Cell Biology

6th Term (II)

Unit 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 nacked 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 nacked 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 X1013 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 unicelluar 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 t0 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	• Surrounds and protects the cell • Make the cell stiff and strong	Supporter and protector
2.	Cell membrane	• Holds and protects the cell • Controls the movement of materials in and out of the cell	Gate of the cell
3.	Cytoplasm	• A watery, gel-like material in • which cell parts move	Area of movement
4.	Mitochondria	• Produce and supply most of The energy for the cell	Power house of the cell
5.	Chloroplasts	• 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	• Store food, water, and chemicals	Storage tanks

7.	Nucleus	• Acts as 'brain' of the cell • Regulates and controls all the cell activities	Control centre
8.	Nucleus membrane	• Surrounds and protects the nucleus control the movement materials in and out of the nucleus	Gate of the nucleus

7th Std term(II)
Unit – 4 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 nacked eyes. Salmonella species is a bacterium that can cause food-borne infection.

- Our earth is a beautiful place where in different 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 bee hive 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 organells in a cell. Function is the activity of each part or organell 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 plant is 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 carryout 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 ells. 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, lungs 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.

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 some diseases 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 an 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 with in the cell membrane, excluding the nucleus. The cytoplasm is made up of the cytosol and cell organelles. The cytosol is a watery, jellylike 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 cells or a bone cell?

- Mitochondrian 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 transfers heredity 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

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.

10th Std
Unit 16 - PLANT AND ANIMAL HORMONES

Introduction

- The word hormone is derived from the Greek word "hormon" meaning " to excite". The function of control and coordination in plants is performed by chemical substances produced by the plants called plant hormones. In plants several cells are capable of producing hormones. These phytohormones are transported to different parts of the plants to perform various physiological functions.

- Endocrine glands in vertebrate animals possess a diversified communication system to co-ordinate physiological and metabolic functions by chemical integration. The endocrine system acts through chemical messengers known as hormones which are produced by specialized glands. Physiological processes such as digestion, metabolism, growth, development and reproduction are controlled by hormones.

Plant Hormones

- Plant hormones are organic molecules that are produced at extremely low concentration in plants. These molecules control morphological, physiological and biochemical responses.

Types of Plant Hormones

- There are five major classes of plant hormones. They are:

1. Auxins
2. Cytokinins
3. Gibberellins
4. Abscisic Acid (ABA)
5. Ethylene

- Among all these plant hormones auxins, cytokinins and gibberellins promote plant growth while abscisic acid and ethylene inhibit plant growth.

Auxins

- Auxins (Gk. auxein = to grow) were the first plant hormones discovered. The term auxin was introduced by Kogl and Haagen-Smith (1931). Auxins are produced at the tip of stems and roots from where they migrate to the zone of elongation. Charles Darwin (1880), observed unilateral growth and curvature of canary grass (Phalaris canariensis) coleoptiles. He came to the conclusion that some 'influence' was transmitted from the tip of the coleoptile to the basal region. This 'influence' was later identified as Auxin by Went.

Went's Experiment

- Frits Warmolt Went (1903– 1990), a Dutch biologist demonstrated the existence and effect of auxin in plants. He did a series of experiments in Avena coleoptiles.

- In his first experiment he removed the tips of Avena coleoptiles. The cut tips did not grow indicating that the tips produced something essential for growth.In his second experiment he placed the agar blocks on the decapitated coleoptile tips. The coleoptile tips did not show any response. In his next experiment he placed the detached coleoptile tips on agar blocks. After an hour, he discarded the tips and placed this agar block on the decapitated coleoptile. It grew straight up indicating that some chemical had diffused from the cut coleoptile tips into the agar block which stimulated the growth.

- From his experiments Went concluded that a chemical diffusing from the tip of coleoptiles was responsible for growth, and he named it as "Auxin" meaning 'to grow".

- Types of Auxins: Auxins are classified into two types, namely natural auxins and synthetic auxins.

- **Natural Auxins:** Auxins produced by the plants are called natural auxins. Example: IAA (Indole – 3 - Acetic Acid)

- **Synthetic Auxins:** Artificially synthesized auxins that have properties like auxins are called as synthetic auxins. Example: 2, 4 D (2,4 Dichlorophenoxy Acetic Acid).

- Physiological effects of auxins: Auxins bring about a variety of physiological effects in different parts of the plant body.

1. Auxins promote the elongation of stems and coleoptiles which makes them to grow.

2. Auxins **induce root formation** at low concentration and inhibit it at higher concentration.

3. The auxins produced by the apical buds suppress growth of lateral buds. This is called **apical dominance**.

4. Seedless fruits without fertilization are induced by the external application of auxins. (**Parthenocarpy**). Examples: Watermelon, Grapes, Lime etc.

5. Auxins **prevent** the formation of **abscission layer**.

Phenyl Acetic Acid (PAA) and Indole 3 Acetonitrile (IAN) are natural auxins. Indole 3 Butyric Acid (IBA), Indole-3- Propionic Acid, α-Naphthalene Acetic Acid
(NAA), 2, 4, 5-T (2,4,5 Trichlorophenoxy Acetic Acid) are some of the synthetic auxins.

Cytokinins

- Cytokinins (Cytos - cell; kinesis - division) are the plant hormones that promote cell division or cytokinesis in plant cells. It was first isolated from Herring fish sperm. Zeatin was the cytokinin isolated from Zea mays. Cytokinin is found abundantly in liquid endosperm of coconut.

Physiological effects of cytokinins

1. Cytokinin induces cell division (cytokinesis) in the presence of auxins.
2. Cytokinin also causes cell enlargement.
3. Both auxins and cytokinins are essential for the formation of new organs from the callus in tissue culture (Morphogenesis).
4. Cytokinins promote the growth of lateral buds even in the presence of apical bud.
5. Application of cytokinin delays the process of ageing in plants. This is called Richmond Lang effect.

Gibberellins

- Gibberellins are the most abundantly found plant hormones. Kurosawa (1926) observed Bakanae disease or foolish seedling disease in rice crops. This internodal elongation in rice was caused by fungus Gibberella fujikuroi. The active substance was identified as Gibberellic acid.

Physiological effects of gibberellins

1. Application of gibberellins on plants stimulate extraordinary elongation of internode. e.g. Corn and Pea.
2. Treatment of rosette plants with gibberellin induces sudden shoot elongation followed by flowering. This is called bolting.
3. Gibberellins promote the production of male flowers in monoecious plants (Cucurbits).
4. Gibberellins break dormancy of potato tubers.
5. Gibberellins are efficient than auxins in inducing the formation of seedless fruit - Parthenocarpic fruits (Development of fruits without fertilization) e.g. Tomato.

Abscisic Acid

- Abscisic acid (ABA) is a growth inhibitor which regulates abscission and dormancy. It increases tolerance of plants to various kinds of stress. So, it is also called as stress hormone. It is found in the chloroplast of plants.

Physiological effects of abscisic acid

1. ABA promotes the process of abscission (separation of leaves, flowers and fruits from the branch).
2. During water stress and drought conditions ABA causes stomatal closure.
3. ABA **promotes senescence** in leaves by causing loss of chlorophyll.
4. ABA **induces bud dormancy** towards the approach of winter in trees like birch.
5. ABA is a powerful **inhibitor of lateral bud growth** in tomato.

Ethylene

- Ethylene is a gaseous plant hormone. It is a growth inhibitor. It is mainly concerned with maturation and ripening of fruits. Maximum synthesis of ethylene occurs during ripening of fruits like apples, bananas and melons

Physiological effects of ethylene

- Ethylene promotes the ripening of fruits. e.g. Tomato, Apple, Mango, Banana, etc
- Ethylene inhibits the elongation of stem and root in dicots.
- Ethylene hastens the senescence of leaves and flowers.
- Ethylene stimulates formation of abscission zone in leaves, flowers and fruits. This leads to premature shedding.
- thylene breaks the dormancy of buds, seeds and storage organs

Human Endocrine Glands

- Endocrine glands in animals possess a versatile communication system to coordinate biological functions. Exocrine glands and endocrine glands are two kinds of glands found in animals. Endocrine glands are found in different regions of the body of animals as well as human beings. These glands are called ductless

- glands. Th eir secretions are called hormones which are produced in minute quantities. Th e secretions diff use into the blood stream and are carried to the distant parts of the body. Th ey act on specifi c organs which are referred as target organs.

