OYO STATE LECTURE NOTES

BIOLOGY

COMPILED BY: Mr. I.A. Kolawole

REVIEWED BY: Dr. I.A. Akinyemi (Biology Department, Emmanuel Alayande College of Education, Oyo)

EDITED BY: Mr. A.F. Lawal

DESIGNED BY: BROWT -ESSCON

NOTES ON SS1 FIRST TERM BIOLOGY LESSONS

WEEK 1

INTRODUCTION TO BIOLOGY

BIOLOGY AS A SCIENCE

The word Biology comes from two Greek words *Bios*, which means life and *logos* which means study. A biologist is a scientist who studies living things. He makes use of common processes and attributes of sciences. The processes are:

- Making an accurate observations
- Identification of problems and plan experiments or investigations under controlled situations
- Predicts or formulates hypothesis
- Analyze results from collected data
- Making reasonable inferences, draw defendable and acceptable conclusion

The scientific methods adopted by the biologist are:

i. ***Hypothesis***: This is the tentative answers given in to a particular problem or question.

ii. ***Experimentation***: This is the act of setting up experiment to test the tentative answers given to the questions or the hypothesis.

iii. ***Variables***: These are the conditions on which experiment is set up. The result is got through variation of the variables.

iv. ***Control experiment***: This is set up to justify the main experiment. This is achieved by not allowing the variable under investigation to change (i.e remain constant).

v. ***Theory***: This is tested and acceptable hypothesis

vi. ***Law***: This is the generalization made from the inferences of many scientists about a particular experiment after obtaining a similar results.

ATTRIBUTES/ATTITUDES OF A BIOLOGIST

i. ***Curiosity:*** Strong desire to find out

ii. ***Objectivity:*** Respect for other scientist feeling and findings

iii. ***Open mindedness:*** Changing of mind to accommodate new discoveries

iv. ***Critical mindedness:*** Probing into scientific investigations before accepting its correctness

v. ***Suspending judgment:*** He concludes after the collection of enough information.

vi. ***Perseverance:*** He takes pain and time in designing and carrying out his experiment

vii. ***Carefulness:*** He takes caution in the procedure of the experiment

viii. ***Rationality:*** He explains the natural phenomenon in terms of natural causes rather than magic or spirits.

ix. ***Humility:*** He is naturally humble

x. ***Honesty:*** Honest in scientific processes and procedure

xi. ***Accuracy:*** The Observations and the results must be accurately recorded

USEFULNESS OF BIOLOGY

1. It helps man to understand the structure of his body and how it works
2. It helps man to discover several mechanisms and methods of treatments, scientific testing, effective drug administrations, immunization and disease prevention.
3. It helps man to increase good production, preservation and breeding of more productive breeds of plants and animals.
4. It also helps in pollution control in our environment.
5. It helps in the area of single cell protein production by micro organisms.
6. Biological researchers and development of new tools and techniques have led to an improved quality of life.
7. Study of biology has helped to promote the understanding of man and his immediate environment
8. It helps in the use of naturally occurring bacteria to clean up oil spills and toxic chemicals
9. The *in vitro* fertilization (i.e fertilization outside the body of an organism) helps infertile couple to have children
10. It proves the fact that when living things die, their substances returns to the realm of non-living things.

BRANCHES OF BIOLOGY

- ***Anatomy***: Study of tissues and its functions
- ***Physiology***: Study of normal functions of living things
- ***Morphology***: This is the form and the structure of living organism
- ***Ecology***: The interaction between living and non living components of an environment in which energy is used and recirculated.
- ***Embryology***: Scientific study of embryo.

- ***Genetic***: Scientific study of different ways by which characters are passed from parents to the offsprings.
- ***Evolution***: Scientific study of gradual development of living things as they adapt to different environmental changes over a long period of time.

The main branches of Biology are:

a. **BOTANY*:*** The study of plants

b. **ZOOLOGY*:*** The study of animals

BIOLOGY AS THE STUDY OF LIVING THINGS

Biology can be simply defined as the study of organisms with the proof of life. The proof of life in this content, are the evidences that they are living things and these are called the characteristics of living things.

GENERAL CHARACTERISTICS OF LIVING THINGS

1. ***Movement***: The ability to move the whole or part of the body using energy produced by the organism
2. ***Nutrition:*** This is the assimilation of food substances needed for respiration and growth.
3. ***Respiration:*** The breakdown of food substances to release energy
4. ***Reproduction:*** The production o new individuals of the same kind for the continuation of life
5. ***Irritability:*** Ability to respond to stimulus from the environment
6. ***Adaptation:*** The possession of features which enables organism to live successfully and to survive in their respective environments.
7. ***Growth:*** An irreversible increase in body size, weight and complexity due to synthesis of fresh protoplasm from nutrient materials.
8. ***Limited size:*** All living things exhibit growth to a limit expected of its kind, forinstant, goat can not grow to the size of an elephant.
9. ***Excretion:*** The removal of waste products of metabolism produced by the chemical process in the body of an organism
10. ***Death:*** Living things cannot live for life, at a certain stage of life, they will die or cease to live.

CLASSIFICATION OF LIVING THINGS

Living things are generally classified into two kingdoms:

Kingdom of plants (Kingdom plantae)

Kingdom of animals (Kingdom animalia)

Differences between plants and animals

S/N	PLANTS	ANIMALS
1.	Presence of chlorophyll, hence autotrophic nutrition	Absence of Chlorophyll, hence heterotrophic nutrition
2.	No active movement except in sensitive plants where slow movement is noticed	Quick and visible movement
3.	Growth is apical and meristematic. It continues for life	Growth is intercalary and stops at maturity
4.	Store carbohydrates as starch	Store carbohydrates as glycogen
5.	Response to stimulus is slow	Response to stimulus is quick and rapid
6.	Cell wall is present and made up of cellulose	Cell wall is absent
7.	No sense organ	Sense organs are present
8.	Absence of locomotory organs	Presence of locomotory organs
9.	Absence of special excretory organs	Presence of special excretory organs

Topic Assessment Questions

(a) Briefly outline five differences between plants and animals

(b) Mention 6 attributes of a scientist

(c) State and explain, features of living things

(d) Mention 5 ways by which the study of Biology is useful to mankind.

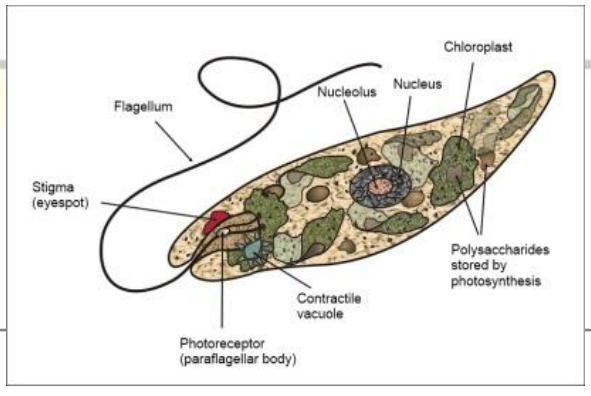
WEEK 2

ORGANIZATION OF LIFE

Organization of life among living organisms falls into four categories. Each group merges with the other, beginning from simple to complex forms.

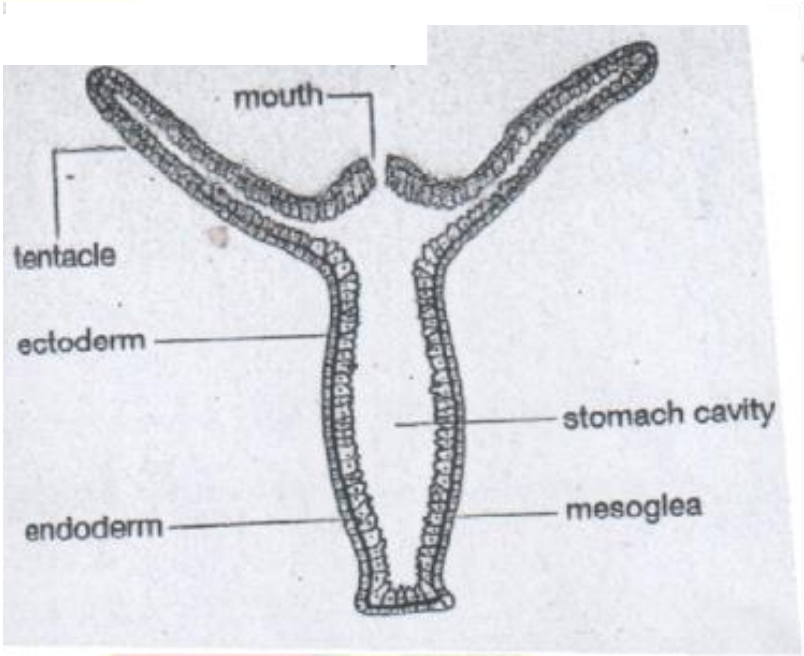
The four categories are:

A. **THE CELL**: This is the basic structural and functional unit of life. It is the smallest unit of a living organism e.g Amoeba, Paremecium, Ovum etc.



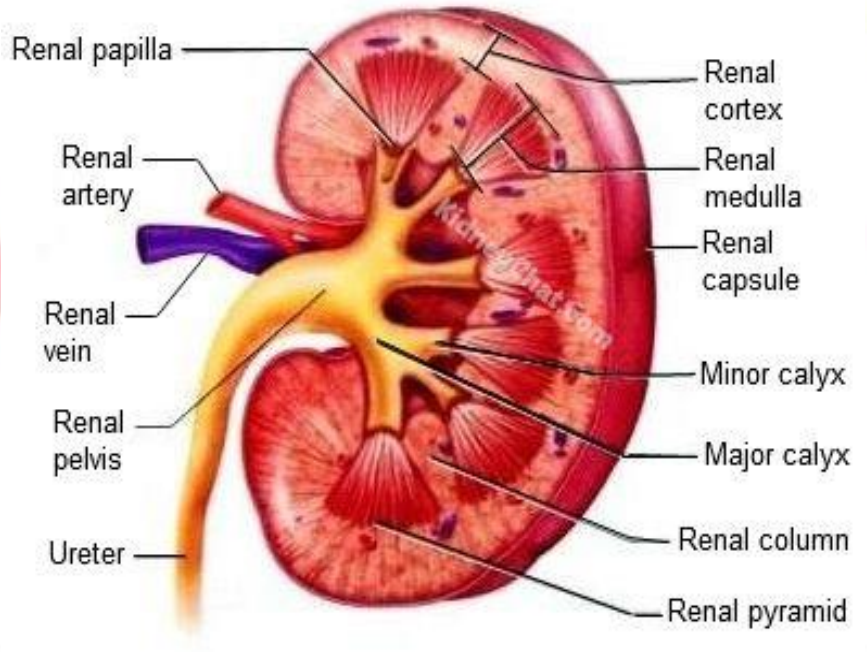
An Euglena Cell (Cellular Level)

B. **TISSUE**: This is the group of numerous similar cells arranged together to perform a specific function in the body e.gPhleom, Epidermis, Hydra etc.



An Hydra (Tissue Level)

C. **ORGAN**: This is the collection of different tissues grouped into an identifiable unit and performing one or more functions in the body. E.g Liver, Kidney.



The kidney (Organ level)

D. **SYSTEM**: This is the set of connected organs performing a major function in the body e.gExcretory system, Digestive system, Respiratory system etc.

COMPLEXITY OF ORGANIZATION IN HIGHER ORGANISM

The complexity of organization found in higher organisms occurs as a result of the following reasons:

1. Complex organism evolved from simple ones, i.e the Unicellular organism evolved into multicellular, simple to the complex and aquatic into terrestrial organisms
2. Higher organisms are considered to be more recent than the lower organisms in coming to existence, i.e vertebrates are recent than the invertebrates, also flowering plants are considered more recent than non-flowering plants.
3. Complexity leads to the evolvement of better adaptive features i.e gaseous exchange in Amoeba and Paramecium is by diffusion while man, there is special respiratory organ i.e lungs. This can be traced in many other systems such as transport, excretory and skeletal system.

   Hence, evolution plays a prominent role in complexity of living organisms.

ADVANTAGES OF COMPLEXITY

1. There is division of labour
2. Cell specialization exists for various functions
3. There is greater efficiency in functions in the higher organisms (plants and animals)
4. The organism with complex organization is able to attain a large body size
5. A complex organization enables an organism to adapt itself to a large number of various habitat

DISADVANTAGES OF COMPLEXITY

1. The area volume ratio diminishes by the complexity of organization
2. Elimination of toxic body waste products is more difficult
3. Physiological process such as osmosis and diffusion become difficult and eventually leads to physiological inefficiency.
4. There is a need for efficient coordination of different body parts i.e nervous system.
5. Longer distances are needed to be covered before simple processes can be accomplished i.e digestion of food

Topical assessment questions

a. List the 4 categories of organization of life
b. Explain with illustration, the meaning of complexity of organization
c. State 4 advantages and 4 disadvantages of complexity
d. State the reasons why man is said to be more advance than other living organisms.

WEEK 3:

CLASSIFICATION OF LIVING THINGS

The scientific process of classification of living things is called "Taxonomy" It is made up of the following sub processes.

- **Nomenclature**: System of naming base on the rule and procedure i.e Binomial system
- **Systematic**: The study of kind and diversity of living organisms
- **Classification**: Biological practice of placing or ordering of living things into groups according to the origin, structure, association and other attributes.
- **Identification**: Process of placing individual organisms into classes that had been initially identified.

PRINCIPLE OF CLASSIFICATION

A Swedish naturalist called Carolus Linnaeus introduced Binomial system of classification in 1778 in which two names are given to an individual organism. **Genus**- is the name corresponding to surnames and **Species**, the other name corresponding to specific or first name. The two names are underlined separately or italized.

e.g	Pawpaw	**Carica**	**papaya**
	Maize	**Zea**	**mays**
	Waterleaf	**Talinum**	**frulicosum**
	Sweet orange	**Citrus**	**sinesis**
	Housefly	**Musca**	**domestica**
	Toad	**Bufo**	**regularis**
	Rainbow lizard	**Agama**	**agama**

GROUPS IN LIVING ORGANISMS

Basically, living organisms are classified into two groups or kingdoms

a. Plant Kingdom and

b. Animal Kingdom

PLANT KINGDOM

- **Algae**: No roots, No stem, No leaf, Chlorophyll is present
- **Fungi**: No roots, stem or leaf, No Chlorophyll, Presence of Hyphae andmycellia
- **Bryophyte**: No true root stem or leaf, Have rhizoids
- **Pteridophyte**: presence of true roots, stem and leaves
- **Spermatophytes**: Produce pollens and form seeds

Spermatophytes

- **Gymnosperms**: Have cones and most members possess needle leaves. They do not have flowers, they have naked seeds
- **Angiosperms**: Have flowers and produce seeds inside fruits. They are flowering plants

Monocotyledonous plants

They possess one seed leaf or cotyledons, possess parallel venation with narrow leaved plants, no tree except the palms

Dicotyledonous plants

They possess two seed leaves or cotyledons, possess net veined and broad leaved plants, They are herbs, shrubs and tree plants

Animal Kingdom

Invertebrates

(No Notochord)
Protozoa (Amoeba)
Porifera (Sponges)
Coelentrata (Hydra)
Platyhelminthes (Tape worm)
Nematoda (Round worm)
Annelida (Eathworm)
Mollusca (Snail)
Arthropoda (Insects etc)
Echinodermata (Star fish)

Vertebrate (Chordata)

(Have Notochord)
Pisces (Fishes)
Amphibian (Toad)
Reptilia (lizard)
Aves (Birds)
Mammalia (man)

All living organisms can be put into two major groups – Procaryotic and Encaryotics

PROCARYOTICS: These are the organism that lack complete complements of hereditary materials; no well defined nuclei; examples of organism in this category include Bacteria and Virus

BACTERIA: These are the earliest life forms from which all others probably evolved. They have the following characteristics.

a. They are small, one celled microscopic organism
b. Most lack chlorophyll and living as saprophytes or parasites
c. They posses cell walls which are not made of cellulose
d. They reproduce asexually by binary fission.

VIRUSES: These are much smaller than bacterial cells with the following characteristics

a. They lack nucleus and cytoplasm
b. They are varying in shape and sizes
c. They can't live an independent life
d. They live and reproduce only within a living cells
e. They are all intracellular parasites.

EUKARYOTICS: These are the organisms with well defined nuclei and genetic materials. Algae, (except blue-green algae), protozoa and other common plants and animals are eukaryotics.

TWO KINGDOM CLASSIFICATIONS

This is the classification in which living organisms are divided into two kingdoms.

Plant Kingdom and Animal Kingdom

The plant kingdom is further divided into Phyla or divisions i.e

1. Thallophyta: Bacteria, Algae and Fungi
2. Byophyta: Mosses and liverworth
3. Pleridophyte: Ferns
4. Spermatophyte: Seed bearing i.e gymnosperm and the angiosperm.

The animal kingdom is divided further into the following phyla, protozoa, porifera, coelentrata, platyhelminthes, nematoda, animalia, mollusca, echinodenmata and chordata.

FIVE KINGDOM CLASSIFICATIONS

This is the modern classification that replaces the old two kingdom classifications. Here, the complexity of the cell, whetherprokaryotic or eukaryotic as well as complexity of the body structure of organism i.e unicellular or multicellular are considered. Also put into consideration is the nutrition (whether autotrophic or heterotrophic).

