, sunlight, water, space and other resources. It results in the undernourishment of crops and leads to low yield. It is mandatory to remove seeds from the field to achieve the

expected yield. Farmers adopt many ways to remove weeds and control their growth. Some of them are explained below.

Mechanical methods

This is the most common method in which weeds are destroyed physically. Hand pulling or weeding with the help of weeding hole is the oldest and most efficient method for controlling weeds.

Tillage methods

It is one of the practical methods of destroying weeds of all categories. Weeds are buried in the soil and also exposed to sun heat by deep ploughing.

Crop rotation

In this method, proper rotation of crops is followed for controlling crop associated and parasitic weeds.

Summer tillage

Deep ploughing after harvest of Rabi crop and exposing underground parts of weeds to strong sunlight during summer months is useful for destroying many annual and perennial weeds.

Biological weed control

In this method, bio agents like insects and pathogens are used to control weeds. The objectives of biological control are not eradication, but reduction and regulation of the weed population.

Chemical methods

Chemical methods are very effective in certain cases and have great scope in weed control. The chemicals used for killing the weeds or inhibiting their growth are called herbicides. These chemicals are mixed with water and sprayed over the crops.

Integrated weed management

Integrated weed management combines different agronomic practices and herbicides use to manage weeds, so that the reliance on any one weed control technique is reduced.

There are over 30000 species of weeds around the world. Out of these 18000 species cause serious losses to crops. The continuous use of the same method leads to building up of tolerant species. Therefore, a suitable combination of different methods of weed control should be practiced for minimizing the losses caused by

weeds in different crops and also for preventing environmental pollution.

Mechanical, biological, cultural and chemical methods are included in integrated weed managements.

Harvesting of Crops

Harvesting of a crop is an important task. The process of cutting and gathering a crop is called harvesting. Different methods are used for harvesting.

Manual harvesting

This is the major method of harvest in India. Certain crops are harvested without using tools. Ground nut crop can be harvested by uprooting with hand, provided soil moisture is adequate for hand pulling. The same method is used in the case of green gram, black gram and horse gram.

Mechanical method

Harvesting in our country is generally done by employing the labours with the help of farm instruments like sickle. This method is a laborious and time-consuming one and it is suitable for small-sized farms only.

Machine harvesting

This harvesting method is used in large sized agriculture fields.

The term harvesting also includes the immediate post-harvest practices such as threshing and winnowing.

Threshing:

The process of separating the grains from their chaffs or pods is threshing.

Winnowing:

After threshing, we must separate the grains from the chaffs. Winnowing is the process of separating the grains.

There are various factors to be considered before harvesting the crops. The crops need close examination to ensure that harvesting is not premature. Premature harvesting leads to shedding of seeds and loss of crop. And if the crops are over ripened, they lose their value in the market and it becomes inconsumable in certain cases.

Storage

Storage is an important aspect of post-harvest technology, because the crop is seasonally produced but consumed throughout the year. Therefore, supply of the produce has to be maintained by proper storage. Before storing, harvested grains should be made free from moisture. Any moisture in the stored grains will lead to the growth of microorganisms. So they need to be dried in the sun before storing. Food grains are collected in gunny bags and then stored in godowns. Silos and granaries are used for the storage of grains on a large scale. Chemical vapors are sprayed to minimize pest and insects in godowns. This is called fumigation. The stored grains are inspected from time to time to make sure that they are free from diseases and pests. In our country, grains are stored on a large scale in government-owned godowns. The different categories of agricultural produce needing storage are food grains, oil seeds, seeds and fodder.

Food Corporation of India (FCI) was set up on 14th January 1965 at Chennai with the objective of distribution of food grains throughout the country for Public Distribution System (PDS) and maintaining a satisfactory level of operational and buffer stocks of food grains to ensure National Food Security. Its capital is in New Delhi now.

Rotation of Crops

Crop rotation is planting a series of different crops in the same field following a defined order. Mono cropping and mixed cropping are the two methods used in crop production. Mono cropping is the repeated planting of the same crop in the same field year after year. Mixed cropping is the cultivation of two or more than two crops simultaneously on the same land without any pattern.

Crop rotation has many advantages. Many crops like legumes may have positive effects on succeeding crops in the rotation, leading to greater production over all. A shallow rooted grain crop, deep rooted cash crop and restorative crop (legume crop) should be included in the rotation for maintaining soil productivity. The leguminous crops should follow nonleguminous crops to have atmospheric nitrogen to succeeding crops. It helps in maintaining a better balance of nutrients in the soil. Weed problem is less in intercropping system compared to their sole crops.

Leguminous plants have a symbiotic relation with the Rhizobium bacteria found in the root nodules of these plants. These plants have the ability to fix atmospheric nitrogen in their roots with the help of these bacteria. The fruits of this plant are called legumes. Examples of legumes include alfalfa, clover, peas, beans, lentils, lupins, mesquite, carob, soy, and peanuts. These plants are used in crop rotation to multiply soil nitrogen.

Seed Bank

Seed bank is a place where seeds are stored in order to preserve genetic diversity. Seeds may be viable for hundreds and even thousands of years. Seed banks are like seed libraries that contains valuable information about evolution strategies of plants.