The branch of biology which deals with the study of the endocrine glands and its physiology is known as 'Endocrinology'. Thomas Addison is known as Father of Endocrinology. English physiologists W. M. Bayliss and E. H. Starling introduced the term hormone in 1909. Th ey fi rst discovered the hormone secretin.

- Exocrine glands have specifi c ducts to carry their secretions e.g. salivary glands, mammary glands, sweat glands.

- Endocrine glands present in human and other vertebrates are

❖ Pituitary gland
❖ Thyroid gland
❖ Parathyroid gland
❖ Pancreas (Islets of Langerhans)
❖ Adrenal gland (Adrenal cortex and Adrenal medulla)
❖ Gonads(Testes and Ovary)
❖ Thymus gland

- Pituitary Gland The pituitary gland or hypophysis is a pea shaped compact mass of cells located at the base of the midbrain attached to the hypothalamus by a pituitary stalk. The pituitary gland is anatomically composed of two lobes and perform different functions. They are the anterior lobe (adenohypophysis) and the posterior lobe (neurohypophysis). The intermediate lobe is non-existent in humans.

- The pituitary gland forms the major endocrine gland in most vertebrates. It regulates and controls other endocrine glands and so is called as the "Master gland".

- Hormones secreted by the anterior lobe (Adenohypophysis) of pituitary

- The anterior pituitary is composed of different types of cells and secrete hormones which stimulates the production of hormones by other endocrine glands. The hormones secreted by anterior pituitary are

❖ Growth Hormone
❖ Thyroid stimulating Hormone
❖ Adrenocorticotropic Hormone
❖ Gonadotropic Hormone which comprises the Follicle Stimulating Hormone and Luteinizing Hormone
❖ Prolactin

- Growth hormone (GH) GH promotes the development and enlargement of all tissues of the body. It stimulates the growth of muscles, cartilage and long bones. It controls the cell metabolism. Th e improper secretion of this hormone leads to the following conditions.

Dwarfism:

- It is caused by decreased secretion of growth hormone in children. The characteristic features are stunted growth, delayed skeletal formation and mental disability.

Gigantism:

- Over secretion of growth hormone leads to gigantism in children. It is characterised by overgrowth of all body tissues and organs. Individuals attain abnormal increase in height.

Acromegaly:

- Excess secretion of growth hormone in adults may lead to abnormal enlargement of head, face, hands and feet.

Thyroid stimulating hormone (TSH)

- TSH controls the growth of thyroid gland, coordinates its activities and hormone secretion.

Adrenocorticotropic hormone (ACTH)

- ACTH stimulates adrenal cortex of the adrenal gland for the production of its hormones. It also influences protein synthesis in the adrenal cortex.

Gonadotropic hormones (GTH)

- The gonadotropic hormones are follicle stimulating hormone and luteinizing hormone which are essential for the normal development of gonads.

Follicle stimulating hormone (FSH)

- In male, it stimulates the germinal epithelium of testes for formation of sperms. In female it initiates the growth of ovarian follicles and its development in ovary.

Luteinizing hormone (LH)

- In male, it promotes the Leydig cells of the testes to secrete male sex hormone testosterone. In female, it causes ovulation (rupture of mature graafian follicle), responsible for the development of corpus luteum and production of female sex hormones estrogen and progesterone.

Prolactin (PRL)

- PRL is also called **lactogenic hormone**. This hormone initiates development of mammary glands during pregnancy and stimulates the production of milk after child birth.

Hormones secreted by the posterior lobe (Neurohypophysis) of pituitary

- The hormones secreted by the posterior pituitary are

1. Vasopressin or Antidiuretic hormone
2. Oxytocin

Vasopressin or Antidiuretic hormone (ADH)

- In kidney tubules it increases reabsorption of water. It reduces loss of water through urine and hence the name antidiuretic hormone.

- Deficiency of ADH reduces reabsorption of water and causes an increase in urine output (polyuria). This deficiency disorder is called Diabetes insipidus.

Oxytocin

- It helps in the contraction of the smooth muscles of uterus at the time of child birth and milk ejection from the mammary gland after child birth.

Thyroid Gland

- The thyroid gland is composed of two distinct lobes lying one on either side of the trachea. The two lobes are connected by means of a narrow band of tissue known as the isthmus. This gland is composed of glandular follicles and lined by cuboidal epithelium.The follicles are filled with colloid material called thyroglobulin.

- An amino acid tyrosine and iodine are involved in the formation of thyroid hormone. The hormones secreted by the thyroid gland are

1. Triiodothyronine (T_3)
2. Tetraiodothyronine or Thyroxine (T_4)

Functions of thyroid hormones

- The functions of thyroid hormones are

❖ Production of energy by maintaining the Basal Metabolic Rate (BMR) of the body.
❖ Helps to maintain normal body temperature.
❖ Influences the activity of central nervous system.
❖ Controls growth of the body and bone formation.
❖ Essential for normal physical, mental and personality development .
❖ It is also known as personality hormone.
❖ Regulates cell metabolism.

Thyroid Dysfunction

- When the thyroid gland fails to secrete the normal level of hormones, the condition is called thyroid dysfunction. It leads to the following conditions

Hypothyroidism

- It is caused due to the decreased secretion of the thyroid hormones. The abnormal conditions are simple goitre, cretinism and myxoedema.

Goitre

- It is caused due to the inadequate supply of iodine in our diet. This is commonly prevalent in Himalayan regions due to low level of iodine content in the soil. It leads to the enlargement of thyroid gland which protrudes as a marked swelling in the neck and is called as goitre.

Cretinism

- It is caused due to decreased secretion of the thyroid hormones in children. The conditions are stunted growth, mental defect, lack of skeletal development and deformed bones. They are called as cretins.

Myxoedema

- It is caused by deficiency of thyroid hormones in adults. They are mentally sluggish, increase in body weight, puffiness of the face and hand, oedematous appearance.

Hyperthyroidism

- It is caused due to the excess secretion of the thyroid hormones which leads to Grave's disease. The symptoms are protrusion of the eyeballs (Exopthalmia), increased metabolic rate, high body temperature, profuse sweating, loss of body weight and nervousness.

Parathyroid Gland

- The parathyroid glands are four small oval bodies that are situated on the posterior surface of the thyroid lobes. The chief cells of the gland are mainly concerned with secretion of parathormone.

Functions of Parathormone

- The parathormone regulates calcium and phosphorus metabolism in the body.They act on bone, kidney and intestine to maintain blood calcium levels.

Parthyroid Dysfunction

- The secretion of parathyroid hormone can be altered due to the following conditions.

- Removal of parathyroid glands during thyroidectomy (removal of thyroid) causes decreased secretion of parathormone. The conditions are

1. Muscle spasm known as **Tetany** (sustained contraction of muscles in face, larynx, hands and feet).
2. Painful cramps of the limb muscles

Pancreas (Islets of Langerhans)

- Pancreas is an elongated, yellowish gland situated in the loop of stomach and duodenum. It is exocrine and endocrine in nature. The exocrine pancreas secretes pancreatic juice which plays a role in digestion while, the endocrine portion is made up of Islets of Langerhans.

- The Islets of Langerhans consists of two types of cells namely alpha cells and beta cells. The alpha cells secrete glucagon and beta cells secrete insulin.

Human insulin was first discovered by Fredrick Banting, Charles Best and MacLeod in 1921. Insulin was first used in treatment of diabetes on 11th January 1922.

Functions of Pancreatic hormones

- A balance between insulin and glucagon production is necessary to maintain blood glucose concentration.