The five kingdoms are:

1. Monera: Bacteria and Blue green algae
2. Protista: Aquatic unicellular organismse.g Amoeba
3. Fungi: Moulds and Mushrooms
4. Plantae: Multicellular photosynthetic plants
5. Animalia: Various multicellular animals

Viruses are excluded due to animate and inanimate characteristics

KINGDOM MONERA

Characteristics

1. Unicellular and filamentous
2. Prokaryotic cells
3. No organized nucleus
4. Lack of complex chromosome
5. No mitochondria, chloroplast and endoplasmic reticulum
6. Lack of cellulose cell wall
7. No sexual reproduction
8. Either autotrophic or heterotrophic

KINGDOM PROSTISTA

Characteristics

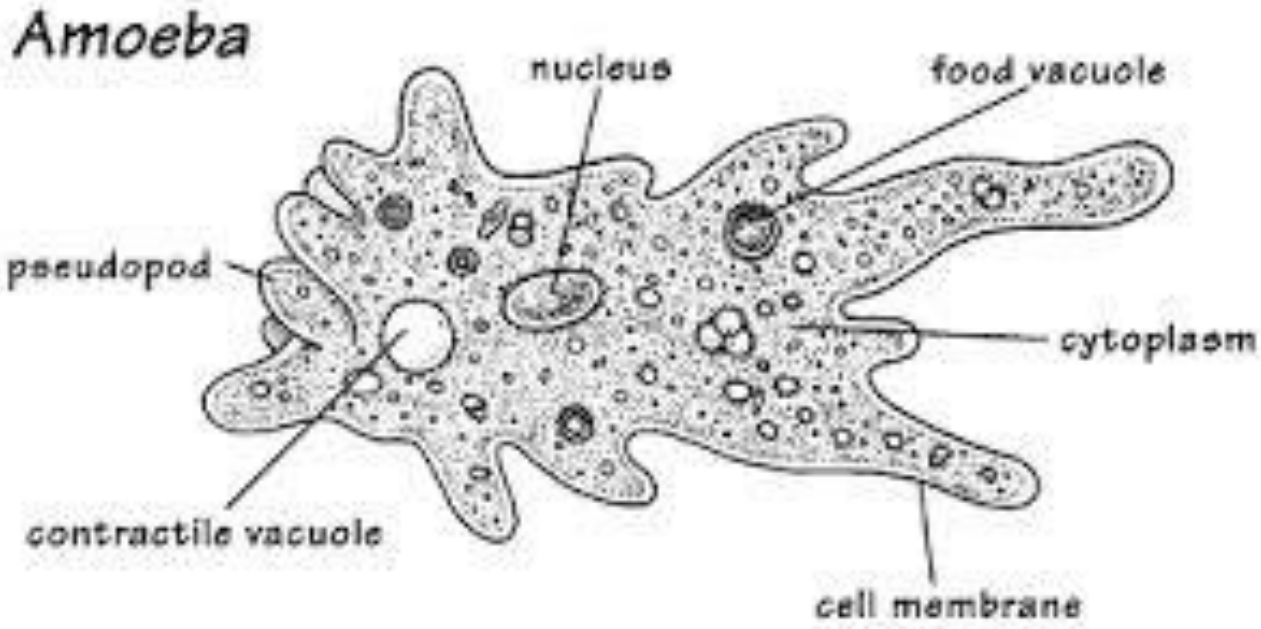
1. Eucaryotic and unicellular
2. Either autotrophic, parasitic or heterotrophic
3. Asexual reproduction by mitosis but some with sexual reproduction by the fussion of gametes.
4. Movement by cilia, flagella or amoeboid

KINGDOM FUNGI

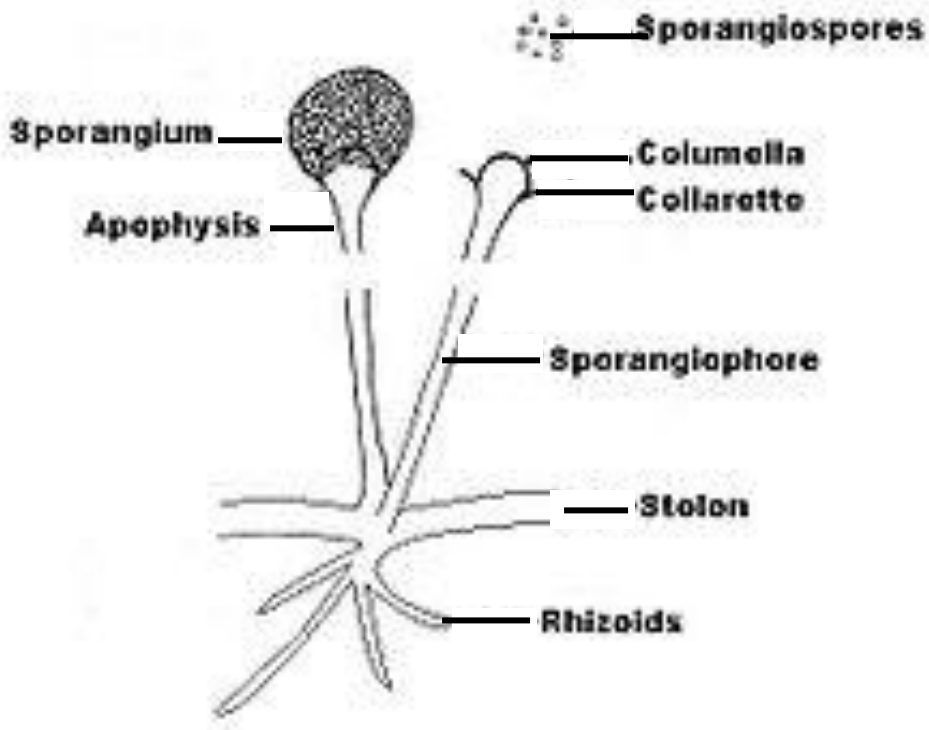
Characteristics

1. Some are unicellular e.g yeast. Many are cellular e.grhizopus, mushrooms
2. The body composed basically of filaments
3. All hyphae are collectively called mycelium

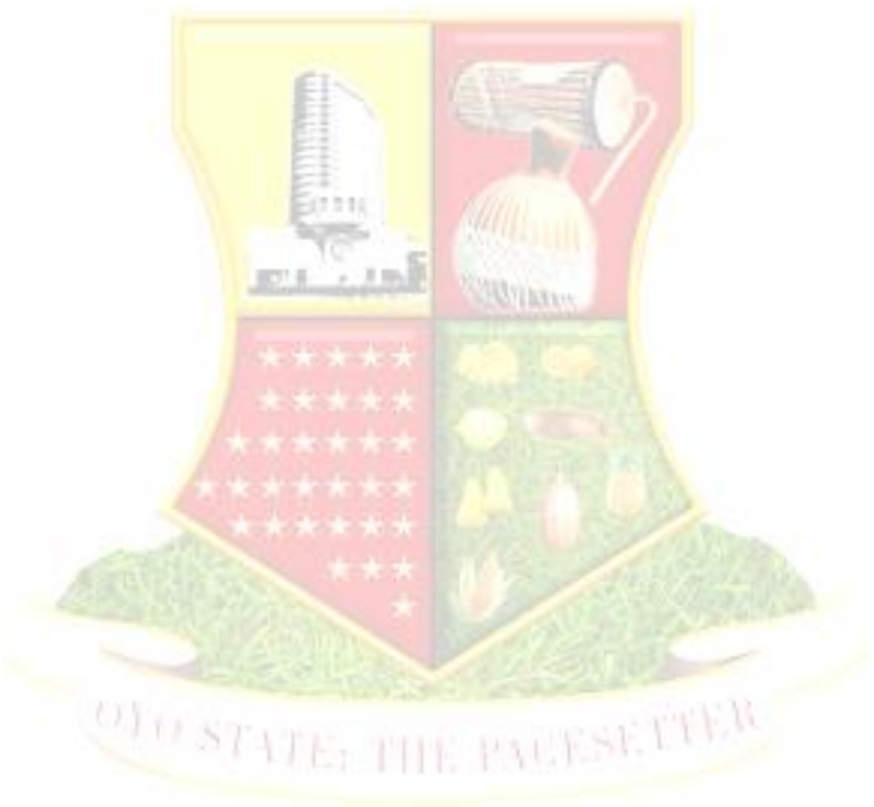
4. They are made up of many nuclei in a cell
5. All fungi are heterotrophic, but some live saprophytic, symbiotic and parasitic life because all lack chlorophyll.



Amoeba (A Protista)



Rhizopus (A fungi)



WEEK 4

KINGDOM PLANTAE

Plants in this kingdom include:

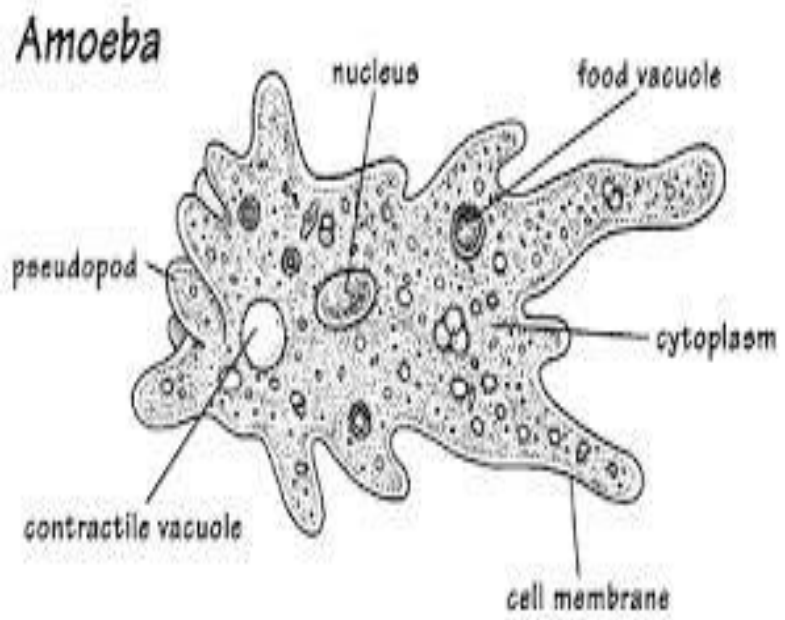
a. Phylum Phaeophyta (brown algae)
b. Phylum chlorophyta (green aquatic plants)
c. Phylum rhodophyta (red algae)
d. Phylum bryophyta (mosses and liverwort)
e. Phylum tracheophyta (land plants)

KINGDOM ANIMALIA

Phylum Protozoa e.g Amoeba, Plasmodium, Trypanosome

Characteristics

1. Unicellular, acellular or non-cellular
2. They are mostly microscopic
3. Some are free-living in water while some are parasitic in animals



An amoeba (A Protozoa)

Phylum Poriferae.g Sponges

Characteristics

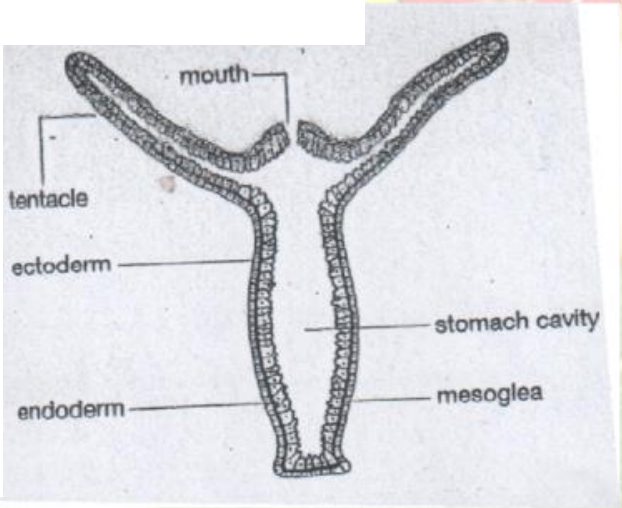
1. Multicellular, Sessile, and largely aquatic
2. Single body cavity with several holes
3. Body with two layers of cells
4. Skeleton is calcareous or siliceous

5. No nervous system
6. Reproduction is asexual by budding

Phylum Coelenteratae.g Hydra, Sea anemone, Jelly fish

Characteristics

1. They are simple and Multicellular
2. They are aquatic
3. They have two body layers
4. Organs are absent
5. Possession of nematoblast called stinging cells.
6. Asexual reproduction is by budding while sexual reproduction is by fussion of gametes.



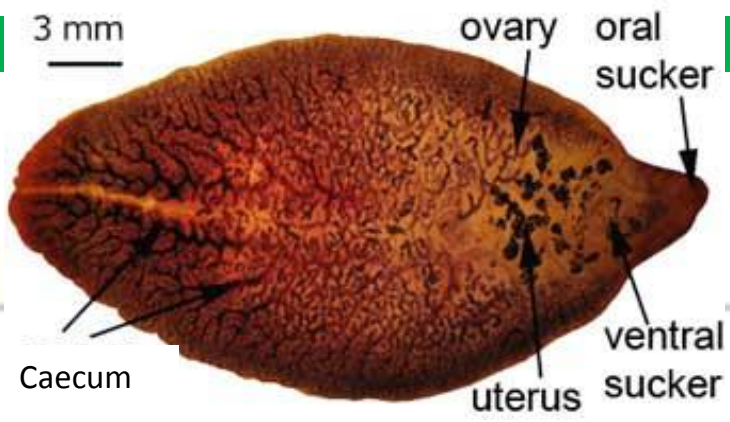
An Hydra

Phylum Platyhelminthese.gThe flatworms

Examples include liver fluke, tape worms, planarian etc

Characteristics

1. Flat and thin bodies
2. They are bilaterally symmetrical
3. They possess three body layers
4. Nervous, excretory and reproductory systems are present
5. Members are mostly hermaphrodites
6. Members are both free-living and parasitic e.g blood fluke, liver fluke fasciola, planaria
7. The body has a single opening –the mouth



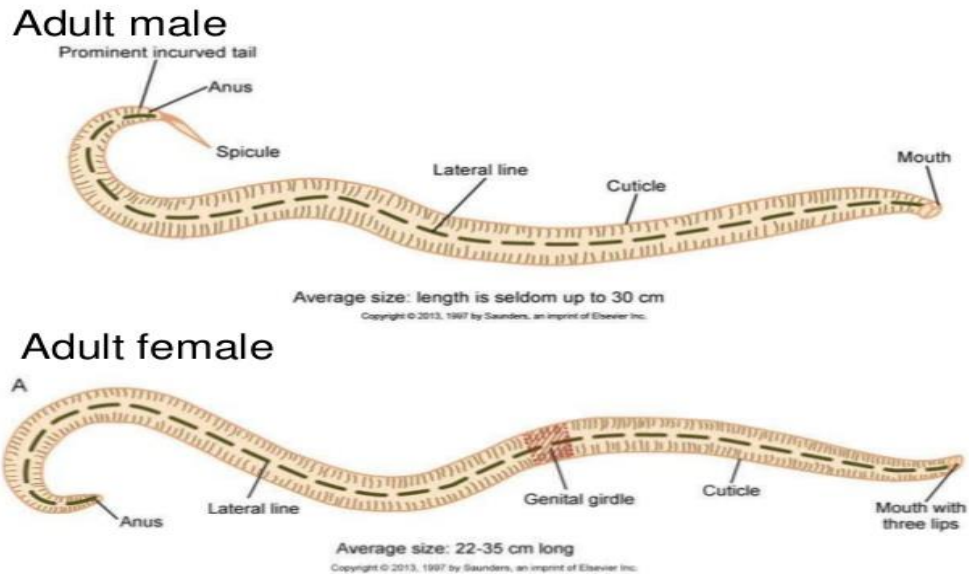
A Liver fluke

Phylum Nematodae.g (The round worm)

Characteristics

1. Long, slender and cylindrical bodies
2. Members have pointed ends
3. Presence of three body layers
4. Mouth and anus present
5. Body covered with cuticle
6. They are bilaterally symmentrical
7. Sexes are separate
8. Members are free living and parasitic

   Examples: Ascaris, Hookworm, Tapeworm, Guinea worm, Filaria worm, Onchocerca



An Ascaris

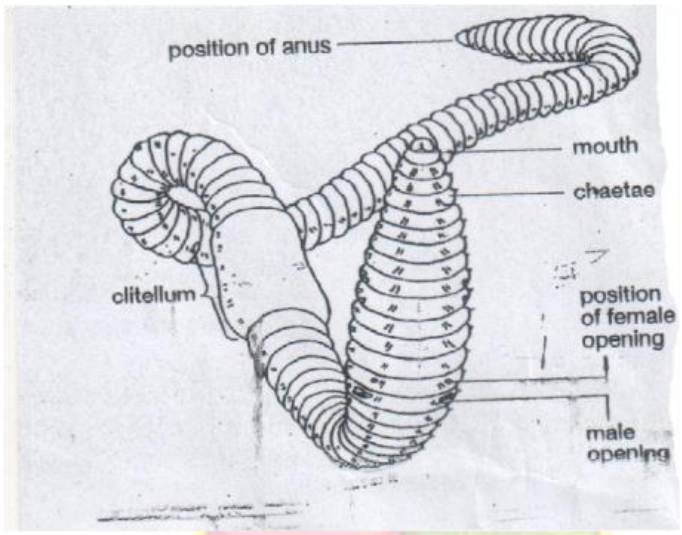
Phylum Annelida

Characteristics

1. Cylindrically elongated body
2. Three body layers

3. Body divided into smaller segments
4. Two openings of the alimentary canal
5. Presence of nervous, excretory, reproductive and also circulatory systems.