The Royal Botanical Gardens located in Kolkatta first started collecting seeds formally as seed bank. Seed banks were created to store native varieties of seeds. With this initiative farmers have started preserving indigenous seeds and reducing their dependence on hybrid seeds from seed companies. The simple and healthiest method of seed storage is in the air tight earthen pots. Navadanyaseed bank, a nongovernmental organization located in New Delhi conserve around 50,000 crop varieties, with the primary focus on preservation of grain species.

Acharya Jagadish Chandra Bose Indian Botanic Garden located in Kolkatta was earlier called Royal Botanic Garden . This garden exhibits a wide variety of rare plants and a total collection of over 12,000 specimens. The area of this garden spreads over 109 hectares.

Seed balls

Seed balls are a mixture of soil, compost and plant seeds. These balls are thrown into land areas. With the monsoon set in, these planted seed balls will germinate into seedling. Making seed ball is a step towards conserving the natural ecosystems. Seed balls are prepared by non-government organization and enthusiastic school children to grow tree for ecosystem restoration. The concept of seed ball has potential to increase tree cover and also to improve the awareness among the people about conserving plants.

Heirloom seed

An heirloom seed is the seed of plant that has been carefully cultivated and passed down through many generations. Heirlooms are usually planted in small, isolated communities and they generally offer something of value to the grower. Heirloom seeds are also called organic seeds. These seeds are generally produced from open-pollinated plants and they transfer their unique characteristics to the descendants. Heirloom seed are harvested, dried and stored so that one can replant them in the following season. The goal of preserving heirloom seed is to prevent any type of change due to outside influence. Most vegetable and flower varieties must be kept protected or isolated from other similar varieties during flowering to avoid cross pollinating plants and mixing their genes. Some vegetable varieties are self-pollinated and are grown with virtually no danger of crossing. Synthetic fertilizers, herbicides or pesticides are not used for organic seeds but conventional fertilizer, herbicides and pesticides are used.

Bio-Indicators

A bioindicator or biological indicator is any species or group of species whose function or status reveals the qualitative status of the environment. Biological indicators are used to document and understand changes in earth's living systems especially changes caused by the activities of an expanding human population. Bio-indicators of soil health give us information about soil structure, development, nutrient storage and biological activities.

Biological indicator characterises the state of an ecosystem and brings its modifications. Lichen is a natural bio-indicator of climate change and air pollution effect. It is a combination of an alga and a fungus which live together in symbiotic association. Lichen is a sensitive environmental parameter like temperature humidity, wind and air pollutants. It gives information about changes in climate, air quality and biological process.

Agriculture Research Institutions

Agricultural research institutions formulate the agricultural practices based on recent research results and farmers' needs. They disseminate those information for the welfare of the people using suitable media and methods. Indian Agricultural Research Institute and Indian Council of Agricultural Research are some of the institutions which are involved in agricultural research.

Indian Agricultural Research Institute (IARI)

The Indian Agricultural Research Institute is a national institute for agricultural research, education and extension. IARI is commonly known as the Pusa Institute. It is financed and administrated by the ICAR (Indian Council of Agricultural Research). This was responsible for research leading to the green revolution in India during 1970s. The policies, plans and programs of IARI have helped to meet the needs of the nation. Several popular high yielding varieties of major crops have been developed by IARI.

Indian Council of Agricultural Research (ICAR)

The Indian Council of Agricultural Research is an autonomous body responsible for co-ordinating agricultural education and research in India. The union minister of agriculture serves as its president. It functions under the Department of Agricultural Research and Education, Ministry of Agriculture. It is the largest network of agricultural research and education institutes in the world.

Krishi Vigyan Kendra

Krishi Vigyan Kendra is a farm science centre. These centres serve as the ultimate link between ICAR (Indian council of Agricultural research) and farmers. Their aim is to apply agricultural research findings in practical localized settings. The first KVK was established in 1974 in Pondicherry. Since then, KVKs have been established in all states and the number continues to grow. KVKs are expected to undertake their own projects. They are also

expected to serve as a resource center for extending government initiative to local areas. KVKs can be formed under a variety of host institutions, including agricultural universities, state departments, ICAR institutes, other educational institutions or non government organisations.

Responsibilities of KVK

Each KVK operates a small farm to test new technologies, such as seed varieties or innovative farming methods developed by ICAR institutes. This allows new technologies to be tested at the local level before being transferred to farmers. It also organizes programs to show the efficacy of new technologies on farmer's fields. KVKs organise workshops to discuss modern farming techniques with groups of farmers. KVKs provide advisory service to the farmers about weather and market pricing through radio and mobile phones. It focuses on crops and cultivation methods. It also facilitates rapport between the institution and the local community.

Foliar Sprays

Foliar feeding is a technique of feeding plants by applying liquid fertilizer directly to their leaves. Plants are able to absorb essential elements through the stomata in their leaves. But total absorption takes place through epidermis. Sea-based plant mixes from kelp contains trace nutrients and some hormones which are useful for the development of plant leaves, flowers and fruit. Foliar feeding is generally done in the early morning or late evening.