Insulin

- ❖ Insulin helps in the conversion of glucose into glycogen which is stored in liver and skeletal muscles.
- ❖ It promotes the transport of glucose into the cells.
- ❖ It decreases the concentration of glucose in blood.

Glucagon

- ❖ Glucagon helps in the breakdown of glycogen to glucose in the liver.
- ❖ It increases blood glucose levels.

Diabetes mellitus

- The deficiency of insulin causes Diabetes mellitus. It is characterised by

- ❖ Increase in blood sugar level (Hyperglycemia).
- ❖ Excretion of excess glucose in the urine (Glycosuria).
- ❖ Frequent urination (Polyuria).
- ❖ Increased thirst (Polydipsia).
- ❖ Increase in appetite (Polyphagia).

Adrenal Gland

- The adrenal glands are located above each kidney. They are also called supra renal glands.
- The outer part is the adrenal cortex and the inner part is the adrenal medulla. The two distinct parts are structurally and functionally different.

Adrenal Cortex

- The adrenal cortex consists of three layers of cells. They are zona glomerulosa, zona fasciculata and zona reticularis

Hormones of Adrenal Cortex

- The hormones secreted by the adrenal cortex are corticosteroids. They are classified into

1. Glucocorticoids
2. Mineralocorticoids

Functions of adrenocortical hormones
Glucocorticoids

- The glucocorticoids secreted by the zona fasciculata are cortisol and corticosterone

❖ They regulate cell metabolism.
❖ It stimulates the formation of glucose from glycogen in the liver.
❖ It is an anti-inflammatory and anti-allergic agent.

Mineralocorticoids

- The mineralocorticoids secreted by zona glomerulosa is aldosterone

1. It helps to reabsorb sodium ions from the renal tubules.
2. It causes increased excretion of potassium ions.

- It regulates electrolyte balance, body fluid volume, osmotic pressure and blood pressure.

Adrenal Medulla

- The adrenal medulla is composed of chromaffin cells. They are richly supplied with sympathetic and parasympathetic nerves.

Hormones of Adrenal Medulla

- It secretes two hormones namely

1. Epinephrine (Adrenaline)
2. Norepinephrine (Noradrenaline)

- They are together called as "Emergency hormones". It is produced during conditions of stress and emotion. Hence it is also referred as "flight, fright and fight hormone".

Functions of adrenal medullary hormones
Epinephrine (Adrenaline)

- It promotes the conversion of glycogen to glucose in liver and muscles.
- It increases heart beat and blood pressure.
- It increases the rate of respiration by dilation of bronchi and trachea.
- It causes dilation of the pupil in eye.
- It decreases blood flow through the skin.

Norepinephrine (Noradrenalin)

- Most of its actions are similar to those of epinephrine.

Reproductive Glands (Gonads)

- The sex glands are of two types the **testes** and the **ovaries**. The testes are present in male, while the ovaries are present in female.

Testes

- Testes are the reproductive glands of the males. They are composed of seminiferous tubules, Leydig cells and Sertoli cells. Leydig cells form the endocrine part of the testes. They secrete the male sex hormone called testosterone.

Functions of testosterone

- ❖ It influences the process of spermatogenesis.
- ❖ It stimulates protein synthesis and controls muscular growth.
- ❖ It is responsible for the development of secondary sexual characters (distribution of hair on body and face, deep voice pattern, etc).

Ovary

- The ovaries are the female gonads located in the pelvic cavity of the abdomen. They secrete the female sex hormones

1. Estrogen

2. Progesterone

- Estrogen is produced by the Graafian follicles of the ovary and progesterone from the corpus luteum that is formed in the ovary from the ruptured follicle during ovulation.

Functions of estrogens

- ❖ It brings about the changes that occur during puberty.
- ❖ It initiates the process of oogenesis.
- ❖ It stimulates the maturation of ovarian follicles in the ovary.
- ❖ It promotes the development of secondary sexual characters (breast development, high pitched voice etc).

Functions of progesterone

- It is responsible for the premenstrual changes of the uterus.
- It prepares the uterus for the implantation of the embryo.
- It maintains pregnancy.
- It is essential for the formation of placenta.

Thymus Gland

- Thymus is partly an endocrine gland and partly a lymphoid gland. It is located in the upper part of the chest covering the lower end of trachea. Thymus in is the hormone secreted by thymus.

Functions of Thymosin

- It has a stimulatory effect on the immune function.
- It stimulates the production and differentiation of lymphocytes.

Classification of Living Organism

6th Term I

Unit 4 – The Living World of Plants

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,

- Root system.
- Shoot system

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.

- Tap root system

- Fibrous root system

Tap Root System

- 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.

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.

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 branchout 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.

Habitat

- 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

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.

- 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.

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

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.

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**
b. **Grassland**
c. **Forest**

- 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 atleast 20% of the earth. The plants which grows 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

Thar Desert, also called Great Indian Desert, is an arid region of rolling sand hills on the Indian subcontinent. It is located partly in Rajasthan state, north-western India, and partly in Punjab and Sindh (Sind) provinces, eastern Pakistan

Grassland habitat

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

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 rain fall ranges from 25-200 cm.

World habitat day is observed on 1st Monday of October

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 tendril, twiners and thorns. These adaptations are seen in plants which live in terrestrial and desert habitat.

Tendril Climber:- Tendril is a twining climbing organ of some weak stemmed plants like peas and bitter gourd. Tendril coils round a support and help the plant to climb. Example

Sweet Peas ⟹ Leaflets are modified into tendrils.

Bitter Gourd ⟹ Axillary buds are modified into tendril which helps the plant to climb.

Bamboo is one of the fast growing plants, during active growth phase.

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.

Thorns:- Leaves of some plants become wholly or partially modified into sharp pointed structures called "thorns or spines" for defensive purpose.

Example:

- Agave - the leaf apex and margins are modified into thorns
- Opuntia - the leaves are modified into spines.
- bougainvillea – the stem has sharp thorns.

6th std
Unit 5 – Living World of Animals

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.

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.

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

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

Euglena

- Euglena is an unicellular animal which moves with a flagellum

Differences between Unicellular and Multicellular Organisms

Unicellular Organisms	Multicellular 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	• 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.

Multicellular organisms:

- Majority of organisms we see around us, including animals are multicellular. In such organisms, different functions are 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.

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.

Fish

- 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.

- 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.

- Most of the fishes have slippery scales all over the body which protect the body.

- The fish has fins for swimming.

- The fish has strong tail which acts as rudder to change direction and keep its body balance in water.

Lizard

- Lizards are scaly-skinned reptiles that are usually distinguished from snakes by the possession of legs, movable eyelids, and external ear openings.

- They mostly inhabit warm regions. Most lizards are quadripedal (walk with four legs) and have a powerful limb.

- Some lizards have the capacity to rotate the head around the head joint.

- They breathe through lungs. Some lizards are able to run bipedally with two legs. In this the tail is held out backward and upward and acts as a counterweight.

- Most lizards eat a variety of insects like mosquitoes and Cockroaches with sharp, tricuspid, teeth adapted for grabbing and holding

- Some lizards (Dinosaurs) have web in the toes, and few lizards are able to glide or parachute the air and make soft landings.

Birds

- They have streamlined body covered with feathers.
- This body shape provides minimum resistance to air.
- They have beak instead of mouth.
- They breathe through lungs.
- They have a pair of wings that are modified forelimbs.
- They have hollow and light bones.
- 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.
- The tail of the bird helps it to control the direction of the movements.
- They have strong chest muscles which help them withstand the pressure of the air while flapping their wings during flight.
- 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:

- The camel has long legs which help it to keep its body away from the hot sand in the desert.

- A camel can drink large amount of water (when it is available) and store it in the body.

- 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.

- A camel's hump has fat stored in it. In case of emergency a camel can break down stored fat for nourshment.

- A 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".

- Camel has long eye lashes and hairs to protect its eyes and ears from the blowing dust.

- 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.