Examples: Libryodrilus- Nigrerian earthworms, Hiriudo, lumbricus, Bruissea, Earthworm



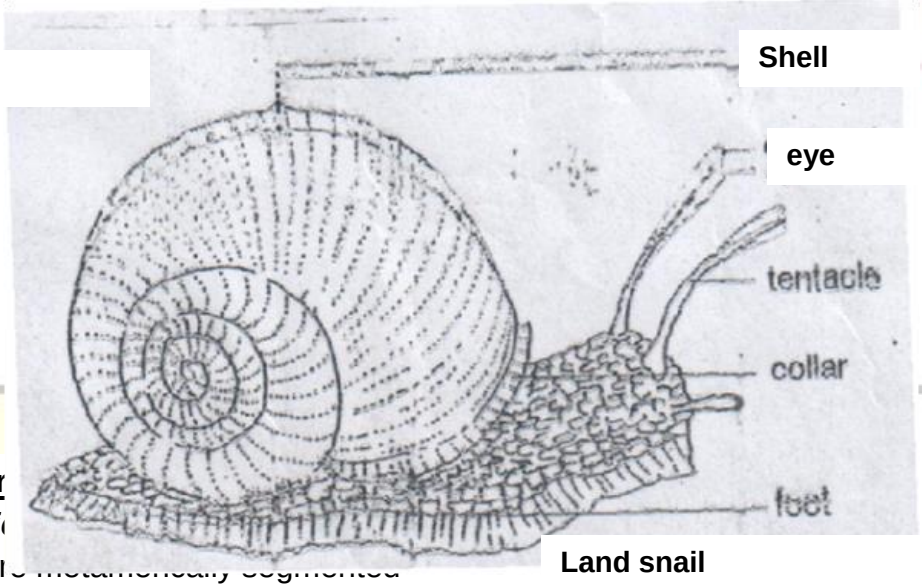
A Earthworm

Phylum Mollusca

Characteristics

1. Soft and unsegmented body
2. Three body layers
3. Body covered with calcareous shell
4. Prominent head and foot
5. Eyes and tentacles present on the head
6. The body is short and composed of a head, a ventral muscular foot and visceral humps

Examples: Snail slugs, Limucularia, Limea



Land snail

Phylum Arthr

Characteristi

1. They ar

2. They are bilaterally symmentrical
3. They are coelomate
4. They have exoskeleton of chitin
5. They have jointed appendages
6. Fertilization is internal

There are four classes in the phylum arthropoda and they are the most widely and successfully distributed

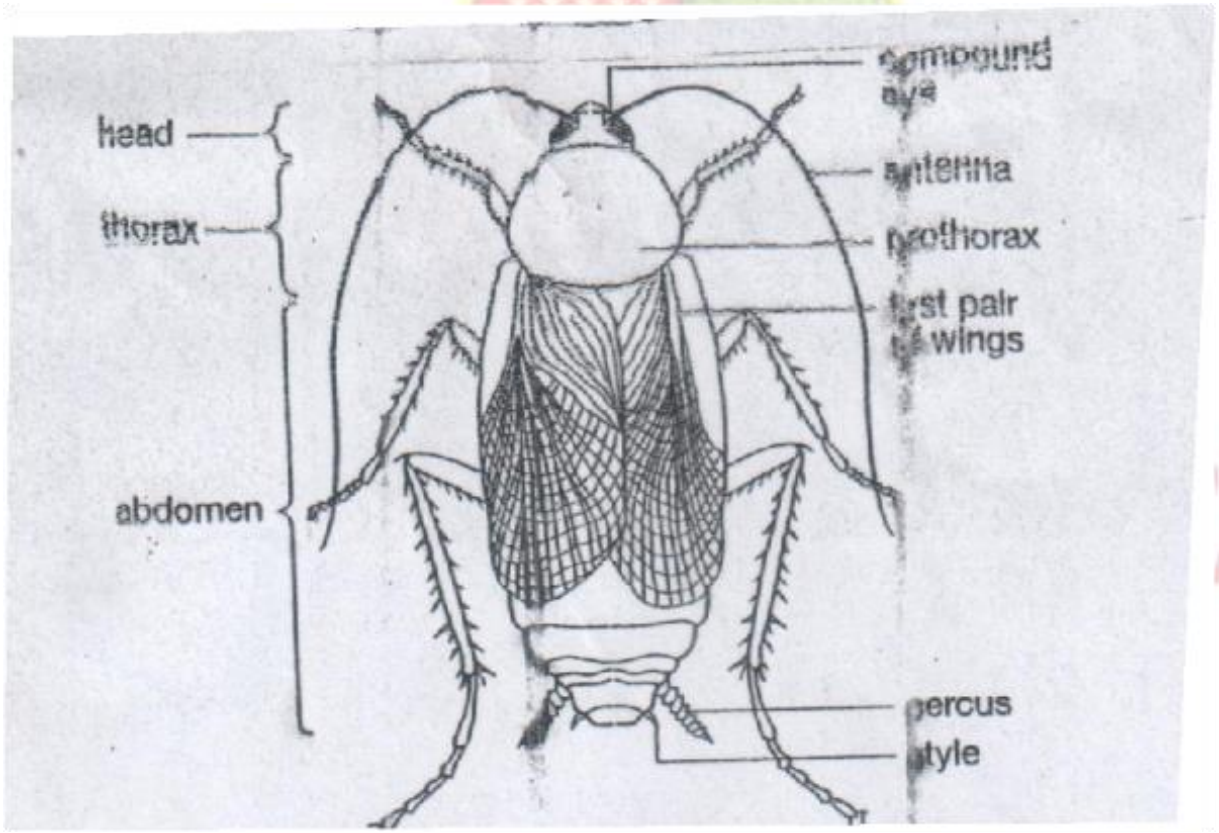
The classes in the phylum are:

a. CLASS INSECTA

Characteristics

1. A pair of jointed antennae
2. A pair of compound eyes
3. 3 body divisions, head, thorax and abdomen
4. 3 thoracic division – prothorax, mesothorax and metathorax
5. A pair of legs per thoracic division
6. Respiration by means of trachea
7. Insects may have wings
8. They undergo metamorphosis

Examples: Cockroach, Housefly, Butterfly, Grasshopper



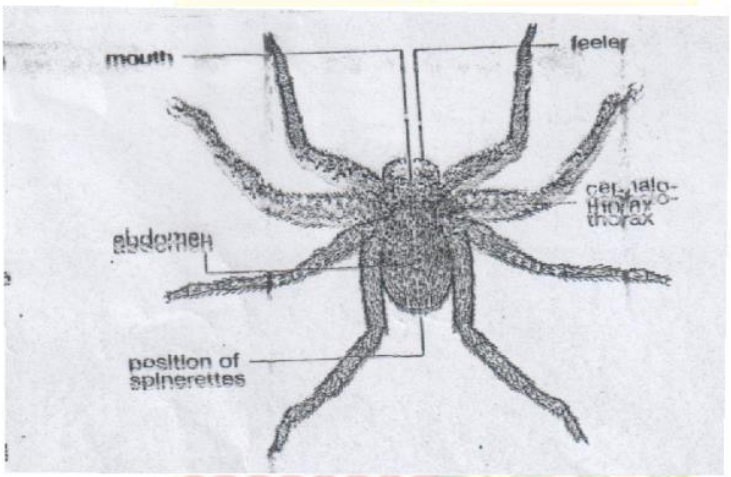
A Cockroach

Class Arachnida

Characteristics

1. 2 body divisions-prostoma and opisthosoma (abdomen)
2. Presence of chelicerae and pedipals
3. Eight simple eyes
4. Eight walking legs
5. Respiration by means of lung book

   Examples: Spider, Scorpions.



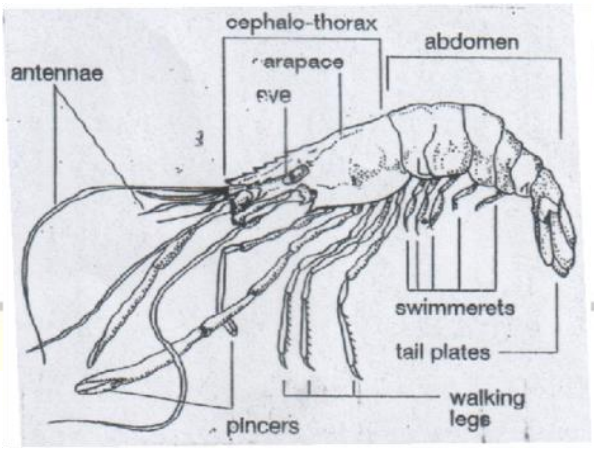
A spider

Class Crustacea

Characteristics

1. 2 body regions cephalothorax and abdomen
2. A pair of antennae for feeling and antennules for smelling
3. 5 pairs of walking legs
4. A pair of stalked compound eyes
5. Respiration by means of gills.

Examples: Prawns, Shrimps, Crab, Water flea, Barnacle



A Prawn

Class Myriopoda

Characteristics

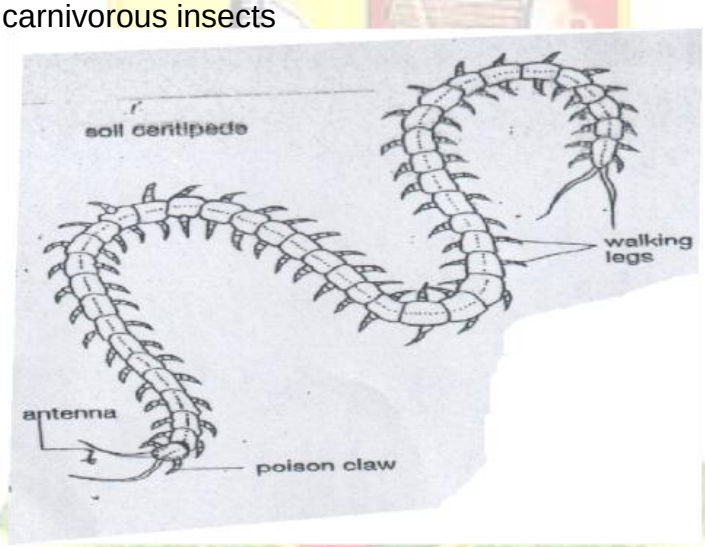
1. They have two body regions – Head with fused trunk and abdomen
2. The abdomen consists of many limb bearing segments
3. A pair of simple eye, jaws and short antennae on the head
4. Breathing by means of trachea

The class has two sub classes i.e

a. Chiplopoda-Centipede

i. A pair of appendages on the segment

ii. They are carnivorous insects

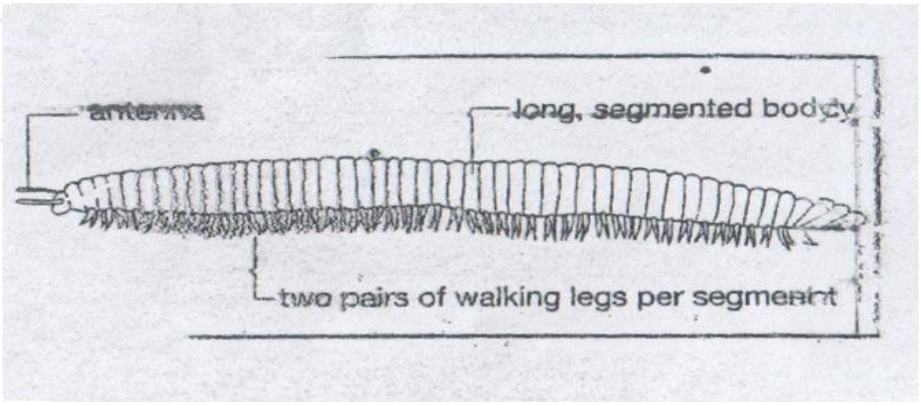


A Centipede

Sub class – ***Diplopoda- Millipede***

i. 2 Pairs of appendages per segment

ii. They are herbivorous



A Millipede

Phylum Echinodermata

Characteristics

1. Aquatic in habitat
2. Radially symmentrical
3. Triploblastic
4. They are coelomate
5. Calcareous exoskeleton
6. Suckers and tube feets for locomotion
7. Separate sexes

Examples – Star fishes,

Star fish

Phylum Chordata

General Characteristics

1. Presence of notochord at early stage of life
2. Presence of visceral clefts in the pharynx
3. Dorsal and tubular nervous system
4. Closed circulatory system
5. Metamerically segmented tail
6. Limbs formed from more than one body segments

SUB PHYLA IN PHYLUM CHORDATA

a. Acraniata – No true skull, brain, heart or kidney

They have the following classes:

i. Hemichordate e.gBalanoglossus
ii. Urochordatae.gCiona
iii. Cephalochordatae.g Amphioxus

b. Sub-phylum craniata or vertebrate

Characteristics

1. Well developed heads and brain
2. Internal skeleton of bones and cartilages
3. Excretion through kidney
4. Ventral heart
5. Few visceral left which are lost at adult

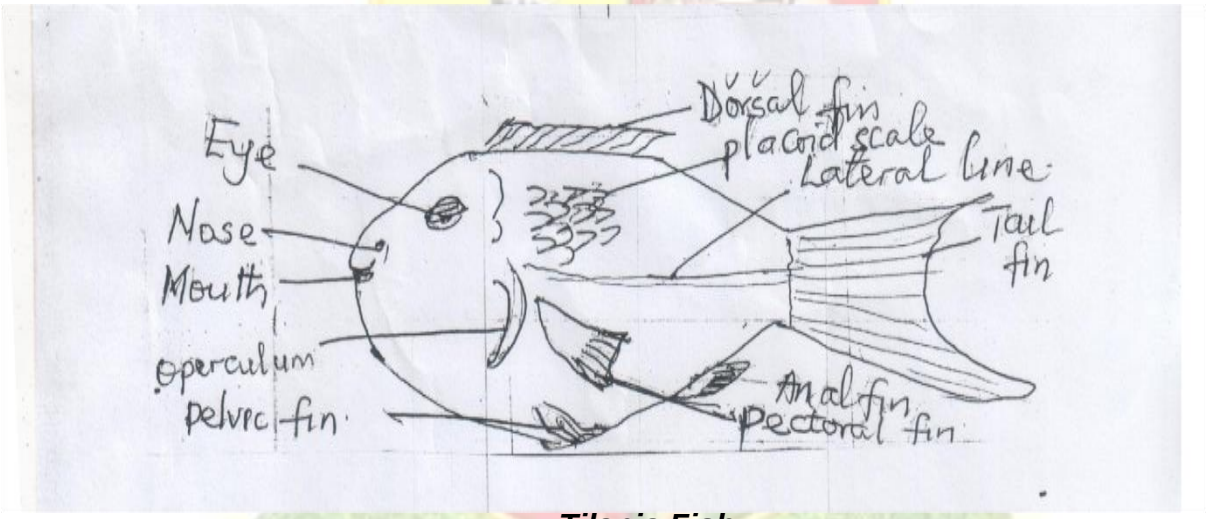
Craniata are divided into 5 classes

a. Class pisces- Fishes

Characteristics

1. Visceral cleft persist as gill in adult
2. Paired limb i.e pectoral and pelvic fins
3. Well developed lateral lines
4. Endo and exoskeleton with cycloid and placoid scales
5. External fertilization

Example: Tilapia, Dog fish etc

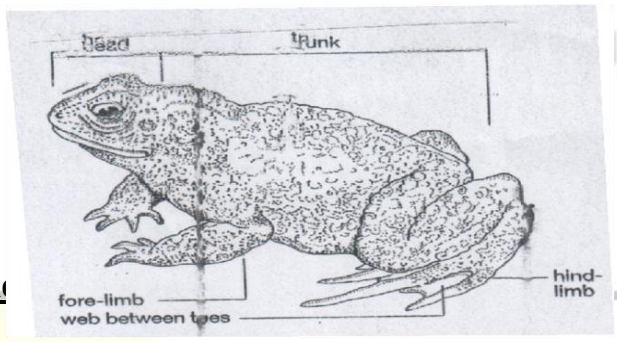


Tilapia Fish

Class Amphibians

1. Presence of pentadactyl limbs
2. Soft skin without scale
3. Gills at tadpole stage but lungs in the adult
4. Presence of external middle ear without external pinna
5. Fertilization is external

Examples – Toad, frogs, strew and salamanda



Toad

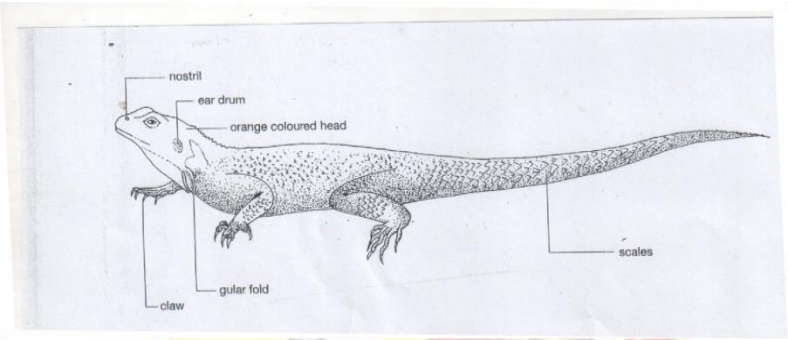
Class Reptalia (R

Characteristics

1. Pentadactyl limb
2. Dry skin with scale

3. Lungs as the respiratory organs
4. Eggs with yolk and no larva stages
5. Fertilization is internal

   Examples – Lizards, Snakes, Crocodile, Tortoise



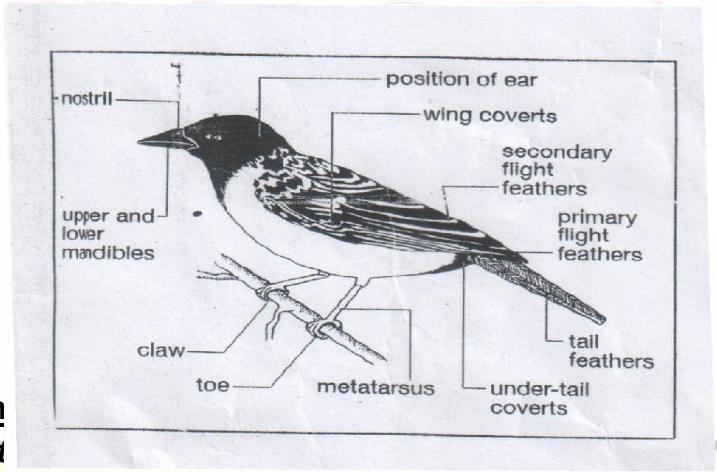
Agama Lizard

The Class Aves (Birds)