Plant shows quick response to the nutrients applied by foliar feedings. The efficiency of nutrients uptake is considered to be 8-9 folds higher when nutrients are applied to the leaves, when compared with nutrients applied to soil. A foliar feeding is recommended when environmental conditions limit the uptake of nutrients by roots.

EM (Effective Microorganisms) Technology

Effective microorganisms are a culture of different effective microbes, commonly occurring in nature. Nitrogen fixers, phosphate stabilizers, photosynthetic micro organisms, lactic acid bacteria, yeast, Rhizo bacteria and various fungi and actinomycetes are used as effective microorganisms. In this consortium, each micro organisms has its own beneficial role in nutrient recycling, plant protection and soil health and fertility enrichment.

Vermiwash

Vermiwash is a liquid that is collected after the passage of water through a column of worm action. It is a collection of excretory product and mucus secretion of earthworms along with micronutrients from the soil organic molecules. Vermiwash is used as a foliar spray for crops.

Panch gavya

Panchgavya is a promoter with a combination of five products obtained from the cow, which includes cow dung, cow's urine, milk, curd and ghee. All the five products are collectively termed as panchgavya. Panchgavya has the potential to play the role of promoting growth and providing immunity booster. It provides resistance to pests and increases the overall yield. It can be prepared by the farmers themselves with the materials available on the farm. Panchgavya can be used for seed treatment also. For this, seeds are soaked for 20 minutes before sowing. The present form of panchgavya is a single organic input which can act as a potentialator. The products of local breed of cow is said to have more potency than the products of exotic breeds.

Biocontrol Methods

Bio-control or biological control is a method of controlling pests such as insects, mites, weed and plant diseases using other organisms. Bio predators, bio-pesticides, bio-repellents' and bio-fertilizers are used for controlling microorganisms which cause damage to the crops, pests and insects.

Bio-predators

These are naturally occurring insects that use pests for feeding or multiplication. By introducing large numbers of predators in a greenhouse we can destroy the pest. Predators like *Chrysopa* spp. and *Menochilus* spp. are highly useful in controlling a wide variety of pests like aphids, white flies, cotton bollworms, leaf insects etc.

The black knee capid is an insect found on fruit trees. It eats more than 1000 fruit tree red spider mites per year.

Bio-pesticide

Bio-pesticides are living organism or their derived parts which are used as bio-control agents to protect crops against insect pests. Entomopathogenic viruses, bacteria insecticides, particularly *Bacillus thuringiensis*, entomofungal pathogens, protozoans and insect parasitic nematodes have been found to control important pests which affect crops. These bio-pesticides are commercially available but quite difficult to formulate in field conditions. Bio-pesticides are of different types based on their origin.

Fungal bio-pesticides:

Trichoderma viride is a fungus used as a biological pesticide. It is useful to control various disease caused by fungi such as wilt, rusting of leaves and root disease.

Bacterial bio pesticide: A culture of *Bacillus thuringiensis* bacteria is effectively used to control the pest *Lepidoptera* that attack cotton, maize plants. Panchgavya and leaves decoction of some plants are also used as bio-pesticides.

Bio - repellent

Compound Azadiractin obtained from seeds of neem serves as a good insect-repellant. One of the earliest pesticides used by man was margosa leaves. The dried leaves repel the pests from stored grains.

Bio-fertilizer

Bio fertilizers are organisms which can bring about soil nutrient enrichment. Nitrogen fixing microorganisms have the capability of converting free nitrogen into nitrogenous compounds and make the soil fertile. The main source of bio-fertilizers is cyano bacteria and certain fungi. Although the chemical fertilizers increase food production, they degrade the natural habitat. Free living bacteria live freely in the soil and fix atmospheric nitrogen and make it available to the crops like cereals, millets, fruits and vegetables. Eg. Azospirillum. Free living cyano bacterium involves in nitrogen fixation along with photosynthesis. Eg. Anabeana, Nostoc. Symbiotic bacteria fix atmospheric nitrogen. eg. Rhizobium



UNIT - 22 CONSERVATION OF PLANTS AND ANIMALS

Introduction

Our planet earth is filled with so many species of plants and animals. According to the scientists there are about 70 - 100 lakh species on the earth. The sum total of all these animals is called biodiversity. Bio means life, diversity means variety or different. Thus bio-diversity means variety of life forms on the earth and the essential interdependence of all living things. When you travel through the forests in the mountain ranges you can see variety of life forms. Forests are abundant with fruit trees and flowers and inhabited by chirping birds, prancing deer and plenty of other animals. All through the literature of ages, it has been mentioned that India is full of forests filled with wildlife. Unfortunately, from then to now, most of these forests have been cut down. This phenomenon is seen all across the world. Forests as a natural resource are decreasing in area in the recent years. In this lesson we are going to learn about deforestation, endangered species, conservation of plants and animals and wildlife sanctuaries and national parks.

Deforestation

Forests are the important renewable resources. They cover about 30 percent of the world's land surface. They produce oxygen and maintain the level of carbon dioxide in the atmosphere. Forests provide many important goods such as timber, paper and medicinal plants. They control water runoff, protect soil, and regulate climate changes. But the forests all around the world are being destroyed. Destruction of forests in order to make the land available for different uses is known as deforestation. Deforestation has resulted in several ecological imbalances such as increase in temperature, deficiency in rainfall etc. It has also resulted in the extinction of several species of animals and plants.