Adaptive Features of Animals from different Habitats

S.No	Name of the Animal	Habitat	Adaptive Features
1	Polar Bear	Polar region	Thick skin for protection, white fur
2	Penguin	Polar region	Paddle to swin,

			walk with two leg.
3	Mountain Goat	Mountains	Strong hooves for running, long hair to protect from cold
4	Lion	Forest	Strong and fast runner has sharp claws to catch prey.

The mountain goat namely Nilgri Tahr can find small spaces on rock to climb with ease and keep its balance as it feeds

7th Term II

Unit 5 – Basis of Classification

Features of dichotomous key

- A single feature that differentiate 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.
    - Presence or absence of back bone, we can classify them into two groups.
    - Animals with back bone can be divided into its subgroup based on its body temperature.
    - 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. Then 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 ask 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.

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.

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.

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 plants 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.
- Plant 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 posses 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:

- Planatae (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 wall 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. Eg. 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.

Characteris es	Monera	Protista	Fungi	Plantae	Animalia
1. Cell type	Unicellula r, Prokaryoti c.	Unicellula r, Eukaryotic	Multicellul ar, Non-green and Eukaryotic	Multicellul ar, Eukaryotic	Multicellul ar, Eukaryotic
2. Nucleus	Absent	Present	Present	Present	Present
3. Body Organism	Cellular level of organizati on	Cellular level of organizati on is	Multi cellular with loose tissue	Tissue level and organ level	Tissue, organ and organ system
4. Mode of Nutrition	Auto (or) Heterotopi c	Auto (or) Heterotopi c	Saprophyti c, Parasitic sometime symbiotic	autotrophic	Heterotopi c

Merits of five Kingdom Classification

- This system of classification is more scientific and natural.
- This system of classification clearly indicates the cellular organization, mode of nutrition,
- and 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 Linnaeas 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 sativam. Genus name is Allium, species name is sativam.

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

8th Term I
Unit 6 – 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 1µm to 5µm (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. Streptococcuspneumoniae 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 an oil globules. Yeast aids in fermentation with the help of the enzyme zymase. Yeast respires 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. Puccina, 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 (panneer) 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.NO	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	Rhabdo viridae (virus)	Animal bite	Fever, hallucination, Paralysis inability to swallow	Anti – rabies vaccine.
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^{o}c to kill the bacteria and it is cooled to 10^{o}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 "protinaceous infectious particle". Prions have neither DNA or RNA to transmit infection. A prion is a mutted form of a usually harmless protein. Prions cause diseases by affecting brain or neural tissue. Eg. Creutzfeldt-Jackob 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.

8th std
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 BEtrf5NTHAM 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 spacew 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 absorbs food from the living organisms with the help of special root called haustoria. e.g. Cercospora personata. It affects groundnut plants and causeTikka 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 gospii and E r y mo t h e c i u m 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.	Fusarium oxispotam	Wilt disease of cotton
2.	Cercospora personata	Tikka disease of ground nut
3.	Colletotrichum	Red rot of sugar cane
4.	Pyricularia oryzae	Blast disease of paddy
5.	Albugo candida	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 lik 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 (Nostac, Anabenae)	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 domina 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 fi xed 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. Sphagnam 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 Cycas 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 leves.	Needle like leaves or scale leaves.	It possesses 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

9th std
Unit 17 – Animal Kingdom

Introduction

- The variety of living organisms surrounding us is incomprehensible. Nearly 1.5 million species of organism which have been described are different from one another. The uniqueness is due to the diversity in the life forms whether it is microbes, plants or animals. Every organism exhibits variation in their external appearance, internal structure and behavior, mode of living etc. This versatile nature among the living animals forms the basis of diversity. The diversity among the living organisms can be studied in an effective way by arranging each kind of animals in an orderly and systematic manner. The study of various organisms would be difficult without a suitable method of classification.

- The method of arranging organism into groups on the basis of similarities and differences is called classification. Taxonomy is the science of classification which makes the study of wide variety of organisms easier. It helps us to understand the relationship among different group of animals. The first systematic approach to the classification of living organisms was made by a Swedish botanist, Carolus Linnaeus. He generated the standard system for naming organisms in terms of genus, species and more extensive groupings using Latin terms.

Classification of Living Organisms

- Classification is the ordering of organism into groups on the basis of their similarities, dissimilarities and relationships. The five kingdom classification are Monera, Protista, Fungi, Plantae and Animalia. These groups are formed based on cell structure, mode of nutrition, body organization and reproduction. On the basis of hierarchy of classification, the organisms are separated into smaller and smaller groups which form the basic unit of classification.

- **Species:** It is the lowest taxonomic category. For example, the large Indian parakeet (Psittacula eupatra) and the green parrot (Psittacula krameri) are two different species of birds. They belong to different species eupatra and krameri and cannot interbreed.

- **Genus:** It is a group of closely related species which constitute the next higher category called genus. For example, the Indian wolf (Canis pallipes) and the Indian jackal (Canis aures) are placed in the same genus Canis

- **Family:** A group of genera with several common characters form a family. For example, leopard, tiger and cat share some common characteristics and belong to the larger cat family Felidae.

- **Order:** A number of related families having common characters are placed in an order. Monkeys, baboons, apes and Man although belong to different families, are placed in the same order Primates. Since all these animals possess some common features, they are placed in the same order.

- **Class:** Related or similar orders together form a class. The orders of different animals like those of rabbit, rat, bats, whales, chimpanzee and human share some common features such as the presence of skin and mammary glands. Hence, they are placed in class Mammalia.

- **Phylum:** Classes which are related with one another constitute a phylum. The classes of different animals like mammals, birds, reptiles, frogs and fishes constitute Phylum Chordata which have a notochord or back bone.

- **Kingdom:** It is the highest category and the largest division to which microorganisms, plants and animals belong to. Each kingdom is fundamentally different from one another, but has the same fundamental characteristics in all organisms grouped under that Kingdom.

The taxa of living organisms are in a hierarchy of categories as follows

Basis for Classification

- We can divide the Animal kingdom based on the level of organization (arrangement of cells), body symmetry, germ layers and nature of coelom.

- Level of organization: Animals are grouped as unicellular or multicellular based on cell, tissue, organ and organ system level of organization

- **Symmetry:** It is a plane of arrangement of body parts. Radial symmetry and bilateral symmetry are the two types of symmetry. In radial symmetry the body parts are arranged around the central axis. If the animal is cut through the central axis in any direction, it can be divided into similar halves. e.g. Hydra, jelly fish and star fish. In bilateral symmetry, the body parts are arranged along a central axis. If the animal is cut through the central axis, we get two identical halves e.g. Frog.

- **Germ layers:** Germ layers are formed during the development of an embryo. These layers give rise to different organs, as the embryo becomes an adult. Organisms with two germ layers, the ectoderm and the endoderm are called

- **diploblastic** animals. e.g Hydra. Organisms with three germ layers, ectoderm, mesoderm and endoderm are called **triploblastic** animals. e.g Rabbit

- **Coelom:** It is a fluid-filled body cavity. It separates the digestive tract from the body wall. A true body cavity or coelom is one that is located within the mesoderm. Based on the nature of the coelom, animals are divided into 3 groups.

➢ Acoelomates do not have a body cavity e.g Tapeworm.

➢ Pseudocoelomates have a false body cavity e.g Roundworm.

➢ Coelomates or Eucoelomates have a true coelom e.g Earthworm, Frog.

- Animal Kingdom is further divided into two groups based on the presence or absence of notochord as below.

- **Invertebrata**
- **Chordata-Prochordata and Vertebrata**

- Animals which do not possess notochord are called as Invertebrates or Non- chordates. Animals which possess notochord or backbone are called as Chordates.

Binomial Nomenclature

- Carolus Linnaeus introduced the method of naming the animals with two names known as binomial nomenclature. The first name is called genus and the first letter of genus is denoted in capital and the second one is the species name denoted in small letter. The binomial names of some of the common animals are as follows

Common Name	**Binominal Name**
Amoeba	Amoeba Proteus
Hydra	Hydra Vulgaris
Tape Worm	Taenia Solium
Round Worm	Ascaris Lumbricoides
Earth Worm	Lampito mauritii/ Perionyx excavatus
Leech	Hirudinaria granulosa
Cockroach	Periplaneta americana
Snail	Pila globosa
Starfish	Asterias rubens
Frog	Rana hexadactyla
Wall lizard	Podarcis muralis
Crow	Corvus splendens
Peacock	Pavo Cristatus
Dog	Canis Familiaris
Cat	Felis Felis
Tiger	Panthera tigria
Man	Homo sapiens.