Characteristics

1. Pentadactyl limb with the fore limb modified into wings
2. Warm blooded animal
3. Feathers on the skin
4. Presence of beak but teeth is absent
5. Scales on the legs and feets
6. Lungs as respiratory organ
7. Eggs with much yolk
8. No larva stage
9. Fertilization is internal

   Examples – Pigeon, Domestic fowl etc



A Bird

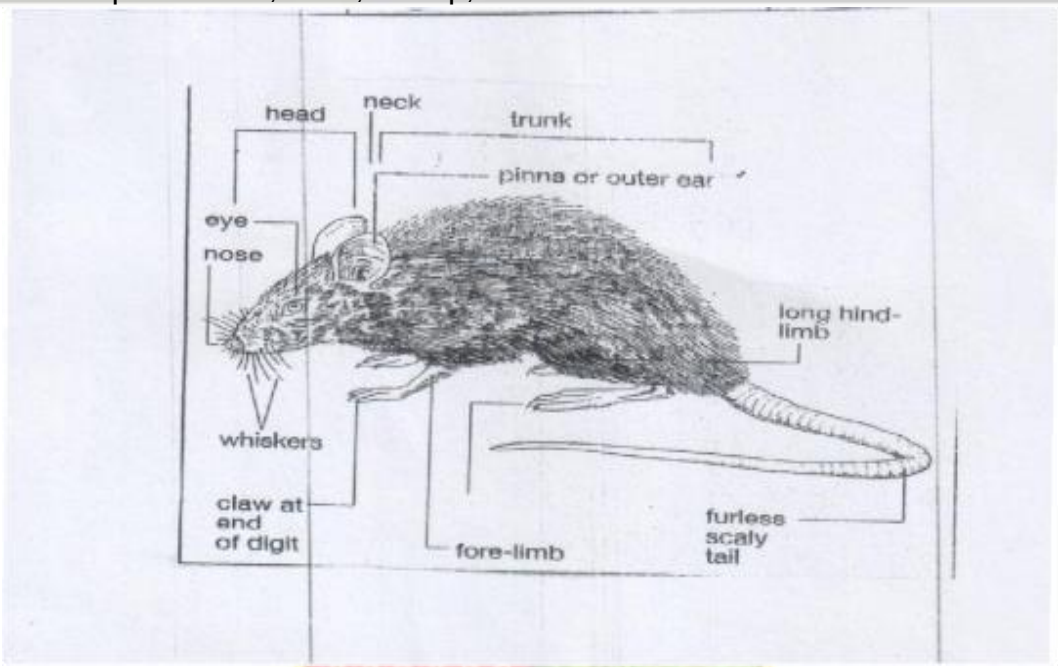
Class Mamn

Characterist

1. Pentadactyl limbs
2. Warm-blooded animal
3. Hair with sweat gland on their skin
4. Presence of mammary gland that produce milk for the young ones

5. Four- chambered hearts
6. Eggs are small and young ones develop inside their mother
7. Fertilization is internal
8. They are viviparous

Examples – Man, Goat, Sheep, Rat etc



A Rat

Topic Assessment Questions

(a) State 5 distinguishing features of mammals
(b) Describe briefly, the
- External features of a named mammal
- Feeding habit of lizard

(c) State 5 distinguishing features of a fish
(d) Write briefly on the adaptive features of Tilapia for movement in water
(e) Draw an annotated diagram of Tilapia fish and label

WEEK 5

THE CELL

The term cell can be defined biologically as the small units of living matter.

Cell dated back to the publication of an English scientist called Robert Hook in 1665 who saw a dead cell without living inner contents in a microscope.

THE CELL THEORY

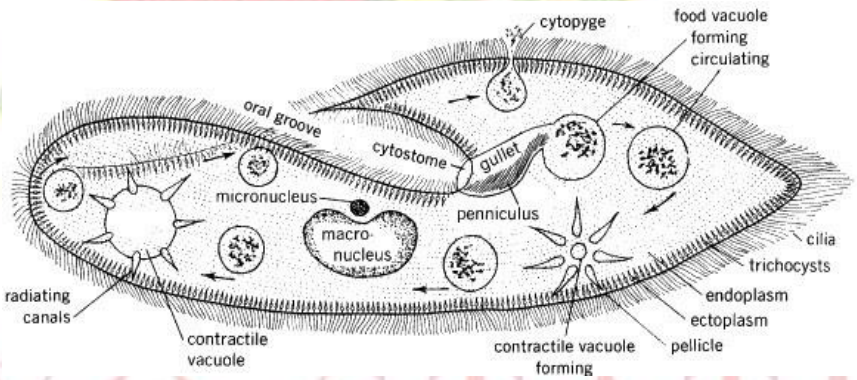
The cell theory comes from scientific work of two German Biologists, Matthias Schleiden and Theodore Schwann in 1838. They put their discoveries together to formulate the theory.

The cell theory states that "all plants and animals are composed of structural and functional units called cells"

FORMS IN WHICH CELLS EXIST

All living cells both in plants and animals exist in 4 different forms

1. Independent, single or free living organism. This is found in organisms such as (a) Amoeba (b) Paramecium (c) Euglena (d) Peurococcus (d) Chlamydomonas etc.



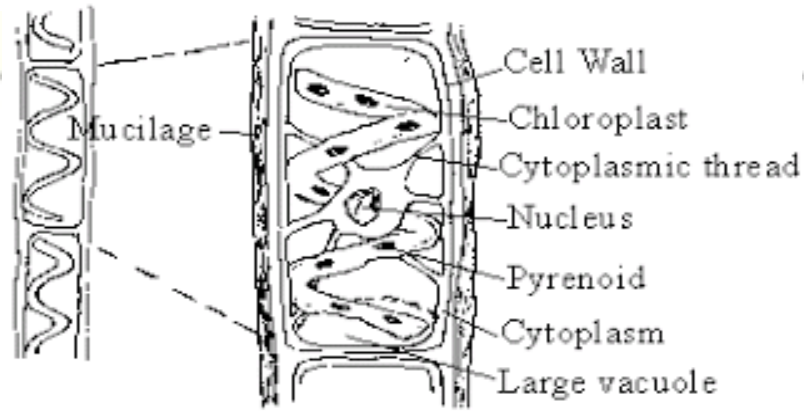
A Paramecium Cell

It carries out all activities of living organism

2. Cell as a colony: The organism is made up of many similar cells that are held together by mucilage. They are loosely held together and may be specialized in their individual functions e.g sponges

A Sponge Colony

3. Cell as a filament : Organisms in this category is made up of similar or identical cells that joined end to end to form an unbranched filament e.g Spirogyra



A Spirogyra Cell

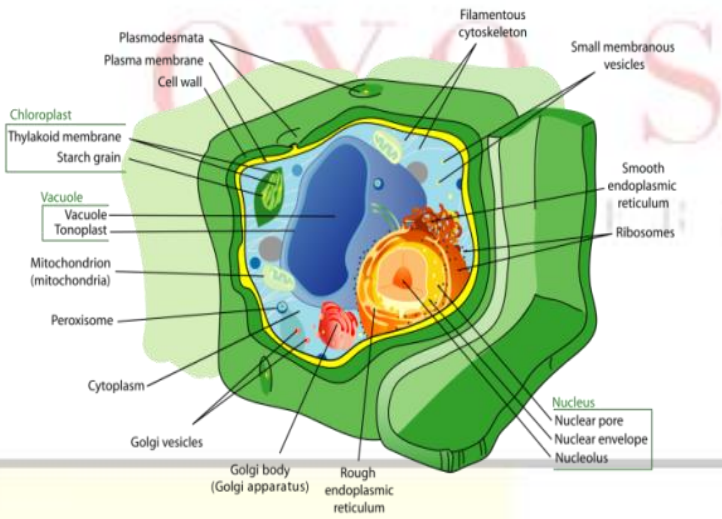
4. Cell as part of living organism: Here all life activities depend on the activities of the cells in the body. The cells specialized for different functions but work together to perform life processes.

CELL STRUCTURE

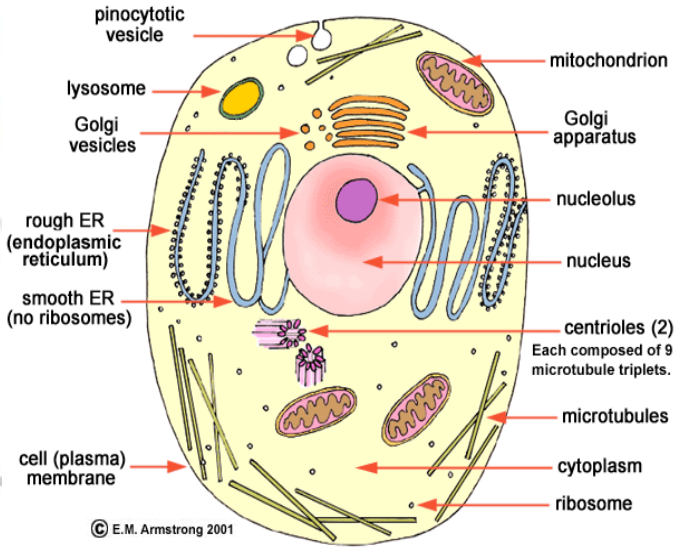
The cell theory states that:

1. The cell is the building and working unit in all living organisms
2. All cell come from pre-existing cells
3. Cells contain information and instructions needed for their development and workings in the hereditary materials from the parent to the offsprings.

The structure of the cell as seen under light or electron microscope is shown below. Although cells vary in size, shape and structure.



A Plant Cell



Animal Cell

FUNCTIONS OF CELL COMPONENTS

1. Cell membrane: Thin and permeable to water, nutrients, waste products and dissolve substances
2. Cell wall: Provide support and shape to the cell
3. Cytoplasm: Medium for all cellular reactions
4. Plastids: (a) Leucoplast – stores starch or oil
   (b)Chromoplast – gives colourto the plants
   (c) Chloroplast – gives green colour and site of photosynthesis
5. Nucleus: It carries hereditary materials and it is the site for all cellular activities
6. Vacuole: It provides supports for the plants and also the site for unused chemical products. Also, it regulates body water content.
7. Protoplasm: All contents of the cell membrane i.e cytoplasm and nucleus
8. Endoplasmic reticulum: Transportation of materials within cytoplasm and across the cell to the nuclear membrane
9. Ribosome: Synthesis of protein
10. Mitochondria: Provides energy needed to form Adenosine triphosphate (ATP)
11. Lysosome: It prevents the cell from digesting itself, it helps to digest and destroy foreign bodies. It secrets digestive enzymes.
12. Golgi complex: Also called Golgi apparatus. It secretes important substances in the body and also transport them within the cell.

SIMILARITIES BETWEEN PLANT AND ANIMAL CELL

1. They both possess the following structures chromosome, cytoplasm, endoplasmic reticulum, Golgi apparatus, Lysosomes, Mitochondria, Nucleus, Ribosome
2. They are both unit of functionalities
3. They both possess hereditary materials

DIFFERENCES BETWEEN PLANT AND ANIMAL CELLS

S/N	PLANT CELL	ANIMAL CELL
1.	Definite shape	No definite shape
2.	Cellulose cell wall permanent	Cellulose cell wall absent
3.	No flexible membrane	Flexible membrane present
4.	Chloroplast present	Chloroplast absent
5.	Stores lipid as oil	Stores lipid as fat
6.	Large central vacuole	Vacuole, if present is small
7.	Nucleus at the edge of the cell	Nucleus at the centre of the cell
8.	Centriole absent	Centriole present
9.	Less dense cytoplasm	Dense and granular cytoplasm
10.	Starch granules present	Glycogen granule present

Topic Assessment Questions

1a. Draw and label plant and animal cell
b. State the cell theory
c. With suitable examples, name and describe the form in which cell exists
2a. List the features common to both spider and insects
b. Why are spider and insects in the same phylum but different classes
c. Draw and label fully, the structure of a spider.

WEEK 6

THE CELL AND ITS ENVIRONMENT

DIFFUSION: Is the process by which molecules of gas or ions move from a region of high concentration to a region of low concentration until they are evenly distributed.

FACTORS CONTROLLING DIFFUSION: The rate of diffusion is controlled by a number of factors which include:

i. State of matter: (Gas moves faster than the liquid& solids
ii. Molecular size (Smaller molecules diffuses faster than big ones)
iii. Difference in concentration (the greater the differences in the concentration of the molecules, the greater the rate of diffusion.
iv. Temperature: High temperature increase the speed at with molecules move (The higher the temperature, the faster the rate of diffusion)

EXPERIMENT TO DEMONSTRATE DIFFUSION IN LIQUIDS

Beaker, water, pipette, potassium permanganate crystals/solution take a beaker and fill it with water. Use pipette to deliver small quantity of potassium permanganate solution (crystals) gently at the bottom of the beaker and leave it to stand for few minutes.

The purple colour of the potassium permanganate solution starts to spread outside until the colour spreads evenly throughout the water medium so that the water have the same shade of purple colour.

EXPERIMENT TO DEMONSTRATE DIFFUSION IN GASES

Material: Bottles of Ammonia solution

Method: Take a bottle of ammonia solution, open the bottle and move some distance away from the bottle and wait for sometime

Observation: The smell of the ammonia gas spread to all corners of the classroom.

Conclusion: The smell perceived everywhere in the classroom shows that diffusion of ammonia gas has taken place.

BIOLOGICAL SIGNIFICANCE OF DIFFUSION IN PLANTS

1. Movement of carbon dioxide through the stomata of the leaves during transpiration and photosynthesis.
2. Movement of oxygen into the leaves through the stomata during respiration
3. Movement of the manufactured food from the leaves to other parts of the plants.

BIOLOGICAL SIGNIFICANCE OF DIFFUSION IN ANIMALS

1. Gaseous exchange in any cells and organisms e.g. amoeba obtains oxygen by diffusion.
2. Exchange of nutrients and oxygen between a foetus and the mother through the placenta.
3. Gaseous exchange in the lungs of mammals
4. Absorption of food from the small intestine through the villi into the blood stream.

OSMOSIS

Is the movement of water or solvent molecules from a region of dilute or a weaker solution to a region of concentrated of stronger solution through a selectively permeable membrane (semi-permeable membrane).

CONDITIONS NECESSARY FOR OSMOSIS TO TAKE PLACE

i. Presence of a stronger solution e.g. salt solution
ii. Presence of a weaker solution e.g. water
iii. Presence of a semi-permeable membrane

LIVING CELLS AS OSMOMETER

A living cell is usually surrounded by a medium which can be described as hypertonic, hypotonic and isotonic.

A. **HYPERTONIC**: When the cell is surrounded by a stronger solution, water will be lost by the cell. The cell shrinks.

B. **HYPOTONIC**: When a cell of a living organism is surrounded by water or solution whose concentration is lower, water passes into the cell by osmosis.

C. **ISOTONIC**: When the solute concentration of the cell and its surrounding medium are the same, the solution is said to be isotonic. No net movement of molecules.

OSMOTIC PRESSURE

Is the pressure which moves water across a membrane into a solution of a higher concentration. Osmotic pressure draws water into the cell. The pressure which a solution can potentially exert is called its Osmotic Potential.

EXPERIMENT ON OSMOSIS

To demonstrate osmosis using a **non-living material**

Materials: Two thistle funnels, beaker, sugar solution, water,cellophane paper

Method: Pour equal quantity of water into the beaker, then cover the bottom of the thistle funnel with cellophane paper (selectively permeable membrane) Then pour sugar solution into thistle funnel A and water into thistle funnel B (control experiment) and mark their levels. Then immerse the two funnels into the beaker containing water. Allow the expt. to stay for 3 – 4 hour.

Observation: At the end of the experiment, the volume of sugar solution will rise in the thistle funnel A, while the level of water in the thistle funnel B remains the same, water level in the beaker will decrease.

Conclusion: The rise of sugar solution in thistle funnel A and a decrease in the water level in the beaker show that osmosis has taken place.

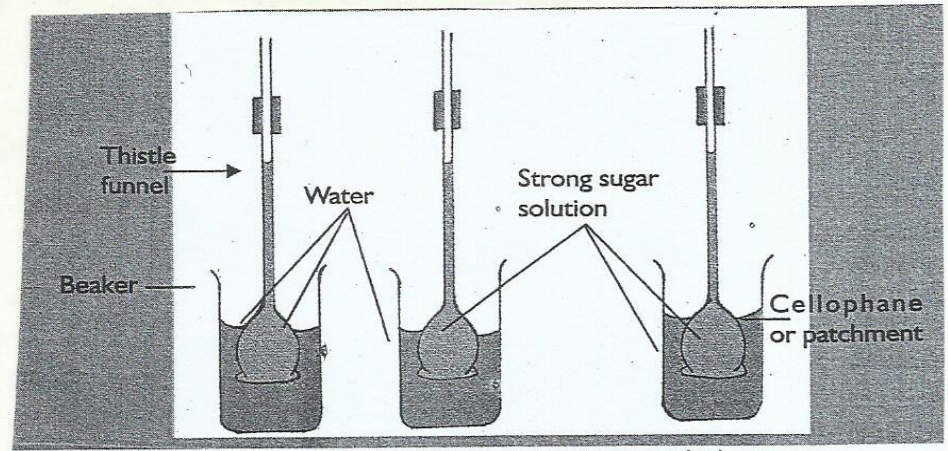


Fig. 15.3 Demonstrating osmosis using celophane or parchment material

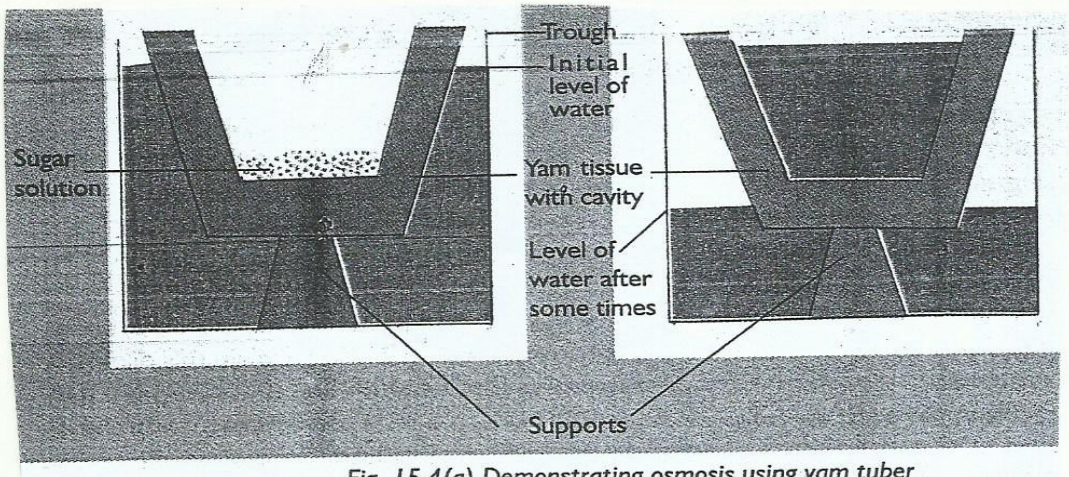


Fig. 15.4(a) Demonstrating osmosis using yam tuber

TO DEMONSTRATE OSMOSIS USING A LIVING TISSUE

Materials: Yam tuber, sugar solution, water, knife, petri-dishes

Method: Unripe pawpaw is pilled and cut into two equal halves, sugar solution is added to A and ordinary water to B. the two are put inside a petris dish for three to four hours. Water levels in both are marked with pins

Observation: Water level in A increases while that of B remains the same.