Causes of Deforestation

Deforestation may be caused by nature or it may be due to human activities. Fires and floods are the natural causes for deforestation. Human activities which are responsible for deforestation include agricultural expansion, cattle breeding, illegal logging, mining, oil extraction, dam construction and infrastructure development. Let us study about some of them in this section.

Agricultural Expansion

With increasing population, there is an overgrowing demand for food production. Hence, large amount of trees are chopped down for crops and for cattle grazing. More than 40% of the forests are cleaned to obtain land and to meet the needs of agriculture.

Urbanization

Increase in population necessitates the expansion of cities. With the expansion of cities more land is needed to establish housing and settlement. Requirements like construction of roads, development of houses, mineral exploitation and expansion of industries also arise due to urbanisation. Forests are destroyed to meet all these needs.

Mining

Mining of coal, diamond and gold require a large amount of forest land. So, a large number of trees is cut down to clear the forest area. Moreover, the waste that comes out from mining pollutes the environment and affects the nearby plants.

Construction of dams

To provide water supply to the increasing population, large size dams are constructed. Hence, a great extend of forest area is being cleared.

Timber Production

We need wood to meet the needs of our daily life. Wood-based industries like paper, match-sticks, furniture need a substantial amount of wood supply. Wood is the most commonly used fuel. Thus, a large number of trees are being cut down for fuel supplies. Some people are involved in illegal wood cutting and destroy more number of trees. This is the main reason for the destruction of some valuable plants.

Chipko Movement is primarily a forest conservation movement. The word 'Chipko' means 'to stick' or 'to hug'. SunderlalBahuguna was the founder of this movement. It was started in 1970s with the aim of protecting and conserving trees and preserving forest from being destroyed.

Forest fire

In many forests, fires are usually expected from time to time. They may be caused by humans, accidents or natural factors. Forest fires wipe out thousands of acres of forest land each year all over the world. This has tremendous effects on biodiversity and the economy as well.

Cyclones

Cyclones destroy the trees on a massive scale. They not only destroy the trees but also affect the livelihood of so many people who depend on them.

Effects of Deforestation

There has been a long history of interdependence between man and the forests. Our survival without forest will be very difficult. They supply us the oxygen we need, cause rainfall and provide so many things needed for our life. But increase in population has

resulted in the destruction of forests. Every year 1.1 crore hectares of forests has been cut down around the world. In India alone 10 lakh hectares of forests are destroyed which has resulted in so many harmful effects. Let us study about some of them.

a. Extinction of species

Deforestation has resulted in the loss of many wonderful species of plants and animals and many are on the verge of extinction. More than 80% of the world's species remain in the tropical rainforest. Reports say that about 50 - 100 species of animals are being lost each day as a result of destruction of their habitats.

b. Soil Erosion

Widespread trees in the forests protect the soil from the heat of the sun. When the trees are cut down, soils are exposed to the sun's heat. Extreme temperature of the summer dries up the moisture and makes the nutrients to evaporate. It also affects the bacteria that helps in the breakdown of organic matter. The roots of the trees retain the water and the top soil which provides nutrients to the plants. When the trees are cut down, soil is eroded and washed away along with the nutrients.

c. Water cycle

Trees suck the water from the roots and release the water into the atmosphere in the form of vapour during transpiration. When trees are cut down the amount of water vapour released decreases and hence there is a decrease in the rainfall.

d. Floods

Trees absorb and store a large amount of water with the help of their roots. When the trees are cut down, the flow of water is disrupted and it leads to flooding in some areas.

Amazon forest is the largest rain forest in the world, located in Brazil. It covers 6000000 square km. It helps to stabilize the earth's climate and slow global warming by fixing Co₂, and producing 20% of the world's oxygen in the process. It has about 390 billion trees. It is the lungs of the planet.

e. Global warming

We inhale oxygen present in the atmosphere and release carbon dioxide as waste. In turn trees absorb the carbon dioxide and provide us the oxygen during photosynthesis. Deforestation reduces the number of trees and hence the amount of carbon dioxide accumulates in the atmosphere. Carbon dioxide along with water vapor, methane, nitrous oxide and ozone forms the green house gases. These gases are responsible for global warming.

The solar energy falling on the earth's surface is reflected into the atmosphere. A part of this energy is reflected by the green house gases back to the earth to keep it warm and a part goes into the space. But gases such as methane and carbon dioxide accumulating in the atmosphere trap the heat energy inside the atmosphere leading to increase in temperature. This is called global warming. This results in the melting of glaciers in the polar region and affects the living organisms like polar bear.

f. Destruction of home land

Indigenous people live in and depend on forests for their survival. They get their food and many other resources from the forests. Destruction of forests affects their livelihood .

Afforestation

Afforestation is the process of planting trees, or sowing seeds, in a barren land to create a forest. As we all know due to deforestation the climate is changing alarmingly in these days and there is no seasonal rainfall. Because of this many cities are facing water scarcity and many of the lands are becoming barren. Water is needed for life to exist on the earth.