Invertebrata

Phylum Porifera (Pore bearers)

- These are multicellular, non-motile aquatic organisms, commonly called as sponges. They exhibit cellular grade of organization. Body is perforated with many pores called ostia. Water enters into the body through ostia and leads to a canal system. It circulates water throughout the body and carries food, oxygen. The body wall contains spicules, which form the skeletal framework. Reproduction is by both asexual and sexual methods. e.g- Euplectella, Sycon.

Phylum Coelenterata (Cnidaria)

- Coelenterates are aquatic organisms, mostly marine and few fresh water forms. They are multicellular, radially symmetrical animals, with tissue grade of organization. Body wall is diploblastic with two layers. An outer ectoderm and inner mesoderm are separated by non-cellular jelly like substance called mesoglea. It has a central gastrovascular cavity called coelenteron with mouth surrounded by short tentacles. The tentacles bear stinging cells called cnidoblast or nematocyst.

- Many coelenterates exhibit polymorphism, which is the variation in the structure and function of the individuals of the same species. They reproduce both asexually and sexually. e.g. Hydra, Jellyfish.

Phylum Platyhelminthes (Flat worms)

- They are bilaterally symmetrical, triploblastic, acoelomate (without body cavity) animals. Most of them are parasitic in nature. Suckers and hooks help the animal to attach itself to the body of the host.

- Excretion occurs by specialized cells called flame cells.

- These worms are hermaphrodites having both male and female reproductive organs in a single individual. e.g- Liverfluke, Tapeworm

Phylum Aschelminthes (Round worms)

- Aschelminthes are bilaterally symmetrical, triploblastic animals. The body cavity is a pseudocoelom. They exist as free-living soil forms or as parasites. The body is round and pointed at both the ends. It is unsegmented and covered by thin cuticle. Sexes are separate. The most common diseases caused by nematodes in human beings are elephantiasis and ascariasis. e.g-Ascaris, Wuchereria.

Phylum Annelida (Segmented worms)

- These are bilaterally symmetrical, triploblastic, first true coelomate animals with organ-system grade of organization. Body is externally divided into segments called metameres joined by ring like structures called annuli. It is covered by moist thin cuticle. Setae and parapodia are locomotor organs. Sexes may be separate or united (hermaphrodites). e.g- Nereis, Earthworm, Leech.

Phylum Arthropoda (Animals with jointed legs)

- Arthropoda is the largest phylum of the animal kingdom. They are bilaterally symmetrical, triploblastic and coelomate animals. The body is divisible into head, thorax and abdomen. Each segment bears paired jointed legs. Exoskeleton is made of chitin and is shed periodically as the animal grows. The casting off and regrowing of exoskeleton is called moulting.

- Body cavity is filled with haemolymph (blood). The blood does not flow in blood vessels and circulates throughout the body (open circulatory system). Respiration is through body surface, gills or tracheae (air tubes). Excretion occurs by malphigian tubules or green glands. Sexes are separate. e.g., Prawn, Crab, Cockroach, Millipedes, Centipedes, Spider, Scorpions.

Centipede means 'hundred legs'. But most species have only 30 pairs. Millipedes have two pairs of legs on each segment. This name means 'thousand legs'. But, most millipedes have only about a hundred

Phylum Mollusca (Soft Bodied Animals)

- They are diversified group of animals living in marine, fresh water and terrestrial habitats. Body is bilaterally symmetrical, soft and without

segmentation. It is divided into head, muscular foot and visceral mass. The foot helps in locomotion. The entire body is covered with fold of thin skin called mantle, which secretes outer hard calcareous shell. Respiration is through gills (ctenidia) or lungs or both. Sexes are separate with larval stages during development. e.g-Garden snail, Octopus.

Octopus is the only invertebrate that is capable of emotion, empathy, cognitive function, self awareness, personality and even relationships with humans. Some speculate that without humans, octopus would eventually take our place as the dominate life form on earth

Phylum Echinodermata (Spiny Skinned Animals)

- They are exclusively free-living marine animals. These are triploblastic and true coelomates with organ-system grade of organization. Adult animals are radially symmetrical but larvae remain bilaterally symmetrical. A unique feature is the presence of fluid filled water vascular system. Locomotion is affected by tube feet. Body wall is covered with spiny hard calcareous ossicles. e.g- Star fish, Sea urchin.

Phylum Hemichordata

- Hemichordates are marine organisms with soft, vermiform and unsegmented body. They are bilaterally symmetrical, coelomate animals with non-chordate and chordate features. They have gill slits but do not have notochord. They are ciliary feeders and mostly remain as tubiculous forms. e.g- Balanoglossus (Acorn worms).

Chordata

- Chordates are characterized by the presence of notochord, dorsal nerve cord and paired gill pouches. Notochord is a long rod like support along the back of the animal separating the gut and nervous tissue. All chordates are triploblastic and coelomate animals. Phylum Chordata is divided into two groups: Prochordata and Vertebrata.

Prochordata

- The prochordates are considered as the forerunner of vertebrates. Based on the nature of the notochord, prochordata is classified into subphylum Urochordata and subphylum Cephalochordata.

Subphylum Urochordata

- Notochord is present only in the tail region of free-living larva. Adults are sessile forms and mostly degenerate. The body is covered with a tunic or test. e.g. Ascidian

Subphylum Cephalochordata

- Cephalochordates are small fish like marine chordates with unpaired dorsal fins. The notochord extends throughout the entire length of the body. e.g. Amphioxus

Vertebrata

- This group is characterized by the presence of vertebral column or backbone. Notochord in an embryonic stage gets replaced by the vertebral column, which forms the chief skeletal axis of the body. Vertebrata are grouped into six classes.

Class: Cyclostomata

- Cyclostomes are jawless vertebrates (mouth not bounded by jaws). Body is elongated and eel like. They have circular mouth. Skin is slimy and scaleless. They are ectoparasites of fishes. e.g. Hag fish.

Class: Pisces

- Fishes are poikilothermic (cold-blooded), aquatic vertebrates with jaws. The streamlined
- body is divisible into head, trunk and tail. Locomotion is by paired and median fins. Their body is covered with scales. Respiration is through gills. Th e heart is two chambered with an auricle and a ventricle. There are two main types of fishes.

- Cartilaginous fishes, with skeleton made of cartilages e.g. Sharks, Skates.

- Bony fishes with skeleton made of bones e.g. Carps, Mullets.

Class: Amphibia (amphi- both; bios- life)

- These are the first four legged (tetrapods) vertebrates with dual adaptation to live in both land and water. Th e body is divisible into head and trunk. Their skin is moist and have mucus gland. Respiration is through gills, lungs, skin or buccopharynx. Th e heart is three chambered with two auricles and one ventricle. Eggs are laid in water. The tadpole larva, transforms into an adult. e.g-Frog, Toad

The Chinese giant salamander Andrias davidians is the largest amphibian in the world. Its length is about five feet and eleven inches. It weighs about 65 kg, found in Central and South China

Class: Reptilia (repere- to crawl or creep)

- These vertebrates are fully adapted to life on land. Their body is covered with horny epidermal scales. Respiration is through lungs. The heart is three chambered with an exemption of crocodiles, which have four-chambered heart. Most of the reptiles lay their eggs with tough outer shell e.g Calotes, Lizard, Snake, Tortoise, Turtle

Class: Aves (avis – bird)

- Birds are homeothermic (warm-blooded) animals with several adaptations to fly. The spindle or boat shaped body is divisible into head, neck, trunk and tail. The body is covered with feathers. Forelimbs are modified into wings for flight. Hindlimbs are adapted for walking, perching or swimming. The respiration is through lungs, which have air sacs. Bones are filled with air (pneumatic bones), which reduces the body weight. They lay large yolk laden eggs. They are covered by hard calcareous shell. e.g. Parrot, Crow, Eagle, Pigeon, Ostrich

Class: Mammalia (mamma-breast)

- Mammals are warm-blooded animals. The skin is covered with hairs. It also bears sweat and sebaceous (oil) glands. The body is divisible into head, neck, trunk and tail. Females have mammary glands, which secrete milk for feeding the young ones. The external ear or pinnae is present. Heart is four chambered and they breathe through lungs. Except egg laying mammals (Platypus, and Spiny anteater), all other mammals give birth to their young ones (viviparous). Placenta is the unique characteristic feature of mammals.e.g Rat, Rabbit, Man.