Conclusion: The rise in the level of sugar solution in A shows that water has passed from the petris dish into the unripe pawpaw, hence, osmosis has taken place in A and not in B.

OSMOTIC PROCESSES IN PLANTS

i. Absorption of water from the soil by the root
ii. Movement of water in and out of quard cells of stomata
iii. Movement of water from one cell to another

OSMOTIC PROCESSES IN ANIMAL

i. Reabsorption of water from glomerular filterate in the kidney
ii. Absorption of water by the colon
iii. Loss of water through sweating

SEMI-PERMEABLE MEMBRANE

The following materials could be used.

i. Plant materials: Yam, cassava, Pawpaw, sweet potato

ii. Animals materials: Pig's bladder

iii. Non-living materials: Cellophane paper

DIFFERENCE BETWEEN

S/N	DIFFUSION	OSMOSIS
1.	Occurs in gaseous and liquid medium	Occur in liquid medium only
2.	Semi-permeable is not required	Semi-permeable is required
3.	Occurs in living and non-living organisms	It occurs naturally in living organisms

PLASMOLYSIS

Plasmolysis is outward movement of water from living cells when they are placed in a hypertonic situation. It involves the withdrawal of water from living cells up to the extent that it will result in the pulling away of cytoplasm from the cell membrane of cell-wall (the cytoplasm shrink) and the whole cell wall collapse).

EXPERIMENT TO DEMONSTRATE PLASMOLYSIS USING SPIROGYRA FILAMENTS

Place a piece of spirogyra filament on a glass slide containing few drops of water, covered with cover slip. Observe the set up under microscope (The cells are noticed to be normal turgid. Add few drops of salt solution on the tissue. Allow it to stay for about 6 minutes. Observe under microscope. It will be observed that the cytoplasm is drawn away from the cell wall showing that exosmosis has occurred or the cells have been plasmolysed.

HAEMOLYSIS

Haemolysis is defined as the process by which red blood cells burst as a result of too much water passing into it when placed in hypotonic solution

TURGIDITY

Turgidity Is defined as the condition in which cells absorbs plenty of water up to a point where the cell is fully stretched. Turgidity is useful to the plants because it makes plants to stand erect, gives support to the stem, leaves, flowers and guard cells.

FLACCIDITY

Is the condition in which plants lose water to their surroundings faster than they can absorb when plant loses more water, it is said to be flaccid. Flaccidity may cause wilting & death.

DIFFERENCES

S/N	PLASMOLYSIS	HAEMOLYSIS
1.	It occurs in plant cell	It occurs in red blood cells
2.	Plant cells shrinks	Red blood bursts
3.	Occurs in hypertonic solution	It occurs in hypotonic solution

PROPERTIES AND FUNCTIONS OF THE CELLS

FEEDING:

Nutrition is the process by which food is taken by living organism in order to supply the nutrients required for the continuous metabolic reactions giving on in the body. Food is the source of nutrients.

USEFULNESS OF FOOD

1. To provide energy needed for various physical and metabolic activities
2. To make essential substances such as hormones and enzymes
3. To make new cells for growth and replacement of worn out tissues
4. To supply various substances required for healthy growth and development.

TYPES OF NUTRITION

There are two major types of nutrition

Autotrophic and Heterotrophic nutrition

AUTOTROPHIC NUTRITION

Autotrophic nutrition is the type of nutrition in which organisms are able to manufacture their own food. These organisms which are able to manufacture their own food are called Autotrophs.

There are two types of autotrophic nutrition

i. Photosynthetic (holophytic) and
ii. Chemosynthetic nutrition

Photosynthesis is the process by which green plants manufacture their food (organic compounds) making use of carbon dioxide and water in the presence of sunlight and chlorophyll

$6CO_2$	+	$6H_2O$	Sunlight	$C_6H_{12}O_6$+	$6O_2$
(Carbon dioxide)		(Water)	Chlorophyll	(Glucose)	(Oxygen)

HETEROTROPHIC NUTRITION

Is the type of nutrition in which organisms cannot manufacture their own food. These organisms are called heterotrophse.g Fungi, Animals.

Forms of heterotrophic nutrition are holozoic, parasitic, saprophytic and symbiotic nutrition.

WEEK 7

TYPES OF NUTRIENTS & ELEMENTS

Plant's nutrients are grouped into two classes.

1. Macro or major nutrients 2. Micro or minor nutrients.

Macro nutrients or major elements: Macro nutrients are mineral elements required by plants in large quantities for healthy growth and development e.g Nitrogen, Phosphorus, Potassium, Magnesium, Calcium, Oxygen, Hydrogen, Carbon, Sulphur and Iron.

Micro nutrients or trace elements: They are mineral elements required by plants in small quantities for healthy growth and development e.g Zinc, Copper, Boron, Molybdenum, Cobalt, Chlorine and Manganese.

METABOLISM

Metabolism in living organisms is grouped into two parts. These are (1) anabolism and Catabolism.

Anabolism: Is building up of complex organic molecules from simple ones in a biological system. In anabolism process energy is usually consumed. E.g formation of glycogen from glucose, formation of starch from glucose, proteins from amino-acids, fats& oil from falty acid & glycerol and photosynthetic process in plants.

Catabolism: Is a process of breaking down complex organic molecules into simple substances. Energy is usually released e.g respiration, fermentation, digestion.

FEEDING IN AMOEBA

Amoeba exhibits holozoic mode of nutrition. It feeds by a process called Engulfing.

FEEDING IN SPIROGYRA

Spirogyra exhibits holophytic mode of nutrition. It is capable of manufacturing its own food through the process of photosynthesis.

EXCRETION

Excretion is defined as the process by which organisms get rid of waste products during its metabolism. Different organisms use different means of removing waste products from their body system.

FORMS IN WHICH WASTE PRODUCTS ARE EXCRETED

1. Liquid form e.g water, uric acid, sweat, urine, urea, nitrogenous wastes, dissolved minerals salts, latex, gums.
2. Gaseous form e.g CO_2, Oxygen, Ammonia gas

3. Solid form: e.g uric acid, Tannin, alkaloids', mucilages in plants

EXCRETORY ORGANS OR ORGANELLES OF SOME ORGANISMS

S/N	PROTOZOA	EXCRETORY ORGAN
1.	Protozoa e.g Amoeba	Body surface/contractile vacuole
2.	Flat worms (tape worms)	Flame cells
3.	Round worms (earthworm)	Nephridia
4.	Insects	Malpighian tubules
5.	Mammals (vertebrates)	Lungs, skin, liver, kidney
6.	Flowering plant	Stomata, lenticles

WEEK 8:

ENZYMES

Enzymes are organic catalysts (usually proteinous in nature), which speed up chemical changes in living cells but are not themselves used up in the process. Enzymes accelerate metabolic activities.

MINERAL SALTS

Plants require mineral salts or elements for their growth. They obtain these salts from the soil in form of solution. The soil is the main source of mineral salts while gaseous elements such as oxygen, hydrogen and carbon are derived from atmosphere.

CELLULAR RESPIRATION

It involves the chemical activities of the cells in which glucose is broken down by a series of reactions controlled by enzymes to release energy. The released energy is stored in adenosine triphosphate (ATP). ATP is the form in which energy is carried, stored and used by all living cells. The purpose of cellular respiration is to generate energy.

TYPES OF CELLULAR RESPIRATION

There are two types

Aerobic and Anaerobic respiration

AEROBIC RESPIRATION

Aerobic respiration requires oxygen to break down glucose into water, carbon dioxide and energy (ATP)

Equation: $C_6H_{12}O_6 + 6O_2 \longrightarrow C02 + 6H_20 +$ Energy

Glucose oxygen Carbon dioxide Water

The breaking down of glucose in the body passes through several pathways before it can produce energy. The pathways are called Glycolysis and Kreb's cycle.

Glycolysis: Is a series of chemical reactions which involves the breaking down of glucose to a 3 carbon molecule called pyruvic acid. During glycolysis, no oxygen is required and it takes place in the cytoplasm of the cells. Little energy is produced during glycolysis.

Kreb's Cycle: Is also known as Citric Acid Cycle or Tricarboxylic Acid Cycle (TAC). It involves a series of cyclic reactions which begin with pyruvic acid formed from glycosis which combined with Acetyl co-enzyme A to form citric acid. Kreb's cycle takes place in the presence of oxygen and in the mitochondria (power house) of all cells. At various stages of the cycle, carbon dioxide and hydrogen are produced. The hydrogen released combines with oxygen to produce water. A total of 36(ATP) are produced during glycosis. The entire breakdown of glucose molecule from glycolysis to Kreb's cycle provides a total net formation of 38 ATPs

DIFFERENCES BETWEEN GLYCOLYSIS AND KREB'S CYCLE

S/N	GLYCOLYSIS	KREB'S CYCLE
1.	Oxygen not involved	Oxygen is involved
2.	Takes place in the cytoplasm	Takes place in the mitochondria
3.	2 ATPs are produced	36 APTs are produced

ANAEROBIC RESPIRATION

This type of respiration does not require the presence of oxygen to break down food. substances (glucose) to produce energy.

$C_6H_{12}O_6 \longrightarrow 2CO_2 + 2C_2H_5OH +$ Energy

Glucose (Carbon dioxide) Alcohol ATP

$C_6H_{12}O_6 \longrightarrow 2C_3H_60_3 +$ Energy

Glucose Lactic acid

FERMENTATION: Is the process by which glucose is broken down to alcohol in the absence of oxygen e.g yeast, bacteria exhibits anaerobic respiration.

DIFFERENCES BETWEEN AEROBIC AND ANAEROBIC

S/N	AEROBIC RESPIRATION	ANAEROBIC RESPIRATION
1.	Oxygen is required	Oxygen is not required
2.	By-products are water and carbon dioxide	By-products are alcohol andlactic acid
3.	More energy is released	Less energy is released
4.	Takes place in mitochondria	Takes place in cytoplasm

WEEK 9

GROWTH

This is an irreservable increase in size and complexity of an organism brought about by the synthesis of new protoplasm.

Growth in plants is indefinite and apical while growth in animals is definite and uniform in all parts of the body.

BASIS OF GROWTH

i. Cell division ii cell enlargement iii Cell differentiation.

TYPES OF CELL DIVISION

MITOSIS: Is the division of a somatic cell (body cell) into two daughter cells, whereby each daughter cell has exactly the same chromosome content as the parent. Mitosis takes place during organisms growth, development and asexual reproduction. In plants, mitosis occurs in the terminal bud of the shoot at the tip of the roots and shoots. In annual growth, mitosis produces diploid cells.

IMPORTANCE OF MITOSIS

1. Growth and development is brought about by mitosis
2. Repair of cells are possible by mitosis
3. Mitosis ensuresthat exact copy of DNA orgenes are transmitted to the daughter cell
4. Mitosis is the basis for asexual reproduction e.g. binary fission.

STAGES OF MITOSIS

There are five phases of mitosis

INTERPHASE: Is the resting stage of the cell: The cell appears normal

PROPHASE: Each chromosome shortens and thickens, and is seen to consist of this chromate, the centrioles began to separate.

METAPHASE: The nuclear membrane disappears, spindle forms, the chromosomemove up across the middle of the cell and become attached to the spindle fibres at their centromeres.

ANAPHASE: The sister chromatids are pulled apart to opposite ends (poles) of the cell as the spindle fibres contract.

TELOPHASE: A nuclear membrane forms around each set of chromatids, and the cell-divides into two daughter cells.

REGIONS OF FASTEST GROWTH

The region of fastest growth in plants are the root and stem apices. The root and stem apices of a plant can be divided in the region of cell division, followed by the region of cell elongation and the region of cell maturation.

FACTORS AFFECTING GROWTH

These factors are grouped into two:

1. External factors e.g. availability of nutrients, humidity, light, temperature, Phe.t.c.
2. Internal factor e.g. hormones.

Hormones are chemical substances secreted by ductless glands and conveyed in the blood to the area where they carry out their functions. Plant hormones which affect the growth of plants are auxins, Gibberellins. Auxins promotes or inhibit cell elongation in stems and roots. Gibberellins promotes cell elongation and brings about growth in stem. In animals, the hormones mainly concerned with growth are secreted by the pituitary gland, thyroid gland and the gonads.

CELL REACTION TO ITS ENVIRONMENT

All living things are capable of responding to internal and external stimuli. Plants and animals are able to detect and respond to changes in their environment.

TYPES OF RESPONSES

There are different types of responses or movement.

1. Taxis or Tactic movement: This is a directional type of response in which the whole organism moves form one place to another in response to external stimuli e.g. light, temperature, watere.t.c.
2. Nastism or Nastic movement: This is a type or response in which a part of a plant moves in response to non-directional stimuli such as changes in light intensity, temperature and humidity e.g. folding of leaflets of the mimosa plant when it is touched.

3. Tropism or the Tropic movement: Tropism is a type of response in which a part of a plant moves in response to a directional stimulus. The direction of the response is related to that of the stimulus. It may be positive if the plant part grows towards the stimulus and negative if the plant grows away from the stimulus.

Examples of tropism or tropic movements are:

1. Phototropism (Light)
2. Geotropism (Gravity)
3. Hydrotropism (Response to water)
4. Thigmotropism (Touch)
5. Chemotropism (Chemical)
6. Thermotropism (Heat)

The instrument for measuring tropism in plants is called *Klinostat*.

MOVEMENT

Movement is the ability of living organisms to move from one place to another. All organisms that can move are equipped with various organelles or organs and mechanism for movement.

1. Cyclosis: Is the circulation of protoplasm in cells. In animals, cyclosis occurs in protozoa like amoeba popularly known as amoeboid movement.
2. Organelles for movement: Organelles which cause movements affecting the whole cells and leading to cellular locomotion in paramecium, chlamydomonas and Euglena are Cilia and Flagella
3. ***Nb***: Growth movement is regulated by auxins

WEEK10:

REPRODUCTION

Reproduction is the ability of living organisms to give rise to new individuals of the same species. The purpose of reproduction is to ensure the continuity of life.

TYPES OF REPRODUCTION

There are two main types of reproduction. These are asexual and sexual reproduction.

Asexual reproduction: Asexual reproduction is the type of reproduction in which new organisms are produced from a simple parent without the production of gametes.

The offspring called the clones are the same in all respects to each other and in the parent organisms that produced them.

TYPES OF ASEXUAL REPRODUCTION

There are four major forms (1) Binary Fission (b) Budding (3) Spore formation (4) Vegetative reproduction

CONJUGATION IN SPIROGYRA

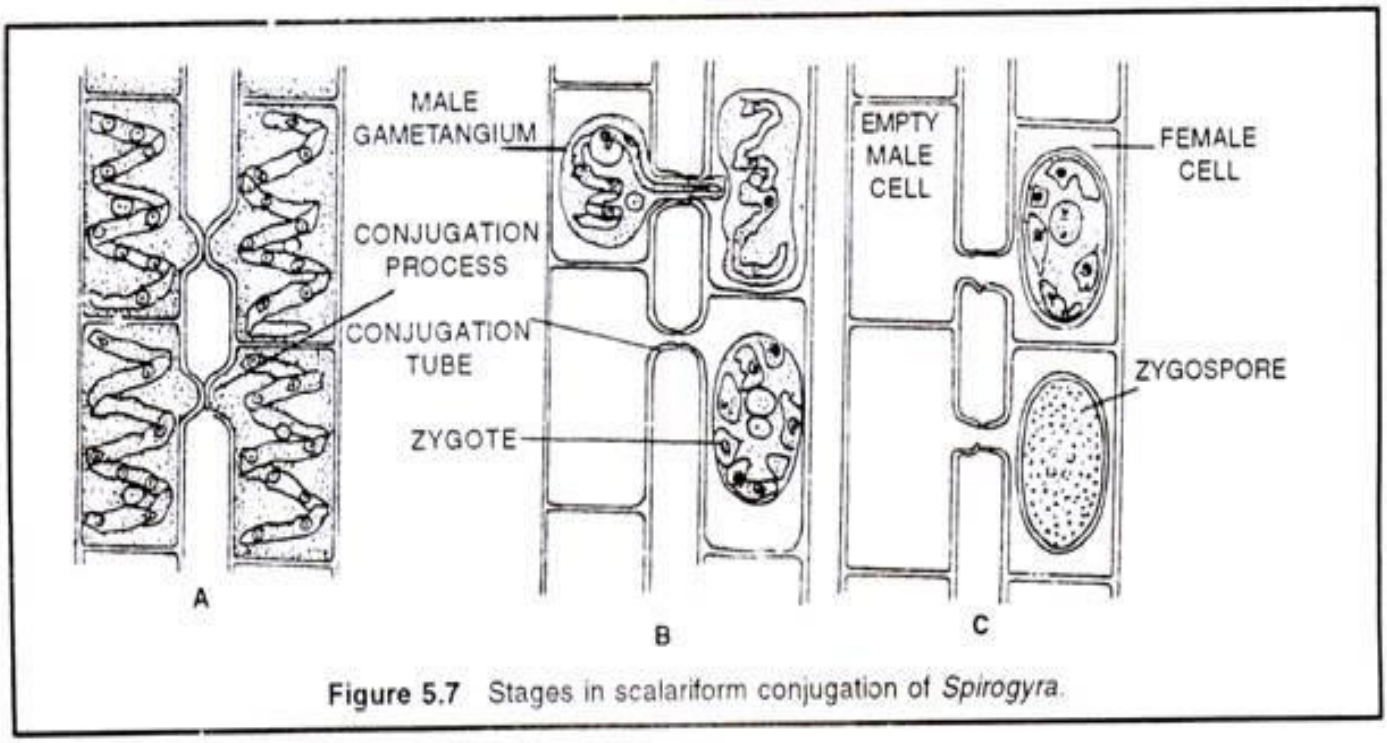


Figure 5.7 Stages in scalariform conjugation of *Spirogyra*.