The term social forestry was first used in 1976 by the then National Commission on Agriculture, Government of India. It means the management and protection of forests and afforestation on barren land with the purpose of helping the environment, social and rural development. It is to raise the plantations thereby reducing the pressure on the traditional forest area.

Afforestation helps us to create the forests differently from natural forests.

Importance of Afforestation

The world is experiencing a great change in the climate in the recent years than ever before. These changes in the climate have given an alarming signal to everyone. To protect our planet earth afforestation would be a better solution. Importance of afforesatation is given below.

- Afforestation helps the wild animals and even humans to have shelter and to find their food source.
- Through afforestation we can increase the supply of oxygen. Trees planted can increase the water vapour in the atmosphere to get the rainfall.
- By planting trees the amount of carbon dioxide in the atmosphere can be reduced and thus the effects of air pollution, green house gases and global warming can be controlled.
- Afforestation enables us to avoid desertification of land.

- Barren lands experience strong winds and it causes soil erosion. Top soil is washed away during rainfall. Afforestation helps to grow more trees so that they can hold the top soil along with the nutrients.
- Creating forests provides us fodder, fruits, firewood and many other resources.
- Industries need specific type of trees. Afforestation helps us to grow a particular type of trees.

Wangari Maathai founded the Green Belt Movement in Kenya in the year 1977. GBM has planted over 51 million trees in Kenya. She was awarded the Nobel Peace Prize for 2004.

Reforestation

Reforestation is the natural or intentional replanting of the existing forests that have been destroyed through deforestation. Reforestation may sound similar to afforestation but both of them are not same. Reforestation is replanting of trees in a land area which had lost its forest cover for some reason. But afforestation is growing forest in an area which originally had no tree cover. Reforestation is an effective strategy to fight global warming. In addition to benefiting the climate, reforestation helps in protecting important species of animals. Reforestation helps to rebuild habitats and degradation which are the leading threats to the health and endangerment of species.

Importance of Reforestation

Both afforestation and reforestation are important for protecting the habitat, increasing the supply of forest products, finding solution to climate changes and for many other reasons. Importance of reforestation is given below.

- Reforestation improves the quality of air we breathe by reducing carbon dioxide in it.
- The effects of deforestation can be checked and global warming can be reduced.
- Reforestation restores habitat loss and degradation and threats to species.
- Forest restoration can reverse the damage done by soil erosion. Reforestation will revive the watersheds which are important aspects of environmental well-being.
- Reforestation maintains the water cycle of the area as trees absorb moisture through the leaves and roots.
- Transpiration of trees helps to restore the moisture of the atmosphere and to maintain the temperature in the local environment.

Difference between Deforestation and Reforestation

Deforestation	Reforestation
When the plants or trees are cut down, it is called deforestation.	When the plants or trees are grown or planted, it is called reforestation.

Deforestation has a negative effect on the environment.	Reforestation has a very good effect on the nature, as it builds the environment.
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Differences between Afforestation and Reforestation

Afforestation	Reafforestation
Trees are planted in new areas where there was no forest cover.	It is practiced in areas where forests have been destroyed.
One sapling is planted to get one tree.	Two saplings are planted to replace every felled tree.
It is practiced to bring more area under forest.	It is practiced to avoid deforestation

Endangered Species

Our country is a home for variety of species and rich flora and fauna. Flora is the plant life occurring in a particular area. Fauna is the animal life occurring in a particular area. The Royal Bengal Tigers, the Asiatic Cheetah and several other birds are found in India. But due to various reasons like environmental pollution, deforestation, loss of habitat, human interference, poaching and hunting many animals in India are extinct and many are endangered. Species which no longer exist on earth are called extinct species. e.g. Dinosaurs, Dodo. An endangered species is an animal or a plant that is considered to be at the risk of extinction. It means that there are only few of them left on the earth and soon they might extinct. It is reported that nearly 132 species of plants and animals are critically endangered in India. Snow leopard, Bengal tiger, Asiatic lion, Purple frog and Indian giant squirrel are some of the endangered animals in India.

Many algae, fungi, bryophytes, ferns and gymnosperms are disappearing with the destruction of forests. And, each disappearing species may take away with it many species of animals and microbes which depend on them for food and shelter. Similarly, list of animals on the verge of being lost is endless. Prawns, oysters, lobsters, crabs, squid, octopus, cuttlefish, beetles, dragonfly, grasshoppers, fish and even frogs are dying of absorbing poisonous gas through their skin. Locust is one insect which has almost disappeared from India. Following animals are getting rare these days.

- ❖ Reptiles: Some lizards, turtles, crocodiles and gharials.
- ❖ Birds: Falcon, eagle, hawk, vulture, peacock-peahen, pigeon, duck.
- ❖ Mammals: Wild cats such as tigers, lions, deer such as chinkara and blackbuck, chiru (Tibetan goat), musk deer, rhino, elephants, blue whale, flying squirrel.

Each year, 22nd May is celebrated as World Biodiversity Day. Biodiversity is a term used to describe the different plants, animals, marine life, microorganisms, insects, habitats, ecosystem etc. that make our planet so unique and so fascinating.

Endangered Plants	Endangered Animal
Umbrella tree	Snow Leopard
Malabar lily	Asiatic Lion
Rafflesia flower	Lion tailed macaque
Indian mallo	Indian Rhinoceros
Musli plant	Nilgiri Tahr

Determination

Whether a particular species is endangered or not is determined by the following ways.