10th Book

Unit 17- Reproduction in plants and Animals

Introduction

- "Living organisms cannot survive for an indefinite period on earth. All living organisms have the ability to produce more of its own kind by the process called reproduction. Reproduction is the unfolding of life forms where new individuals are formed. It ensures continuity and survival of the species. This process is to preserve individual species and it is called as self-perpetuation. The time required to reproduce also varies from organism to organism. You may find great variations in period of reproduction in yeast, bacteria, rat, cow, elephant and humans. In sexual reproduction offsprings are produced by the union of male and female gametes (sperm and egg). The male and female gametes contain the genetic material or genes present on the chromosomes which transmit the characteristic traits to the next generation. There are three types of reproduction in plants namely i) Vegetative ii) Asexual and iii)Sexual reproduction. In this unit you willknow more about the types and the process of asexual and sexual reproduction in plants, animals and human.

Vegetative Reproduction

- In this type, new plantlets are formed from vegetative (somatic) cells, buds or organs of plant. The vegetative part of plant (root, stem, leaf or bud) gets detached from the parent body and grows into an independent daughter plant. It has only mitotic division, no gametic fusion and daughter plants are genetically similar to the parent plant.

Vegetative reproduction may take place through

- Leaves**:** In Bryophyllum small plants grow at the leaf notches

- **Stems:** In strawberry aerial weak stems touch the ground and give off adventitious roots and buds. When the connections with the parent plant is broken, the offspring beomes independent

- **Root:** Tuberous roots (Asparagus and Sweet potato) can be used for vegetative propagation.

- Bulbils**:** In some plants the flower bud modifies into globose bulb which are called as bulbils, when these falls on the ground they grow into new plants. e.g. Agave.

- **Fragmentation**: In filamentous algae, breaking of the filament into many fragments is called fragmentation. Each fragment having atleast one cell, may give rise to a new filament of the algae by cell division e.g. Spirogyra

- Fission**:** In this type the parent cell divides into two daughter cells and each cell develops into a new adult organism e.g. Amoeba.

- **Budding:** Formation of a daughter individual from a small projection, the bud, arising on the parent body is called budding. e.g. Yeast.

- **Regeneration:** The ability of the lost body parts of an individual organism to give rise to an whole new organism is called regeneration. It takes place by specialized mass of cells e.g Hydra and Planaria

Asexual Reproduction

- Production of an offspring by a single parent without the formation and fusion of gametes is called asexual reproduction. It involves only mitotic cell divisions and meiosis does not occur. Offspring produced by asexual reproduction are not only identical to parents but are also exact copies of their parent.

- Asexual reproduction occurs by spore formation. This is the most common method of asexual reproduction in fungi and bacteria.

- During spore formation a structure called sporangium develops from the fungal hypha. The nucleus divides several times within the

sporangium and each nucleus with small amount of cytoplasm develops into a spore. The spores are liberated and they develop into new hypha after reaching the ground or substratum.

Sexual Reproduction in Plants

- Sexual reproduction is the process in which two gametes (male and female) are fused to produce offspring of their own kind. In such cases both sexes, male and female sex organs are needed to produce gametes. You have already learnt that the flower is a reproductive organ of a flowering plant. To

understand this further we need to study the structure of a flower

Parts of a Typical Flower

- A flower is a modified shoot with limited growth to carry out sexual reproduction. A flower consists of four whorls borne on a thalamus. These whorls are from outside

- **Calyx – consisting of sepals**
- **Corolla – consisting of petals**
- **Androecium – consisting of stamens**
- **Gynoecium or pistil – consisting of carpels**

- The two outermost whorls calyx and corolla are non–essential or accessory whorls as they do not directly take part in the reproduction. The other two whorls androecium and gynoecium are known as the essential whorls, because both take part directly in reproduction.

- **Androecium:** Androecium, the male part of flower is composed of stamens. Each stamen consists of a stalk called the filament and a small bag like structure called anther at the tip. The pollen grains are produced in the anther within the pollen sac.

- **Pollen grain:** Pollen grains are usually spherical in shape. It has two layered wall. The hard-outer layer is known as exine. It has prominent apertures called germpore. The inner thin layer is known as intine. It is a thin and continuous layer made up of cellulose and pectin. Mature pollen grains contain two cells, the vegetative and the generative cell.

Vegetative cell contains a large nucleus. The generative cell divides mitotically to form two male gametes.

Gynoecium: Gynoecium is the female part of the flower and is made up of carpels. It has three parts:

- **Ovary**
- **Style**
- **Stigma**

The ovary contains the ovules.

Structure of the Ovule

- The main part of the ovule is the nucellus which is enclosed by two integuments leaving an opening called as micropyle. The ovule is attached to the ovary wall by a stalk known as funiculus. Chalaza is the basal part.

- The embryo sac contains seven cells and the eighth nuclei located within the nucellus. Three cells at the micropylar end form the egg apparatus and the three cells at the chalaza end are the antipodal cells. The remaining two nuclei are called polar nuclei found in the centre. In the egg apparatus one is the egg cell (female gamete) and the remaining two cells are the synergids.

Process of sexual reproduction in flowering plants. It involves:

- Pollination
- Fertilization

Pollination

- The transfer of pollen grains from anther to stigma of a flower is called as pollination.

Importance of Pollination

- It results in fertilization which leads to the formation of fruits and seed.

- New varieties of plants are formed through new combination of genes in case of cross pollination.

Types of Pollination

- **Self-pollination**
- **Cross pollination**

Self-pollination (Autogamy)

- Self-pollination is also known as autogamy. The transfer of pollen grains from the anther to the stigma of same flower or another flower borne on the same plant is known as self-pollination. e.g. Hibiscus.

Advantages of self-pollination

- Self-pollination is possible in certain bisexual flowers.
- Flowers do not depend on agents for pollination.
- There is no wastage of pollen grains

Disadvantages of self-pollination

- The seeds are less in numbers.
- The endosperm is minute. Therefore, the seeds produce weak plants.
- New varieties of plants cannot be produced

Cross pollination

- Cross-pollination is the transfer of pollen from the anthers of a flower to the stigma of a flower on another plant of the same species e.g. apples, grapes, plum, etc.

Advantages of cross pollination

- The seeds produced as a result of cross pollination, develop and germinate properly and grow into better plants, i.e. cross pollination leads to the production of new varieties.
- More viable seeds are produced.

Disadvantages of cross-pollination

- Pollination may fail due to distance barrier.
- More wastage of pollen grains
- It may introduce some unwanted characters
- Flowers depend on the external agencies for pollination

Agents of Cross Pollination

- In order to bring about cross pollination, it is necessary that the pollen should be carried from one flower to another of a different plant.
- This takes place through the agency of animals, insects, wind and water.

Pollination by wind

- The pollination with the help of wind is called anemophily. The anemophilous flowers produce enormous amount of pollen grains. The pollen grains are small, smooth, dry and light in weight. Pollen of such plants are blown off at a distance of more than 1,000 km. The stigmas are comparatively large, protruding and sometimes hairy to trap the pollen grains. e.g. Grasses and some cacti.