PRACTICALS

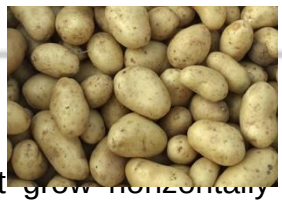
MODIFIED STEMS (PRACTICAL)

A stem is a vegetative part of a plant that bears- leaves. Leaves are borne on sides of the stem called nodes. The internodes of a stem represents the region between two successive nodes. A stem also has auxillary and terminal buds. The stem bears the leaves and flowers. It also transports water and mineral salts from the root to the other parts of the plant.

In some plants, stem may be modified to carry out other functions such as food storage and vegetative reproduction.

TYPES OF MODIFIED STEM

1. **Yam Tuber**: Not all stems grow above the ground. Example of an underground stem is Yam, Irish potato. Such stem is called tuber.



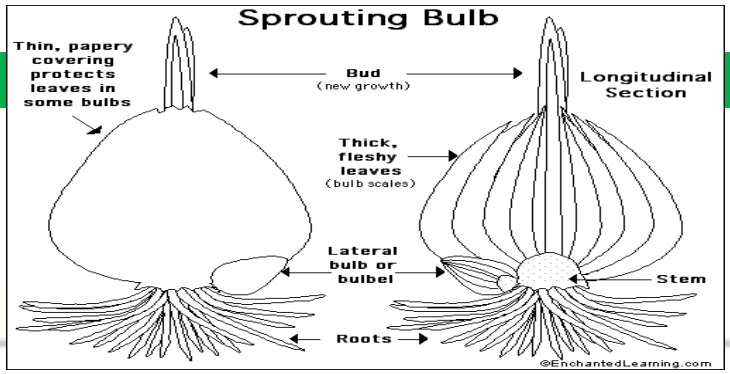
2. **Rhizome**: These are stems that grow horizontally underground, upright stem arise from nodes of rhizome. Examples of rhizome are ginger canalily, water hyacinth etc.

Rhizome

3. **Corms**: These are short, thick, fleshy, underground stems. They grow vertically underground and are swollen with food reserves. They bear nodes and internodes, scales, leaves, terminal and auxiliary lateral buds, adventitious root e.g Cocoyam

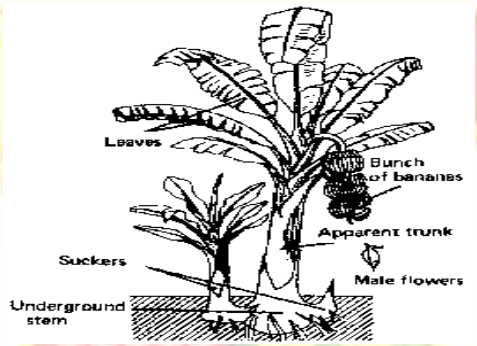
Corms

4. **Bulbs**: They are similar to corms. Unlike corms, bulbs are composed to a short stem surrounded by numerous fleshy leaves. The stem also bears brown membranous scale leaves which cover and protect the inner fleshy leaves. Auxiliary and terminal buds are present. Examples are onion, Garlic, Daffoidils. etc



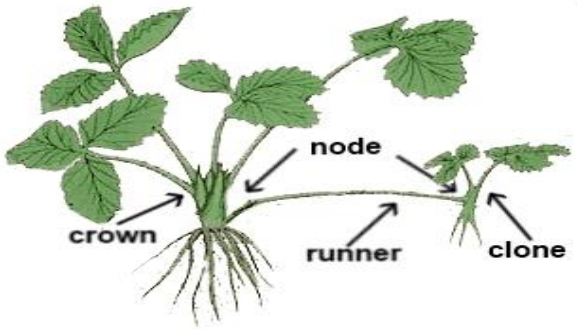
Bulbs

5. **Sucker Stem:** This is a short lateral branch, underground stem, with terminal bud which gives rise to aerial shoots. Sucker is found in banana, plantain, pineapple.



Sucker stem

6. **Runners:** This is a prostrate, cylindrical and slender stem which grows horizontally on the surface of the ground. It has nodes and internodes and adventitious roots. The buds give rise to aerial shoots. Examples are sweet potato, Anonpous, Oxalis etc.



Runners

2ND TERM SS ONE

(WEEK 1)

Topic: **TISSUES AND SUPPORTING SYSTEM**

Definition: Skeleton is the rigid supporting system (the frame work) of the body of a living organism which gives support and shape to the body

FORMS OF SKELETON

(i) Bones (ii) chitin (iii) fluid (iv) carapace e.g. shell (v) cartilages

TYPES OF SKELETONS

(a) Hydrostatic skeleton – Made of fluid e.g. earthworm

(b) Exoskeleton e.g. chitin found in cockroach

(c) Endoskeleton e.g. Bones found in Man

VERTEBRATE SKELETONS

This is of two parts

(A) AXIAL Skeleton: made up of: (i) Skull which houses the Brain (ii) The vertebra column: the small bones of the spinal part of the body. They are called “The Vertebrae”

1. Cervical vertebrae are made up of two bones (a) Atlas (b) Axis. They work together to bring about the “rotation of the head.
2. Thoracic vertebrae
3. Lumbar vertebrae
4. Sacral vertebrae
5. Caudal vertebrae 23

6.

B. **APPENDICULAR SKELETON** - Made up of two parts: (1) fore and Hind limbs.

ii The limbs girdles: (a) the pectoral girdle and pelvic girdles

(WEEK 2)

VERTEBRAE TYPES, LOCATION AND NUMBERS IN MAN AND RABBIT

TYPES	LOCATION	NO MAN	RABBIT
Cervical vertebrate	Neck	7	7
Thoracic vertebrae	Chest	12	13
Lumbar vertebra	Upper abdomen	5	3-4
Sacral vertebrae	Tail	4	16

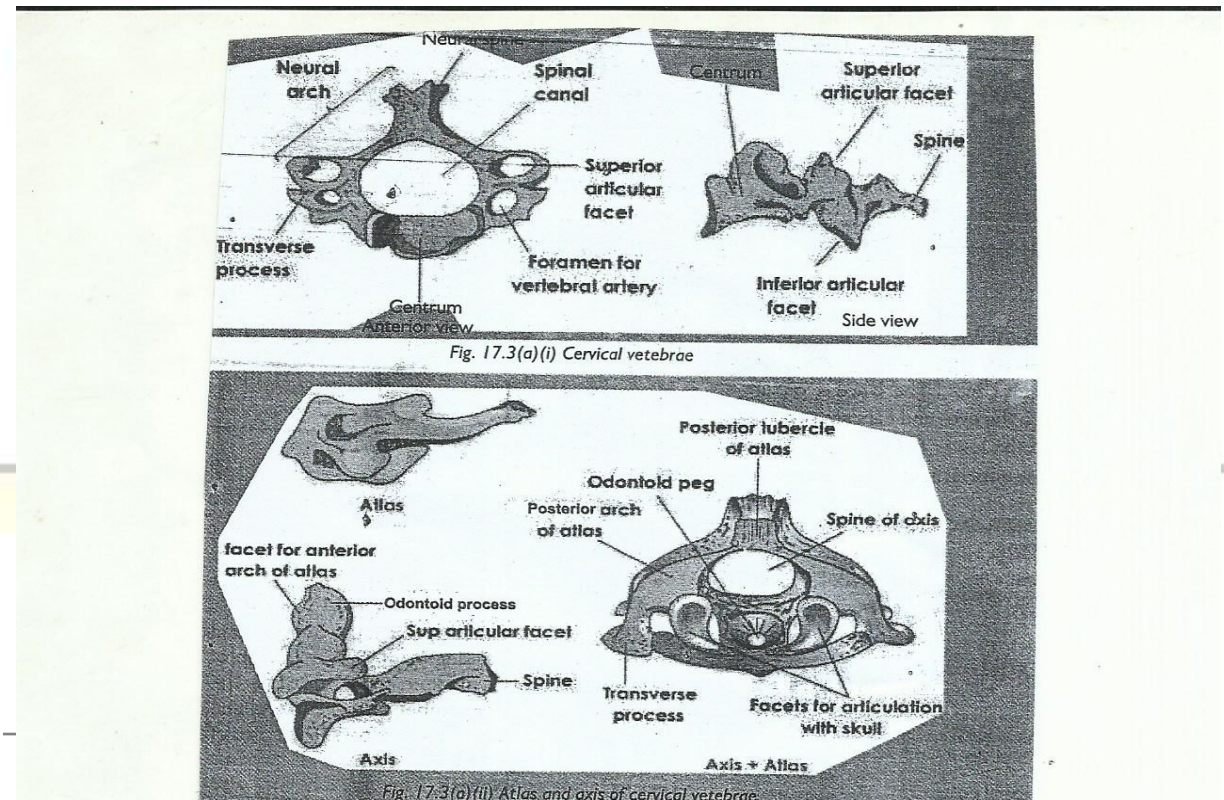


Fig. 17.3(a)(i) Cervical vetebrae

Fig. 17.3(a)(ii) Atlas and axis of cervical vetebrae

1. Protection e.g. organ such as Brain, Lungs, Heart e.t.c
2. Movement: Making movement possible
3. Support: Mechanical support for the organs
4. Attachment: Muscles are attached to the bones
5. Shape: It gives shape and form to the body
6. Production of red blood cell in bone marrows
7. Breathing: Aids breathing in higher organisms
8. Mineral storage such as calcium and phosphorous are stored in the bones

SUPPORTING TISSUES IN PLANTS

These are the plant tissues that provide the mechanical support for the plant which make them to remain upright

These supporting tissues are:

(a) Strengthening (b) Hardness (c) Rigidity
(d) Resilience (e) Flexibility (f) Elasticity

JOINT IN ANIMALS

These are points where bones meet

Types of joints:

(A) Movable Joints: movement is allowed in different ways. Four types are identified:
a. Gliding joints (wrist and ankles)
b. Hinge joints (elbow and knee joint)
c. Ball and socket joints (Femur and pelvic, Humerus and Scapular)
d. Pivot joint (Atlas and axis of the neck)
(B) Immovable Joint: No Movement is allowed e.g. suture joint of the skull
(C) Cartilagenous Joints: slight movement is allowed e.g. the vertebrae

WEEK 3

FOOD SUBSTANCES

(A) TYPES OF FOOD

i. Carbohydrates ii. Proteins iii. Fats and Oils iv. Mineral Salts v. Water

(B) Balanced diet: This is a meal that contains all the classes of food in a correct proportion and adequate amount for normal growth, development and maintenance of good health. It must contain the following:

(a) Carbohydrate, proteins, fats and oils

(b) Vitamins (c) Mineral salts (d) Water (e) Roughages

HETEROTROPHIC NUTRITION

This is the mode of nutrition in which the organism is unable to manufacture its food by itself but depend on the food produced autotrophically directly or indirectly for their daily supply of energy.

TYPES OF HETEROTROPHIC NUTRITION

(a) Holozoic nutrition: A situation whereby an organism ingest solid food materials e.g. man

(b) Saprophytic feeding: Method of feeding by which an organism rely on dead and decaying organic matter e.gRhizopus.

(c) Parasitic feeding: A method of feeding in which an organism called parasite depends on another organism called the host for food, shelter and other organic benefits e.g. Roundworm in the intestine of man, Ticks on the body of cow.

FEEDING MECHANISM IN HOLOZOIC FEEDING

(a) **FILTER FEEDING:** The filter feeders are mainly aquatic animals that feed on very tiny microscopic organisms e.g. planktons. They have sieve – like mouth part with which they sieve food e.g. water ducks

(b) **FLUID FEEDERS:** These are the animals that feed on the fluid materials e.g. Housefly, Mosquito, butterfly e.t.c Fluid feeders can be

divided into (i) ***Suckers*** e.g. Mosquito (ii) ***Wallowers*** e.g. these are the organism that wallow their food by absorbing them through their body surface e.g tapeworm, Hook worm e.yc.

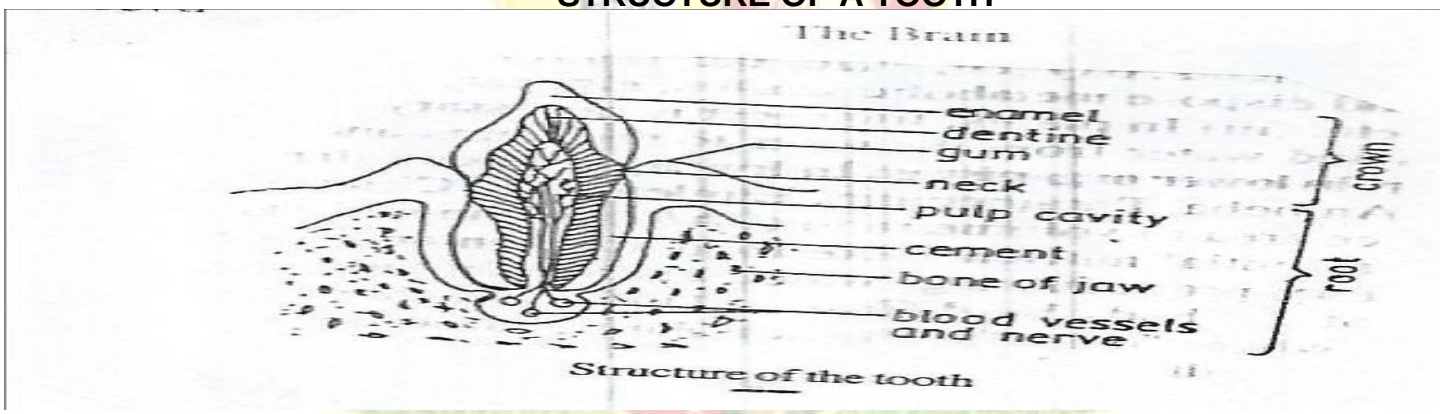
(c) **DEPOSIT FEEDERS:** these are the animals living in the estuary often in the tidal or a mangal. They included mud snail, mud crab which feed on plant and animal debris buried in the mud.

WEEK 4

Mammalian teeth: There are different types of teeth in mammals. These are:

(a) Incisors (b) Canines (c) Premolars (d) Molars

STRUCTURE OF A TOOTH



A typical teeth is made of the three regions namely:

(i) The crown

(ii) The neck: The narrow junction between the crown and the root.

(iii) The root: The part embedded in the socket of the jaw bone

DENTITION

Dentition can be defined as the structure, number and arrangement of teeth in the mouth of a mammal.

Dental formula: This is the formula representing the number, structure and the arrangement of teeth in the half of the mouth both at the end upper and the lower jaws of the mouth. The total number of teeth is found by the addition of the numbers of teeth in both halves of the mouth.

Dental formula of a Man:

i= $^{2}/_{2}$ $C^{1}/_{1}$ PM $^{2}/_{2}$ $M^{3}/_{3}$

Where i = incisors, C = canine, PM = Premolar and M = Molar

Dog = i = $^{3}/_{3}$ C = $^{1}/_{1}$ PM = $^{4}/_{4}$ M= $^{2}/_{3}$

Rabbit = i = $^{2}/_{1}$ C= $^{0}/_{0}$ PM = $^{3}/_{2}$ M = $^{3}/_{3}$

ENZYMES

Enzymes are the organic catalyst produced in living cell, which speed up the rate of chemical reaction in the body of living organisms.

CHARACTERISTICS OF ENZYMES

1. Enzymes are specific in action
2. Only small quantity of enzyme is required for action
3. Enzymes do not loose the chemical composition after reaction
4. Enzymes has specific temperature for their action i.e 370c
5. Enzymes are protein in nature
6. Enzymes are sensitive to PH
7. Action of enzyme is irreversible
8. Enzymes are produced by the gland of the system requiring them
9. They are required in small quantity

CLASSIFICATION OF ENZYMES

(a) Proteases - digest protein
(b) Amylases - digest starches and sugar
(c) Lipases - digest fats and oils
(d) Celluloses - act on cellulose

IMPORTANCE OF ENZYMES

(1) Enzymes speed up and control biochemical reactions
(2) They play large roles in energy production
(3) Enzymes are useful in industries e.g for baking
(4) Enzymes are important in the manufacture of certain drugs

(WEEK 5)

BASIC ECOLOGICAL CONCEPTS

Ecology: The study of the relationship between organisms and their external environment. It involves the measurement of factors affecting the environment and the distribution of the organisms in that particular environment.