- ❖ When the geographical range of the species is limited.
- ❖ The population of the species is limited i.e., less than 50 adult individuals.
- ❖ When the population has decreased or will decrease by more than 80% in 10 years.
- ❖ If the population is less than 250 individuals and is continuously declining at 25% for the past three years.
- ❖ There is a high possibility of extinction in the wild.

Yeoman Butterfly has been declared state butterfly of Tamil Nadu. This species is endemic to Western Ghats. It is among 32 butterfly species found in Western Ghats.

Causes for Endangerment

There are various reasons why a species may become endangered or extinct. Some of them are explained below.

Loss of habitat

Trees that provide food and shelter to so many species are destroyed due to human intervention.

Over hunting and poaching

Large number of animals is hunted for their horns, skin, teeth and many other valuable products.

Pollution

Number of animals are affected by pollutions like air pollution and water pollution. In the recent years more number of animals is affected by wastes in the form of plastic.

New habitat

Sometimes animals are taken by people to new habitat where they do not naturally live. Some of them may extinct and some may survive. The new ones may also get attacked by the species already living there and cause their extinction.

Chemicals

We use pesticides and other chemicals to get rid of damaging insects, pests or weeds. But they can also poison desired plants and animals if we do not use them correctly.

Diseases

Diseases due to various unknown reasons may affect the animals and make them extinct.

Natural calamities

Animals may also be destroyed due to natural disasters like flood and fire.

Saving Endangered Species

Nature is beautiful and it is filled with different plants and animals. For maintaining healthy ecological balance on the earth, animal and plant species are important. They have medicinal, scientific, ecological and commercial value. Each organism on the earth has a unique place in food chain that contributes to the ecosystem. But they are endangered mainly due to human activity. We need to take certain measures to protect them and preserve them.

- ❖ Some of the animal species are endangered mainly because of hunting and poaching. If it is controlled there can be a significant change in the number of endangered animals.
- ❖ Controlling pollution can have a positive impact on animals, fish and birds all over the world.
- ❖ When we consume more, more pollutants are put into the environment. By consuming less, we can protect the ecosystems.
- ❖ Animals often mistake plastic for food and hence plastics harm and cause endangerment of many species. Limiting the amount of plastic and recycling it can save the endangered animals.
- ❖ Recycling things and buying eco friendly products will preserve the environment resources and hence the animals.
- ❖ Pesticides and chemicals which cause damage to the environment should be avoided.
- ❖ Planting native trees will provide food to the animals.

Planting the native trees like Neem tree, Umbrella tree and Banyan tree in our

surrounding will be helpful for the animals. Many birds and animals find shelter in those trees.

Government Initiatives

In order to preserve the plants and animals, government has taken lot of initiatives and some acts have been passed to protect them. For example, Project Tiger is a wildlife conservation project initiated in India in 1972 to protect the Bengal Tiger. It was launched on 1st April 1973 and has become one of the most successful wildlife conservation ventures. Corbett National Park was the first National Park in India to be covered under project Tiger. Due to 'Project Tiger' the population of Tiger has increased in India from 1400 in 2006 to 2967 in 2018. The government has enacted the following Acts.

1. Madras Wildlife Act, 1873.
2. All India Elephant Preservation Act, 1879.
3. The Wild Bird and Animal Protection Act, 1912.
4. Bengal Rhinoceros Preservation Act, 1932.
5. All India Wildlife Protection Act, 1972.
6. Environmental Protection Act, 1986.

Red Data Book

The Red Data Book is the file for recording rare and endangered species of animals, plants and fungi. Even some local sub-species that exist within the territory of a state or country are recorded in red data books. Red data book gives important data for observational studies and monitoring programmes on habits and habitats of rare and endangered species. This book is created to identify and protect the species which are about to extinct.

Red Data Book is maintained by the International Union for Conservation of Nature. It is an international organization working in the field of nature conservation and sustainable use of natural resources. It was founded in 1964 with the aim of maintaining a complete record of every species that ever lived. The Red Data Book classifies species mainly into three categories namely, threatened, not threatened and unknown. This Book also has information as to why a species has become extinct along with the population trends and its distribution. **The Red Data Book contains colour-coded information sheets like black for species which are extinct, red for species that are endangered and so on. They are arranged according to the extinction risk of many species and subspecies. The following figure gives the colour coded information.**

IUCN Red List Categories

WWF - World Wildlife Fund

ZSI - Zoological Survey of India

BRP - Biosphere Reserve Programme

CPCB – Central Pollution Control Board

IUCN – International Union for Conservation of Nature

Advantages of the Red Data Book

- ❖ It helps to evaluate the population of a particular species.
- ❖ The data given in this book can be used to evaluate the species at the global level.
- ❖ The risk of a species becoming globally extinct can be estimated with the help of this book.
- ❖ It provides guidelines for implementing protective measures for endangered species.

Disadvantages of the Red Data Book

- ❖ The information available in the Red Data Book is incomplete. Many extinct species are not updated in this book.
- ❖ The source of the book's data has been speculated.
- ❖ This book maintains the complete record of all animals, plants, other species but it has no information about the microbes.