Pollination by insects

- Pollination with the help of insects like honey bees, flies are called entomophily. To attract insects these flowers are brightly coloured,

have smell and nectar. The pollen grains are larger in size, the exine is pitted, spiny etc., so they can be adhered firmly on the sticky stigma. Approximately, 80% of the pollination done by the insects is carried by honey bees.

Pollination by water

- The pollination with the help of water is called hydrophily.This takes place in aquatic plants.

- Pollen grains are produced in large numbers.

- Pollen grains float on surface of water till they land on the stigma of female flowers e.g. Hydrilla, Vallisneria.

Pollination by Animals

- When pollination takes place with the help of animals, it is called Zoophily. Flowers of such plants attract animals by their bright color, size, scent etc. e.g. sun bird pollinates flowers of Canna, Gladioli etc., Squirrels pollinate flowers of silk cotton tree.

Fertilization in Plants

- Pollen grains reach the right stigma and begin to germinate.

- Pollen grain forms a small tube-like structure called pollen tube which emerges through the germ pore. The contents of the pollen grain move into the tube.

- Pollen tube grows through the tissues of the stigma and style and finally reaches the ovule through the micropyle.

- Vegetative cell degenerates and the generative cell divides to form two sperms (or male gametes).

- Tip of pollen tube bursts and the two sperms enter the embryo sac.

- One sperm fuses with the egg (syngamy) and forms a diploid zygote. The other sperm fuses with the secondary nucleus (Triple fusion) to

form the primary endosperm nucleus which is triploid in nature. Since two types of fusion syngamy and triple fusion take place in an embryo sac the process is termed as double fertilization.

- After triple fusion, primary endosperm nucleus develops into an endosperm.
- Endosperm provides food to the developing embryo.
- Later the synergids and antipodal cells degenerate.

Significance of Fertilization

- It stimulates the ovary to develop into fruit.
- It helps in development of new characters from two different individuals.

Post fertilization changes:

- The ovule develops into a seed.
- The integuments of the ovule develop into the seed coat.
- The ovary enlarges and develops into a fruit.

The seed contains the future plant or embryo which develops into a seedling under appropriate conditions.

Sexual Reproduction in Human

- In human beings the male and female reproductive organs differ anatomically and physiologically. New individuals develop by the fusion of gametes. Sexual reproduction involves the fusion of two haploid gametes (male and the female gametes) to form a diploid individual (zygote).

Organs of the reproductive system are divided into primary and secondary (accessory) sex organs.

- Primary reproductive organs include the gonads (Testes in male and Ovaries in female).

- Accessory sex organs

- **Male:** Vas deferens, epididymis, seminal vesicle, prostate gland and penis.

- **Female:** Fallopian tubes, uterus, cervix and vagina.

The secondary (accessory) sex organs include those structures which are involved in the

- Process of ovulation
- Fusion of the male and female gametes (fertilization)
- Division of the fertilized egg upto the formation of embryo
- Pregnancy
- Development of foetus
- Child birth.

The cells of the primary reproductive organs in human male and female and their role in reproduction.

Male Reproductive Organ - Structure of Testes

- Testes are the reproductive glands of the male that are oval shaped organs which lie outside the abdominal cavity of a man in a sac like structure called scrotum. Now we shall study the various cells which are present in the testes.

- Each testes is covered with a layer of fibrous tissue called tunica albuginea. Many septa from this layer divide the testes into pyramidal lobules, in which lie seminiferous tubules, cells of Sertoli, and the Leydig cells (interstitial cells).

- The process of spermatogenesis takes place in the seminiferous tubules. The Sertoli cells are the supporting cells and provide nutrients to the developing sperms. The Leydig cells are polyhedral in shape and lie between the seminiferous tubules and secrete testosterone. It initiates the process of spermatogenesis.

Female Reproductive Organ - Structure of Ovary

- The ovaries are located on either side of the lower abdomen composed of two almond shaped bodies, each lying near the lateral end of fallopian tube. Each ovary is a compact structure consisting of an outer cortex and an inner medulla. The cortex is composed of a network of connective tissue called as stroma and is lined by the germinal epithelium. The epithelial cells called the granulosa cells surround each ovum in the ovary together forming the primary follicle. As the egg grows larger, the follicle also enlarges and gets filled with the fluid and is called the Graafian follicle.

Gametogenesis

- The formation of the sperm in male and the ovum in female is called gametogenesis. It involves spermatogenesis (formation of spermatozoa) and oogenesis (the formation of ova). Gametes with haploid cells are produced through gametogenesis.

Structure of Human Sperm

- The spermatozoan consists of head, a middle piece and tail. The sperm head is elongated and formed by the condensation of nucleus. The anterior portion has a cap like structure called acrosome. It contains hyaluronidase an enzyme that helps the sperm to enter the ovum during fertilization. A short neck connects the head and middle piece which comprises the centrioles.The middle piece contains the mitochondria which provides energy for the movement of tail. It brings about sperm motility which is essential for fertilization.

Structure of Ovum

- The mature ovum or egg is spherical in shape.The ovum is almost free of yolk. It contains abundant cytoplasm and the nucleus. The ovum is surrounded by three membranes. The plasma membrane is surrounded by inner thin zona pellucida and an outer thick corona radiata. The corona radiata is formed of follicle cells. The membrane forming the surface layer of the ovum is called vitelline membrane. The fluid-filled

space between zona pellucida and the surface of the egg is called perivitelline space.

Puberty

- The reproductive system in both males and females becomes functional and an increase in sex hormone production resulting in puberty. This phenomenon tends to start earlier in females than in males. Generally boys attain puberty between the age of 13 to 14 years, while girls reach puberty between 11 to 13 years. In male, the onset of puberty is triggered by the secretion of the hormone testosterone in the testes, in female the secretion of estrogens and progesterone from the ovary. The secretion of both male and female hormones are under the control of the pituitary gonadotropins luteinizing hormone (LH) and follicle stimulating hormone (FSH).

Menstrual Cycle-Process of Ovulation

- The cyclic events that take place in a rhythmic fashion during the reproductive period of a woman's life is called menstrual cycle. In human females the menstrual cycle starts at the age of 11-13 years which marks the onset of puberty and is called menarche, and ceases around 48-50 years of age and this stage is termed menopause. The reproductive period is marked by characteristic events repeated almost every month in physiologically normal women (28 days with minor variation) in the form of a menstrual flow. The menstrual cycle consists of 4 phases.

- Menstrual or Destructive Phase
- Follicular or Proliferative Phase
- Ovulatory Phase
- Luteal or Secretory Phase

- These phases show simultaneous synchrony of events in both ovary and uterus. Changes in the ovary and the uterus are induced by the pituitary hormones (LH and FSH) and ovarian hormones (estrogen and progesterone).

Phase	Days	Changes in Ovary	Changes in Uterus	Hormonal Changes
Menstrual Phase	4-5 days	Development of Primary Follicles	Breakdown of Uterine endometrial lining leads to bleeding	Decrease in Progesterone and Oestrogen
Follicular phase	6^{th} – 13^{th} days	Primary follicles grow to become a fully mature Graafian follicle	Endometrium regenerates through Poliferation	FSH and Oestrogen increase
Ovulatory phase	14^{th} day	The Graafian follicle ruptures, and releases the Ovum (Egg)	Increase in endometrial thickness	LH Peak
Luteal Phase	15^{th} – 28^{th} days	Emptied Graafian follicle develops into corpus luteum	Endometrium is prepared for implantation if fertilization of egg takes place, if fertilization does not occur corpus luteum degenerates, Uterine wall ruptures, bleeding starts and unfertilized egg is expelled	LHS and FSH Decrease, corpus luteum Produces progesterone and its level increases followed by a decline, if menstrual bleeding occurs.

Fertilization to Foetal Development

Fertilization

- Fertilization in human is internal and occurs in the oviduct of the female genital tract. It takes place usually in the ampulla of the fallopian tube. An oocyte is alive for about 24 hours after it is released from the follicle. Fertilisation must take place within 24 hours. The sperm enters into the ovum and fuses with it, resulting in the formation of a 'zygote'. This process is called fertilization. The zygote is a fertilized ovum.