TERMS IN ECOLOGY

(1) ***Environment:*** This is the surroundings of an organism.

(2) ***Biosphere:*** the part of the earth that supports life (i.e soil, air, and water)

(3) ***Habitat:*** A particular place where living organism lives

(4) ***Niche:*** the role an organism plays particularly in the course of interacting with one another

(5) ***Population:*** Total number of a particular organism of a specific specie living together in a given habitat

(6) ***Biotic Community (Biome):*** A group of organisms living together and interacting together in a given area.

(7) ***Ecosystem:*** interaction between living components in a given community in which energy is used and recirculated. It is a natural unit.

(8) ***Lithosphere:*** The earth crust

(9) ***Hydrosphere:*** the water bodies e.g. ocean, lake, seas, rivers, stream e.t.c

(10) ***Atmosphere:*** the envelope of gases surrounding the earth.

COMPONENT OF ECOSYSTEM

(A) **ABIOTIC FACTORS:** These are the basic factors that actually support lives in an ecosystem. They are:

i. The organic factor: The real food materials e.g. carbohydrate, protein, e.t.c

ii. Inorganic factors i.e. oxygen needed for respiratory

iii. The climatic factors e.g. rainfall, light, Temperature e.t.c

iv. The adaphic factor i.e. soil, soil profile, texture, topography e.t.c

(B) BIOTIC FACTORS: These are the living factor in a given ecosystem. They consists the following:

1. Producers - green plants
2. Consumers - These comprise of three types namely:

(a) Primary consumer feeds on the plant directly

(b) Secondary consumer feeds on primary consumer

(c) Tertiary consumer feed on the secondary consumer

3. Decomposers: They breakdown the body of dead plants and animals and return their useful part to the soil

(C) **Aquatic ecosystem:** includes interaction taking place in water bodies eg oceans, sea, rivers etc.

(D) Terrestrial ecosystem: takes place on land

(WEEK6)

BASIC ECOLOGICAL CONCEPTS (II)

Sampling methods: This is used to measure the number and to know the types of species of trees in a large field or vegetation.

Types: (i) Selected sampling

(ii) Random sampling

(iii) Restricted sampling

(iv) Systematic sampling

TERMS IN POPULATION STUDY

(1) **Population size:** This is the proportion of the size of ground covered by individual organism' it is simply called "cover"

(2) **Dominance:** This is an individual organism that is continually appearing from one generation to another even after the external forces had wiped others out.

(3) **Density:** This is a number of an organism of a particular type in a quadrat area.

(4) **Factors that affect population:** These are the factors that can lead to increase or decrease in the population of an organism in a particular

area. These are (a) food (b) Maternity (c) Emigration (d) Emigration (e) war/Disaster (f) Mortality

ECOLOGICAL FACTORS: These are the factors that affect the life of living organisms in a particular habitat

(a) Aquatic habitat

(1) Salinity/concentration of dissolved salts in the water

(2) Speed of flow

(3) Turbidity or Transparency

(4) Nature of bottom

(5) PH concentration

(b) **Terrestrial Habitat**

(1) **Climatic Factors:** Climate is the characteristic pattern of weather elements in an area over a period of time. These weather elements are rainfall, temperature, relative humidity, sunlight, wind etc. All these are called climatic factors.

(2) **Topographical Factors** i.e physical features of an area

(3) **Edaphic Factors:** These are factors relating to soil structure, texture, feature, soil ph and soil water etc, in a given soil.

IMPORTANCE OF ECOLOGICAL FACTORS TO POPULATION

(A) ANIMALS (i) It determines survival (ii) It determines the type of animal found in a particular area. (iii) It determines their population (iv) It determines the availability of food to animal population

(B) PLANTS

1. It determines the vegetation of a place
2. It determines the survival of plant in a given habitat
3. It determines the types of plant that can be found in a given ecosystem
4. They force the plant to develop adaptable characteristics for survival

SOIL

(a) Types of soil (1) clay soil (2) sandy soil (3) loamy soil

SOIL TYPE	WATER HOLDING CAPACITY

Clay soil	High
Loamy soil	Average
Sandy soil	Low

MEASUREMENT OF ECOLOGICAL FACTORS

S/N	ABIOTIC FACTOR	INSTRUMENT
1	Rainfall	Rainguage
2	Temperature	Maximum and minimum thermometer
3	Wind direction	Wind vane
4	Wind speed	Anemometer
5	Pressure	Anaeroid barometer
6	Humidity	Hygrometer
7	Light	Light meter
8	Water depth	Meter rule & knotted string
9	Height	Meter rule
10	Slope	Slope guage

(WEEK 7)

FUNCTIONING OF ECOSYSTEM

(1) **AUTOTROPH**: This can be simply called the "**PRODUCER"** They are the organisms that are able to use solar energy or to build-up their own food through the process of photosynthesis. These include all grasses, trees, scrubs e.t.calso, aquatic plants such as phytoplanktons, water hyacinth, sea weeds e.t.c. are also introduced.

(2) **HETEROTROPHY:** This is the group of living organisms that cannot produce their own food through the process of photosynthesis that feed directly on plants. They are generally called **"THE CONSUMERS"** the one that feeds directly on the consumer is called ***Primary Consumer,*** those feeding on primary consumers are called ***Secondary***

Consumers, while those feeding on Secondary Consumers are called ***Tertiary consumers.***

(3) CONSUMERS: Depend on the producer for their energy supply

(4) TROPHIC LEVEL: This is the position an organism occupies in a food chain e.g. producers make up the first trophic level, and consumers make up the second and third levels.

Grass → Grasshopper → Lizard → Snake → Hawk

AUTOTROPH

Producer: The organisms that synthesize their food by themselves i.e. plants they are called the ***Autotrophs*** all green plant belong to this group

HETEROTROPHS

These are the consumers. They feed on the food already made by the producers. All animals belong to these groups of organism.

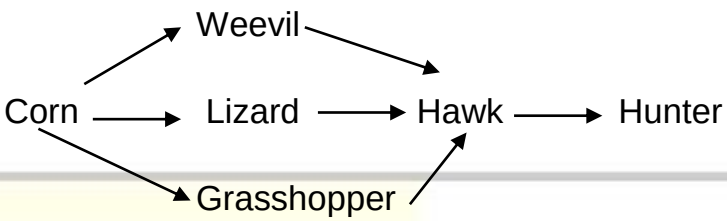
FOOD CHAIN: This is the feeding relationship between organism in an ecosystem. It starts with the producers and ends with decomposers. It is the flow of energy.

FOOD WEB: A network of interrelated food chains representing the complex feeding relationships of organisms in an ecosystem.

Example of Food Chain:

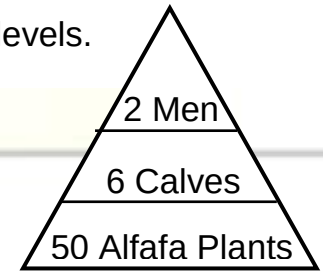
Green plant → Insect → Toad → Snake → Man

Example of Food Web:



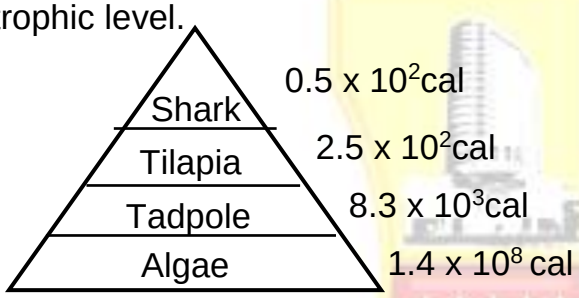
ECOLOGICAL PYRAMIDS

(1) Pyramid of Numbers: It gives comparative numbers of organisms at the trophic levels.



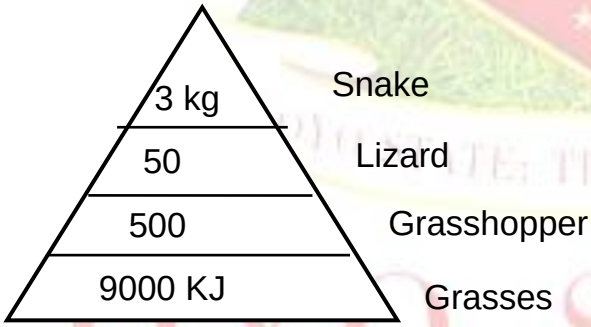
PYRAMIDS OF BIOMAS

It expresses the biomas based on the dry weight of the organisms at each trophic level.



PYRAMID OF ENERGY

This shows the amount of energy produced at each trophic level. The amount of energy decrease from the producer to the consumer.



ENERGY LOSS IN THE ECOCSYSTEM

The ultimate source of energy to the ecosystem is the sun. it gives its energy in form of solar energy. About 5% of the energy radiated from the sun actually get to the plant as absorbed by the chlorophyll. The majority of the energy is loss as heat energy into the environment for warming of the air and water bodies.

The 5% trapped by the chlorophyll is converted to chemical energy as synthesized in form of carbohydrates through the process of photosynthesis.

LAWS OF THERMODYNAMICS

(1) First law states that: Energy cannot be destroyed nor created but can be converted from one form to another.

(2) Second law of thermodynamic states that when one form of energy is converted to another, the conversion is not complete because energy is loss to the environment as heat.

APPLICATION OF LAWS OF THERMODYNAMICS

Only small fragment of the energy released by the sun as solar energy is actually trapped by the chlorophyll and converted to chemical energy made available to the consumers.

The amount of chemical energy stored by the plants from the solar energy is called ***Primary food production.*** Almost half of it is used by the plants themselves while the remaining part is stored and later made available to the consumers. The amount made available to the consumers is called **"NET PRIMARY PRODUCTION"**

RELEVANCE OF BIOLOGY TO AGRICULTURE

(1) Classification of plants: This is done in 4 ways:

(a) Botanical classification

(b) Agricultural classification

(c) Life cycle classification

(d) Life form classification

(a) Botanical Classification:

(i) Schizophyta (ii) Thallophyta (iii) Bryophyta

(iv) Pleridophyta (v) Spermatophyta

Agricultural classification of plants: This is the types of classification based on the uses of plants. In this classification, crops or plants are grouped into the following categories based on their uses.

1. **Cereal Plants:** These plants belongs to the grass family and they provide carbohydrate, e.g. maize, rice millet, guinea corn,

2. **Pulses (Grain legumes):** Pulses are crop which provide proteins, e.g. cowpea, soyabeans, groundnut,
3. **Root and tuber crops:** These crops produce tubers under the ground and they provide carbohydrate e.g. cassava, yam cocoyam, sweet potato, Irish potato
4. Vegetable crops provide vitamins and minerals e.g. tomatoes, amaranths, onions, okra.
5. Fruit plants: Fruits plants also provide vitamins and miner also e.g. orange, banana, pineapple, mango, pawpaw.
6. **Beverage plants:** These crops plants provide food dinks when processed into finished products like bournvita, ovaltine, pronto etc. Examples of beverage crops are cocoa, coffee, tea kola etc.
7. **Spices:** These crops plants provide vitamins and minerals e.g. ginger, pepper, onion etc.
8. **Oil plant:** Oil plants can provide oil when processed both for domestic and industrial uses e.g. oil palm, groundnut, melon, coconut, soyabean, cotton etc
9. **Fibre crops:** These are crops plants used for making clothing materials, ropes and bags e.g. cotton sisal, hemp, kenaf, hibiscus etc
10. **Latex crops:** These are crops which provide some white, sticky liquid (latex) used in plastic industries, e.g. rubber.

WEEK 3

Classification of plants Based on life cycle

Plants are grouped into three categories based on their life cycle of the life span of the crop plant, or the number of years a plant is able to grow matures and produces fruit. The groups are:

1. **Annuals:** Annuals are plants which complete their life cycles in one season (year). Examples are maize, rice, cowpea, millet.
2. **Biennials:** These are plants which complete their life cycles within two years. Examples are pepper, carrot, onion and ginger

3. **Perennials:** Perennial plants grow, mature and produce fruits for more than two years. Examples are coca, banana, orange oil palm,

Classification of plants Based on life forms

1. **Herbs:** Grow for few centimeters above the ground
2. **Shrubs:** They are soft stemmed plant of less than two metres above the ground
3. **Trees:** They grow for many metres above the ground level and forms canopies

(c) Lifecycle Classification:

(1) Annual: Survive for only a year

(2) Biennial: Survive for two seasons of growth to maturity

(3) Perennials: They live for more than two seasons before they die

(d) Life forms Classification: These are (a) Herbs (b) Shrubs (c) Trees

EFFECTS OF AGRICULTURAL ACTIVITIES

(i) Bush burning: This is the setting of the bush on fire. It exposes the soil to erosion as well as destroying the habitat of organisms. Some useful soil organisms are destroyed in the process.

(ii) Tillage: this is the breaking of the soil lumps in order to soften the soil for easy penetration of water and air

(iii) Fertilizer/herbicide application: These are chemicals added to the soil to improve the soil fertility as well as eradicating the weeds.

Effects:

(i) Pollute the water bodies

(ii) Kills aquatic organisms

(iii) Kills crops when in contact with the roots

FARMING PRACTICES

(1) Shifting cultivation: When a land is continuously used and later abandoned for another new site for it to regain its fertility.

(2) Crop rotation: A system of farming where the crops planted are rotated in order to maintain the fertility of the soil.

FOOD PRODUCTION AND STORAGE

Methods of crop improvements

(i) Hybridization (ii) pests and disease control (iii) soil improvement (iv) introduction of improved breed (v) improved cultural practices

METHODS OF FOOD PRESERVATION

(i) Sun drying (ii) Canning (iii) Salting (iv) siloing (put in treated silo)

(v) osmotic preservation (vi) smoking (vii) freezing (viii) refrigeration

(ix) pasteurization (x) sterilization (xi) addition of natural inhibitors

POPULATION GROWTH AND FOOD SUPPLY

Population is increasing geometrically while food production is increasing arithmetically; hence, the population outnumber food production

GOVERNMENT EFFORTS AT INCREASING FOOD PRODUCTION

1. Agricultural grants and aids
2. Construction of feeder roads
3. Provision of agricultural machines e.g. tractor
4. Formation of agricultural banks
5. Establishment of farm settlement.

PESTS OF SOME COMMON CROPS

S/N	CROP	PEST
1.	Cotton	Cotton stammer
2.	Bean	Bean weevil
3.	Rice	Rice weevil
4.	Cocoa	Amphids
5.	Okra	Whitefly
6.	Yam	Yam beetle, stem borers
7.	Cassava	Mealy bug, rat
8.	Groundnut	Boll worm

S/N	ANIMAL	DISEASE	CAUSAL AGENT
1.	Cattle sheep	Foot and mouth	Virus
2.	Poultry	Coccidiosis	Protozoan
3.	Man, cattle	Trypamosomiasis	Protozoan
4.	Swine	Brucellosis	Bacteria
5.	Foods	New castle	Virus
6.	Sheep, cattle	Aspergillosis	Fungi
7.	Pig, poultry	Tuberculosis	Bacteria

3RD TERM SS1

WEEK1: THE MICROORGANISMS

BACTERIA

Meaning: Microorganism can be defined as the tiny organism that cannot be seen with naked eyes but with the aid of microscope. They were discovered by a man called Anthony Van LeeuwenHaek in 1674. He lived between 1632 to 1723.

GROUP OF MICRO ORGANISM

(A) Eukaryotes e.g Bacteria
(B) Prokaryotes e.g Fungi, Protozoa and Algae.
(C) Akaryotese.g viruses.

CONCEPT OF CULTURING

CULTURE MEDIUM: This is an artificial component on which microorganism is cultivated in the laboratory. E.g. -blood agar- for the growth of wide range of micro organisms, selective agar- where a particular organism is isolated.

PREPARATION OF CULTURE

- Weigh the medium to be used
- Add distilled water and shake thoroughly
- Cover with foil and sterilized with cooker
- Pour the sterilized medium into peril dish

INOCULATION: This is the introduction of microorganisms into the prepared medium using sterilized inoculating loop

IDENTIFICATION OF MICROORGANISM

Microorganisms can be formed in (i) Air (ii) Pond water (iii) Rivers (iv) Stream (v) Food (vi) Everywhere

MICROORGANISM IN OUR BODY

Microorganism is present around us in the air, water etc. They do enter our body, food materials such as boiled rice, fish, bread, milk, fruit. These food materials kept at room temperature for long got spoilt by microorganism.

Our body also contains several microorganisms. For instance they can be found in our mouth, teeth, nose, skin etc.