World Wildlife Day is observed on March 3rd every year.

Red Data Book of India

India, a mega-diverse country with only 2.4% of the world's land area, accounts for 7-8% of all recorded species, including over 45,000 species of plants and 91,000 species of animals. The country's diverse physical features and climatic conditions have resulted in a variety of ecosystems such as forests, wetlands, grasslands, deserts, coastal and marine ecosystems which harbour and sustain high biodiversity and contribute to human well being. Four out of 34 globally identified biodiversity hotspots, the Himalayas, the Western Ghats, the North-East, and the Nicobar Islands, can be found in India.

India became a State Member of IUCN in 1969, through the Ministry of environment, Forest and Climate Change (MOEFCC). The IUCN India Country Office was established in 2007 in New Delhi. Red Data Book of India contains the conservation status of animals and plants which are found in the Indian subcontinent. Surveys conducted by the Zoological Survey of India and the Botanical Survey of India under the guidance of the Ministry of Environment, Forest and Climate Change provide the data for this book.

CONSERVATION

According to WWF (World Wildlife Fund) there has been 60% decrease in the size of population of animals, birds, fish, reptiles and amphibians over the past 40 years. In order to

leave something for the future generation, we need to conserve it now. Conservation is the protection, preservation, management of wildlife and natural resource such as forest and water. Conservation of biodiversity helps us to protect, maintain and recover endangered animals and plant species. Conservation is of two types. They are:

- ❖ In-situ conservation (within habitat)
- ❖ Ex-situ conservation (outside the habitat)

In-situ conservation

It is nothing but conservation of living resources within the natural ecosystem in which they occur. This is achieved by protection of natural habitat and maintenance of endangered species in certain protected areas such as national parks, wildlife or bird sanctuaries and biosphere reserves. In India, there are about 73 national parks, 416 sanctuaries and 12 biosphere reserves.

National Parks

A National park is an area which is strictly reserved for the betterment of the wildlife. Here, activities like forestry, grazing or cultivation are not permitted. Even private ownership rights are not allowed in these areas. The national parks cover an area of 100 - 500 square kilometers. In these parks a single plant or animal species are preserved.

Name	State	Established year
Jim Corbett National Park	Uttarakhand	1936
Dudhwa National Park	Uttar Pradesh	1977
Gir National Park	Gujarat	1975
Kanha National Park	Madhyapradesh	1955
Sundarbans National Park	West Bengal	1984

Name	Established year	District
Guindy National Park	1976	Chennai
Gulf of Mannar National Park	1980	Ramanathapuram
Indira Gandhi National Park	1989	Coimbatore

Mudumalai National Park	1990	The Nilgiris
Mukurthi National Park	1990	The Nilgiris

Wildlife sanctuaries

A sanctuary is a protected area which is reserved for the conservation of animals only. Human activities like harvesting of timber, collection of forest products and private ownership rights are allowed here. Controlled interference like tourist activity is also allowed. The differences between national parks and wildlife sanctuaries are given in Table.

Difference between National Parks and Wildlife Sanctuaries

Wildlife Sanctuary	National Parks
Human activities are allowed.	No human activities are allowed.
Main aim is to protect a particular flora or fauna.	Can include flora, fauna or any other objects of historical significance.
There are no fixed boundaries.	Boundaries are fixed and defined.
It is open to the general public	Not usually open to the public.
Sanctuaries are usually formed by the order of Central or the State Government	National Parks are formed by the State or Central Legislature.
A sanctuary can be upgraded to a national park	A national park cannot be downgraded to a sanctuary.

Wildlife Sanctuaries in Tamil Nadu

Name	Established year	District
Meghamalai Wildlife Sanctuary	2016	Theni
Vandaloor Wildlife Sanctuary	1991	Chennai

Kalakad Wildlife Sanctuary	1976	Thirunelveli
Grizzled Squirrel Wildlife Sanctuary	1988	Virudhunagar
Vedanthangal Wildlife Sanctuary	1936	Kanchipuram

Biosphere reserves

Biosphere is a protected area where human population also forms the part of the system. The area of these places will be around 5000 square kilometers. They conserve the eco system, species and genetic resources. These areas are set up mainly for economic development.

Biosphere Reserves in India

Name of Biosphere	State
Nanda Devi	U.P
Nokrek	Assam
Manas	Meghalaya
Sunderbans	West Bengal
Gulf of Mannar	Tamil Nadu
Nilgiri	Tamil Nadu
Great Nicobars and Similipal	Orissa

Advantages of In-situ conservation

- ❖ Species can be adapted to their habitat.
- ❖ Species can interact with each other.
- ❖ Natural habitat is maintained.
- ❖ It is less expensive and easy to manage.
- ❖ Interests of indigenous people are protected.

Ex-situ Conservation

It is the conservation of wildlife outside their habitat. Establishing zoos and botanical gardens, conservation of genes, seedling and tissue culture are some of the strategies followed in this method.

Botanical gardens

It is a place where flowers, fruits and vegetables are grown. These places provide a healthy and calm environment.

Zoological parks

Zoological parks are the areas where wild animals are conserved. In India there are about 800 zoological parks.