Cleavage and Formation of Blastula

- The first cleavage takes place about 30 hours after fertilization. Cleavage is a series of rapid mitotic divisions of the zygote to form many celled blastula (Blastocyst) which comprises an outer layer of smaller cells and inner mass of larger cells.

Implantation

- The blastocyst (fertilized egg) reaches the uterus and gets implanted in the uterus. The process of attachment of the blastocyst to the uterine wall (endometrium) is called implantation. The fertilized egg becomes implanted in about 6 to 7 days after fertilization

Gastrulation

- The transformation of blastula into gastrula and the formation of primary germ layers (ectoderm, mesoderm and endoderm) by rearrangement of the cells is called gastrulation. This takes place after the process of implantation.

Organogenesis

- The establishment of the germ layers namely ectoderm, mesoderm and endoderm initiates the final phase of embryonic development. During organogenesis the various organs of the foetus are established from the different germ layers attaining a functional state.

Formation of Placenta

- The placenta is a disc shaped structure attached to the uterine wall and is a temporary association between the developing embryo and maternal tissues. It allows the exchange of food materials, diffusion of oxygen, excretion of nitrogenous wastes and elimination of carbon dioxide. A cord containing blood vessels that connects the placenta with the foetus is called the umbilical cord.

Pregnancy (Gestation)

- It is the time period during which the embryo attains its development in the uterus. Normally gestation period of human last for about 280 days. During pregnancy the uterus expands upto 500 times of its normal size.

Parturition (Child Birth)

- Parturition is the expulsion of young one from the mother's uterus at the end of gestation. Oxytocin from the posterior pituitary stimulates the uterine contractions and provides force to expel the baby from the uterus, causing birth.

Sometimes ovaries releases two eggs and each is fertilised by a different sperm, resulting in Non-Identical Twins (Fraternal Twins). If single egg is fertilised and then divides into two foetus, Identical Twins develop.

Lactation

- The process of milk production after child birth from mammary glands of the mother is called lactation. The first fluid which is released from the mammary gland after child birth is called as colostrum. Milk production from alveoli of mammary glands is stimulated by prolactin secreted from the anterior pituitary.

The ejection of milk is stimulated by posterior pituitary hormone oxytocin.

Reproductive Health

- According to World Health Organization (WHO) reproductive health means a total well being in all aspects of reproduction, ability to reproduce and regulate fertility, women's ability to undergo pregnancy and safe child birth, maternal and infant survival and well being.

- Several measures were undertaken by the government to improve the reproductive health of the people by launching National Health Programmes such as the

- Family Welfare Programme
- Reproductive and Child Health Care (RCH) Programme

Family welfare programme: The National Family Welfare Programme is a comprehensive scheme which includes:

- Maternal and child health care (MCH)
- Immunization of mothers, infants and children.
- Nutritional supplement to pregnant women and children.
- Contraception with health education, to motivate couples to accept contraceptive methods and to have small family norms, which improve economic status, living status and the quality of life.

Reproductive and Child Health Care (RCH) Programme:

It has integrated all services which include

- Pregnancy and child birth
- Postnatal care of the mother and child
- Importance of breast feeding
- Prevention of reproductive tract infections and sexually transmitted diseases.

Population Explosion and Family Planning

- Population explosion defined as the sudden and rapid rise in the size of population, especially human population. Realizing the dangers inherent in population growth, the Government of India has taken

several measures to check population growth and introduced family planning. India has been one of the first country in the world to launch the nation wide family planning programme in 1952.

- Family planning is a way of living that is adopted voluntarily by couples on the basis of knowledge and responsible decisions to promote the health and welfare of the family group and society. The WHO (World Health Organisation) has also stressed the importance of family planning as global strategy health for all.

The inverted red triangle is a symbol of family planning in India for family welfare. It is displayed prominently at all hospitals, primary health clinics and family welfare centres where any help or advice about family planning is available free of cost. The symbol is displayed along with a slogan Small Family, Happy Family.

Contraception

- Contraception is one of the best birth control measures. A number of techniques or methods have been developed to prevent pregnancies in women. The devices used for contraception are called contraceptive devices. Common contraceptive methods used to prevent pregnancy are discussed here

- Barrier methods
- Hormonal methods
- Intra-Uterine Devices (IUDs)
- Surgical methods

Barrier Methods

- This method prevents sperms from meeting the ovum. Its entry into the female reproductive tract is prevented by barrier.

- Condom**:** Condom prevents deposition of sperms in the vagina. Condoms are made of thin rubber or latex sheath. Condom also protect against sexually transmitted diseases (STD) like syphilis, AIDS.

- Diaphragm **(Cervical cap):** Vaginal diaphragm fitting into the vagina or a cervical cap fitting over the cervix. This prevents the entry of sperms into the uterus.

Hormonal Methods

- Hormonal preparations are in the form of pills or tablets (contraceptive pills). These hormones stop (interfere with ovulation) the release of egg from the ovary.

Intra-Uterine Devices (IUDs)

- The intrauterine device (IUD)are contraceptive devices inserted into the uterus. There are two synthetic devices commonly used in India are Lippe's Loop and Copper-T made of copper and plastic (non irritant). This can remain for a period of 3 years. This reduces the sperm fertilizing capacity and prevents implantation. This also helps to give adequate time interval between pregnancies.

Surgical Methods

- Surgical contraception or sterilization techniques are terminal methods to prevent any pregnancy. This procedure in males is vasectomy (ligation of vas deferens) and in females it is tubectomy (ligation of fallopian tube). These are methods of permanent birth control.

Urinary Tract Infection (UTI)

- Many diseases affect both women and men, but a few diseases occur at a higher frequency in woman. Woman are susceptible to UTI from the bacteria that are present on skin, rectum or vagina. This will enter the urethra, before moving upwards. The types of UTI are:

Cystitis or Bladder infection

- Bacteria lodged in the urinary bladder thrive and multiply leading to inflammation. It is most common in the age group of 20 to 50.

Kidney Infection

- The bacteria can travel from the urinary bladder and upward to ureter and affect one or both the kidneys. It also infects the blood stream and leads to serious life-threatening complications.

Asymptomatic Bacteriuria

- The bacteria present in the urinary bladder which may not show any symptoms.

Personal Hygiene

- Hygiene is the practice of healthy living and personal cleanliness. Personal hygiene is caring of one's own body and health. Social hygiene is proper care of the surrounding environment. The main aspect of hygiene are body hygiene, food hygiene, sanitary hygiene and hygienic environment.

Body Hygiene

- Washing is vital to all age group of people which maintains our personal hygiene. A daily bath regularly keeps skin clean and free of germs. Hair should be kept clean by frequent washing. Mouth wash should be done after every meal. We should wash our hands many times during the day.

- Cloth towels used to dry our hands or body should be dried after each use and laundered regularly. Clothes, handkerchief, undergarments and socks should be washed daily. Washing prevents body odour, infections and skin irritation.

Toilet Hygiene

- The toilet has a lot to do with personal hygiene and general health as it is a place that cannot be avoided and used regularly. Parents should guide and practice their children on how to use the toilets at home, in schools and other public places so that it will protect the children from

various contagious infections and diseases. The following measures can ensure toilet hygiene

- The floors of the toilet should be maintained clean and dry. This helps to reduce the bad odour and also infection.

- Toilet flush handles, door knobs, faucets, paper towel dispensers, light switches and walls should be cleaned with disinfectants to kill harmful germs and bacteria.

- Hands should be washed thoroughly with soap before and after toilet use.

Menstrual and Napkin Hygiene

- Women's health depends upon the level of cleanliness to keep them free from skin and genitourinary tract infection.

Menstrual hygiene

- Maintaining menstrual hygiene is important for the overall health of women. The basic menstrual hygiene ways are

- Sanitary pads should be changed regularly, to avoid infections due to microbes from vagina and sweat from genitals.

- Use of warm water to clean genitals helps to get rid of menstrual cramps

Wearing loose clothing rather than tight fitting clothes will ensure the airflow around the genitals and prevent sweating.