The oldest zoo is Schoenbrunn Zoo in Vienna, established in the year 1759. In India the first Zoo was established in Barrachpur in the year 1800.

Tissue Culture

It is a technique of growing plant cells, tissues, organs, seeds or other plant parts in a sterile environment on a nutrient medium.

Seed bank

The seed bank preserves dried seeds by storing them in a very low temperature. The largest seed bank in the world is the Millennium Seed Bank in England.

Cryo Bank

It is a technique by which a seed or embryo is preserved at a very low temperature. It is usually preserved in liquid nitrogen at -196°C . This is helpful for the conservation of species facing extinction.

Advantages of Ex-situ conservation

- ❖ It prevents the decline of species.
- ❖ Endangered animals can be bred in these ways.
- ❖ Threatened species are bred and released in natural environment.
- ❖ It is useful for conducting research and scientific work.

PBR (PEOPLE'S BIO DIVERSITY REGISTER)

People's Biodiversity Register is a document which contains comprehensive information on locally available bio-resources including landscape and demography of a particular area or village. Bio-resources mean plants, animals and microorganisms or parts thereof, their genetic material and by-products with actual or potential use or value. A

Biodiversity Management Committee is set up in each local body according to the provisions of Biological Diversity Act, 2002. This committee prepares the People's Biodiversity Registers with the guidance and technical support of National Biodiversity Authority and the State Biodiversity Boards.

Preparation of this register promotes conservation, preservation of habitats and breed of animals and gathering of knowledge relating to biological diversity. The register entails a complete documentation of biodiversity in the area related to the plant, food source, wildlife, medicinal source, traditional knowledge etc.

BIOMAGNIFICATION

Biomagnification is the increase in contaminated substances due to the intoxicating environment. The contaminants might be heavy metals such as mercury, arsenic, and pesticides such as polychlorinated biphenyls and DDT (DichloroDiphenylTrichloro ethane). These substances are taken up by the organisms through the food they consume. When the organisms in the higher food chain feed on the organisms in the lower food chain containing these toxins, these toxins get accumulated in the higher organisms.

Causes of Bio-magnification

Following are the major causes of bio-magnification:

- a. The agricultural pesticides, insecticides, fertilizers and fungicides are very toxic and are released into the soil, rivers, lakes, and seas. These cause health issues in aquatic organisms and humans.
- b. Organic contaminants cause adverse impact on the health of humans, animals, and wildlife.
- c. Industrial activities release toxic substances which enter into the food chain leading to bio-magnification.
- d. Mining activities generate a large amount of sulphide and selenium deposits in water. These toxic substances are absorbed by the aquatic organisms in the food chain.

Effects of Bio-magnification

Following are the effects of bio-magnification on living organisms and the environment:

- a. It has more impact on humans causing cancer, kidney problems, liver failure, birth defects, respiratory disorders, and heart diseases.
- b. It also affects the reproduction and development of marine organisms
- c. The destruction of coral reefs affects the lives of many aquatic animals.
- d. The chemicals and toxins which are released into the water bodies disrupt the food chain.

ANIMAL WELFARE ORGANISATIONS

Animal welfare organizations are the group of people concerned with the health, safety and psychological wellness of animals. They include animal rescue groups which help animals in distress, and others which help animals suffering from some epidemic. In this section we will study about some of them.

Blue Cross

Blue Cross is a registered animal welfare charity in the United Kingdom, founded in 1897 as 'Our Dumb Friends League'. The vision of this charity is that every pet will enjoy a healthy life in a happy home. The charity provides support for pet owners who cannot afford private veterinary treatment, helps to find homes for unwanted animals, and educates the public in the responsibilities of animal ownership.

The organisation was founded to care for working horses on the streets of London, UK. It opened its first animal hospital, in Victoria, London, on 15 May 1906.

Captain V. Sundaram founded the Blue Cross of India, the largest animal welfare organization of Asia in Chennai in the year 1959. He was an Indian pilot and animal welfare activist. Now, Blue Cross of India is country's largest animal welfare organizations and it runs several animal welfare events like pet adaptation and animal right awareness. Blue Cross of India has received several international and national awards. This organization is entirely looked after by volunteers. The main office is located at Guindy, Chennai, with all amenities like hospitals, shelters, ambulance services and animal birth controls, etc. Activities of the organization include, providing shelters, re-homing, adoption, animal birth control, maintaining hospitals and mobile dispensary and providing ambulance services.

CPCSEA

CPCSEA stands for 'The Committee for the Purpose of Control and Supervision of Experiments on Animals'. It is a statutory committee set up under the Preservation of Cruelty to Animals Act, 1960. It has been functioning since 1991 to ensure that animals are not subjected to unnecessary suffering during experiments on them.

Objectives of CPCSEA

1. To avoid unnecessary pain before and after experiment.
2. To promote the human care of animal used in experiments.
3. To provide guidelines for animal Housing, breeding and maintenances.
4. To promote the human care of animal used in biomedical and behavioural research and testing.

Functions of CPCSEA

1. Approval of animal house facilities.
2. Permission for conducting experiments involving usage of animals
3. Action against establishments in case of established violation

4. Registration of establishments conducting animal experimentation or breeding of animals for this purpose.
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