BENEFICIAL EFFECTS OF MICROORGANISMS

1. Fungi as food e.g. yeast, mushroom
2. Source of fermentation e.g. yeast
3. Useful in industries e.g. cheese production
4. Production of Antibiotics, antitoxins and anti cholesterol
5. Enzyme from fungi is useful in textile industry.
6. Fungi as experimental organisms
7. Bacteria are useful in the production of food e.g. yougurt
8. Bacteria are useful in chemical industries for the production of Agrochemicals
9. Useful in sewage treatment
10. Useful as a decomposing agents of plant and animals
11. Play prominent roles in nutrient circulation e.g. nitrifying bacteria
12. Help in the digestion of cellulose in herbivores

HARMFUL EFFECT OF MICROORGANISMS

Harmful microorganisms are responsible for the diseases of plants and animals, they are called “the microbes”

MICROBES	DISEASE	SYMPTOMS	MODE OF TRANSMISSION	PREVENTION

VIRUSES	Yellow fever	Fever, diarrhea	Bites of mosquito	Vaccination
	Poliomyelitis	Fever, pain paralysis	Food and water contaminated with faeces.	Vaccination
	Hepatitis A	Dark urine	Contaminated water	Vaccination
	AIDs	Fever, diarrhea, loss of weight	Sexual intercourse, contaminated blood transfusion	Safe sex, screening of blood before transfusion
BACTERIA	Cholera	Diarrhea, vomiting	Contaminated food and water	Vaccination
	Gonorrhea	Genital burning, pain during urination	Sexual intercourse	Safe sex, vaccination
	Tuberculosis	Coughing with blood	Droplet infection	Vaccination
FUNGI	Ringworm	Hair falling patches in the skin	Direct contact through injected towel	Avoid infected materials, vaccination
	Athlete's foot	Itching and pain foot	Direct contact	Vaccination
PROTOZOAN ENTAMOEBA HISTOLYSTICAL	Amoeboic dysentery	Diarrhea with blood and mucus	Contaminated food and water	Improved sanitation
PLASMODIUM SPP	Malaria	Recurrent fever	Bite of anopheles mosquito	Prevent contact with mosquito
TRYPANOSOME	Trypanosomiasis	Fever, emaciation	Bite of infected tsetse fly	Prevent tsetse fly bite

2. ***Carriers of Microorganism:*** These are animals on which the microbe live from where they carryout their pathogenic activities e.g. mosquito carries plasmodium, tsetse fly carries Trypanosome. They are otherwise called "**Vectors".**

Pathogens: These are the disease – causing microorganisms e.g. plasmodium, Trypanosome e.t.c.

Pathogenesis: This is the ability of a particular living organism or microbe to cause diseases.

WAYS THROUGH WHICH PATHOGENS SPREAD THEIR DISEASES

1. Through infected food, water, air e.t.c.
2. Transmission from infected organism
3. Body contact e.g. Ring worm
4. Poor sanitation
5. Through vector e.g. rat, Mosquito, Cockroach
6. Through unprotected sex e.g. HIV
7. Sneezing
8. Stooling from infected person

(WEEK 3)

TOWARDS BETTER HEALTH

CONTROL OF HARMFUL MICROORGANISM

1. High temperature
2. Sterilization
3. Use of Antibiotics e.g. penicillin, streptomycin
4. Use of Antiseptic e.g. Dettol, Septol, Potassium magnate

WAYS OF CONTROLLING VECTORS

1. Destruction of breeding sites e.g. pond, water pots

2. Killing of larvae stage of mosquito
3. Biological control i.e. introduction of predator
4. Environmental management
5. Chemical methods of oiling water surface to kill larva
6. Destruction of larva level to prevent egg production.
7. Good sanitation
8. Use of insecticide
9. Electrocution

PUBLIC HEALTH

IMPORTANCE OF COMMUNITY HEALTH

1. Control of disease through health education, sanitary inspection and isolation of patient with infectious disease.
2. Provision of portable water e.g. Tap water and Boreholes
3. Treatment and discharge of refuse and sewages
4. They ensure that manufactured food are canned and fit for consumption
5. Make provision for well treated community water.
6. They plan and ensure availability of health center in their community.

HEALTH ORGANISATIONS

(1) RED CROSS SOCIETY: founded in 1863 by Henri Dunant

Functions

(i) Training of people on how to give aids to the people
(ii) Rehabilitation of victims of disasters
(iii) They are responsible for medical and social care of disaster people
(iv) Provision of drugs
(v) Treatment and welfare of prisoners and war prisoners

(2) UNITED NATION INTERNATIONAL CHILDREN EMERGENCY FUND (UNICEF) An agency of United Nation.

They support children to become healthy and useful citizens through supply of essential things to the Mother and the Children.

(3) FOOD AND AGRICULTURAL ORGANIZATION (FAO)

Established essentially to raise the food output of farm land, forest, fisheries and poultry production. It is to raise world nutrition level.

(4) WORLD HEALTH ORGANIZATION

Established toward coordination of global health to raise the standard of health both physical and mental of the world population

Functions

1. Strengthening health services
2. Training of staff
3. Fighting major diseases
4. Promoting material and child health
5. Promoting mental health

WEEK 4

AQUATIC HABITAT

Characteristics:

1. Size: very large. It occupies over 70% of the earth's total area.
2. Chemical composition: contains dissolved salts of Na^+, k^+, Ca^+, Mg^+, Cl^-, HCO^- etc.
3. Salinity – The average salinity is 35 parts of salts by weight per 1000 parts of water.
4. Oxygen concentration: High at surface and decreases towards the bottom.
5. pH: Alkaline at the surface with pH 8.2
6. light penetration: Light penetration in 200metre depth after is total darkness
7. temperature: does not changes as on land it decreases with depth
8. density: very high about 1.028
9. Pressure: increases with depth at 1 atm per 10m
10. Stability; fairly stable
11. Wave, currents and tides: common occurrence in marine habitat

Major ecological zones

a. The splash/ supratidal zone
b. Intertidal zone
c. Subtidal zones
d. Oceanic zone
e. Hadal zone

4. Distribution of organisms in different zones

S/N	ZONE	ORGANISMS
1.	Splash/supratidal	Animals: Starfish, , ghostcrab, bwalve, periwinkle **Plants:** Sea weeds
2.	Intertidal	**Animals:** Burrowing Clam, squids, Periwinkle, bansile, crab, starfish copepods **Plants:**Sargasum, sesurium
3.	Sybtidal/lithoral	**Animals:** Zooplanktons, Crayfish, strongfish, tilapia, mackerel, shrimps, copepods **Plants:**Phytoplanktons
4.	Oceanic/Betthic zone	**Animals:** Shark, rayfish, sea catfish, croaker **Plants:**Phytoplanktons
5.	Hadal/Aphotic	**Animal:** Lantern fish, Octopus, Sponge **Plants:** Nil

ESTUARINE HABITAT

CHARACTERISTICS

(i) Salinity flunctuates
(ii) Shallow water
(iii) Quiet with little or no wave netron
(iv) Tiutal action momiment
(v) Soft subractum
(vi) Rich in nutrients especially organic ones
(vii) Low species number
(viii) Subractum is poorly aerated

(ix) High turbidity

TYPES OF ESTUARINE HABITAT

(1) Hypersaline estuarine habitat
(2) Mixed or homogenous estuarine habitat
(3) Moderately stratified estuarine habitat
(4) Highly stratified estuarine habitat

ADAPTIVE FEATURES OF EXTUARINE ORGANISMS

ANIMALS:

a. Possession of cells that can tolerate fluctuating salts
b. Possession of degree of osmoregulation
c. Possession of fairly impermeable body surface
d. Burrowing into the mud to escape low salinity
e. Possession of shell into which they withdraw to prevent discretion
f. Retention of water in their cell for gill breathing
g. Living in empty snail shell for protection.

PLANTS

a. Possession of silt roots
b. Possession of breathing roots
c. Excretion of excess salt through leaves
d. Possession of thick leaves with cuticle
e. Germination of seed while still on the parent
f. Possession of green leaves, less stem to prevent water loss through transpiration.

(WEEK 5)

FRESH WATER HABITAT

CHARACTERISTICS

a. Little or no salt
b. Relatively small
c. Volume varies with season

d. Relatively shallow

e. Varied temperature

f. Oxygen contents of fresh water is relatively high

TYPES OF FRESH WATER

1. Lentic fresh water 2. Lotic fresh water

THE TERRESTRIAL HABITAT

CHARACTERISTICS OF MARSH

a. It is lowland habitat
b. The soil is wet, soft and waterlogged
c. It contains scattered pools
d. The atmosphere is damp and highly humid
e. Decreased oxygen concentration due to high level of decay
f. Low light intensity

FORMATION OF MARSH

There are two types of marsh: (a) temporary marsh (b) permanent marsh

(a) Temporary marshes: this occurs only during the raining season and are formed in the lowland with poor drainage with pool of water where plants such as grasses, shrubs and water plants like spirogyra grow. They dig up completely during the dry season

(b) Permanent Marshes: formed at the adjourning water bodies and rivers, streams and lagoons or when lagoon revive water from the sea at the high tides. It i s a gradual process in which and aquatic habitat is transformed into terrestrial habitat

Marshes are of two types (1) salt water marshes and (2) fresh water marshes

ORGANISMS IN THE MARSHES

(1) Phytoplanktons algae, seges, grasses and water hyacinth, are found in the water marshes while in the fresh water marshes can be formed plants such as algae, water lettuce, water lily, ferns, and ulticularia.

Animals in salt water mashes include mangrove crabs hermit crab, mud skippers, oysters and barbacles. While in fresh water mases are the animals such as earthworm, frogs, toads, snakes, insects, mudfishes and birds.

ADAPTIVE FEATURES OF THE PLANTS AND ANIMALS

(a) Most plant have large and interconnecting air-spaces
(b) Air spaces are found at the central portion of the roots
(c) Most animals in the marshes are burrowing animals
(d) Most of the animals live inside the mud, hence high tolerance for low oxygen
(e) They show adaptation similar to fresh water and estuarine animals

WEEK SIX (6) THE FOREST

The forest is a biome characterized and populated mainly by trees. The three abiotic factors common to forest are; Tempeature, relative humidity and rainfall. They affect the distribution of these trees.

CHARACTERISTICS OF FOREST

(a) Presence of trees, mainly mesophytes with broad leathery leaves
(b) Smooth and straight trunks.
(c) Buttress root system
(d) Small flowers but large fruits
(e) Trees occur in strata or layers. (ground, lower, middle and upper and top layers.
(f) The floor contains large amount of litters made up of decomposing fallen leaves, fruits, flowers and branches.
(g) Presence of large inner of woods, chambers and epiphytes
(h) High relative humidity especially at lower level

DISTRIBUTION OF PLANTS AND ANIMALS

Plants: (a) Shade loving plants are found on the floor of the forest e.g ferns, oil palm, raphia etc.

(b) Presence of saprophytic fungi

(c) Presence of different types of trees egKhaya, Chlorophoraexelca (Iroko), etc.

(d) Presence of Climbers, epiphytes and parasitic plants such as mistletoe.

ANIMALS: (a) Earthworms, termites, crickets that live in the soft soil

(b) Vertebrates such as rats, rabbits and snails

(c) Invertebrates such as millipedes, ants, spider etc.

ADAPTIVE FEATURES OF PLANTS AND ANIMALS

PLANTS:

1. Trees with well developed roots
2. Tall trees with Butress roots system
3. Abundance support of the strengthened tissues
4. Thin broad leaves with thin cuticle
5. Climbers are common
6. Plants grow within the shade of the canopy of the forest.

ANIMALS:

(a) Possessions of opposable digits on their legs and hands.

(b) Prehensile tails

(c) Sticky and friction pads

(d) Possession of grasping scales

(e) Possession of long claws

(f) Possession of powerful hindlimbs

THE GRASSLAND: This is a plant community dominated by grasses shrubs and short scattered trees.

CHARACTERISTICS

1) The vegetation is dominated by tall grasses
2) Rainfall range is between moderate and low with several months without rainfall
3) Intense sunshine
4) Bush fire is common
5) Soil is mainly sand but with high humus content

TYPES OF GRASSLAND

1. Temperate grassland
2. Tropical grassland

DISTRIBUTION OF PLANTS AND ANIMALS

Plant: - Grasses are the dominant plants e.g. Andropogons

- Presence of shrubs and trees scattered in grassland
- Common trees species include sea butter, African balsam, Baobab, Africa locust beans e.t.c

Animals - The ground dwellers e.g. termites, rats e.t.c

- The grazers e.g Zebra, deer, elephants, grasscutters, gazelles e.tc
- The browser e.g Giraffes, antelopes
- Other herbivores e.g grasshoppers, guinea fowl e.t.c
- Carnivores e.g. lions, cheetah, leopard, jackal, tiger e.t.c
- Scavengers e.g. Hyena, vultures e.t.c
- Reptiles e.g. crocodiles, alligators, snakes, lizard e.t.c

ADAPTATION OF PLANTS AND ANIMALS

PLANTS: - Tree with tick barks

- Seasonal shedding of leaves
- Few branches with small numbered leaves
- Broad succulent trunks with storage cells
- Deep and extensive root system
- Grasses are drought resistance
- Seeds and underground stems are fire resistance
- Grasses with ability to regenerate

ANIMALS

a. Borrowing animal like rat escape into holes
b. Large herbivores run fast for their lives
c. Good sense of sight
d. The herbivores move together in group
e. The size of the herbivore is an advantage against predator

f. Some have colour pattern which blend with tall greenish brown grasses

(WEEK 7)

THE ARIDS LAND

Arid lands are the habitat where water is very scarce. The habitat where water is very scarce.

The habitat is dry and extremely hot.

CHARACTERISTICS

(a) Low rainfall
(b) High and extremely temperature
(c) Sandy and rocky soil
(d) Intense sunshine
(e) Low relative humidity
(f) Strong wind
(g) Poor vegetation of scarcity grasses

TYPES OF ARID LANDS

(1) Hot arid land (2) Cold arid land

DISTRIBUTION OF ORGANISM IN ARID LAND

PLANTS:
(a) Rapid growth during the raining season
(b) Presence of underground stem
(c) Deep and extensive root system
(d) Some trees without leaves
(e) Reduced leaves with sunken stomata

ANIMALS
(a) Animals are very active during the night
(b) Some with impermeable body covering
(c) Presence of efficient water re – absorbing excretory system
(d) Inefficient sweat gland for water conservation

(e) Protoplasm of some animals can withstand great water loss

(f) Some animals can survive on water content of their food

(g) Legs adapted for swift movement

(WEEK 8)

REPRODUCTION IN UNICELLULAR ORGANISM AND INVERTEBRATES

(1) **Amoeba:** Amoeba reproduces through two methods of reproduction i.e (i) sexual method called conjugation and (2) asexual method called Binary fission

- **Sexual Method (Conjugation):** Two amoeba lie side by side, the cytoplasmic content of one refers to as male moves into the other refers to as female. It is a simple genetic recombination between two Amoebae.
- **Asexual method (Binary Fission):** When an Amoeba has grown to maturity, it divides into two equal parts along the nucleus. The two halves then grow into an individual amoeba called the daughter cells.

Multiple Fission: This also occurs in Amoeba when an Amoeba has grown into maturity, It become rounded in shape by forming a cyst, after certain period of time, it divides severally inside the cyst where several individual Amoeba had been formed. The cyst later burst and the new Amoeba are released.

SEXUAL REPRODUCTION IN PARAMECIUM

This occurs in form of conjugation. Two paramecia pair to exchange their nuclei contents through a conjugation tube i.e. bridge. It is a process of genetic recombination between two paramecia cells. Both are called “conjugal”

Asexual reproduction in paramecia is by binary fission where a matured paramecium cell divides into two equal parts to form two daughter cells.

REPRODUCTION IN SPIROGYRA

- Asexual reproduction in spirogyra is called fragmentation where individually matured spirogyra cleavage or breaks into several units which later grows into complete organism.
- Sexual reproductive occurs in spirogyra by conjugation. The nuclei contents of a male individual moves into female individual through the cytoplasmic bridge formed between them when they lie side by side. The cyst formed later burst to produce several individual spirogyra.

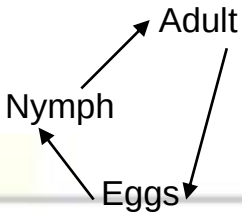
(WEEK 9)

REPRODUCTION IN UNICELLULAR ORGANISM AND INVERTEBRATES

(1) **EARTHWORM:** Earthworms are hermaphrodites. Each earthworm possesses both male and female sex organs. Each pair of animal, during mating, overlap from ends ventrally and each exchanges sperm with other. The clitellum becomes reddish to pinkish in colour and the egg use is secreted by the clitellum band. After a while a small buk fully formed earthworm emerges and it attains a full size after 60 – 90 days.

Asexual reproduction in earthworm is by fragmentation in which a fragment or small part of an earthworm grows into fully blown earthworm. It occurs due to the fact that each segment of an earthworm has separate sexes and the animal can regenerate when cut into small units.

(2) **COCKROACH:** Cockroach undergoes internal fertilization sexes are separate and mating occurs between male and female. The eggs are fertilized as they pass through the oviduct. Cockroach undergoes an incomplete metamorphorsis and the egg hatches into Nymph which looks like the adult. It is also colourless. They feed, grow and are small in size to the adult. They feed, grow and moult several times before becoming an adult.



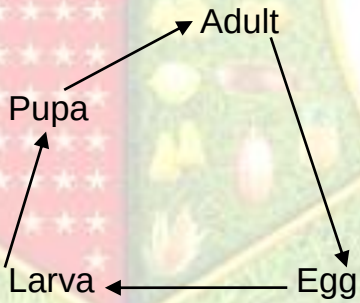
Incomplete metamorphosis in Cockroach

REPRODUCTION IN HOUSEFLY

Mating occurs between male and female housefly, fertilization is internal. The sperm is stored until the eggs are mature for fertilization. The eggs are laid and hatched into Larva within 24 hours. The larva feeds on decaying material where it hatches. The larva is called the maggot mouth twice before becoming pupa.

The pupa is a barred – shaped and inactive. It actually developes into young adult between 3 – 4 days but this is affected by cold and weather.

The young adult pushes open a special vesicle (Plilium) on the front of the head and emerges out of decaying matters. Within few hours, the wings espand and harden, then the adult or imago can fly.

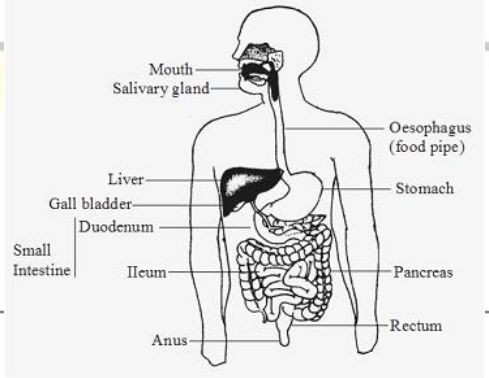


REPRODUCTION IN SNAIL

Some snails are hermaphrodites while some have separate sexes. Snails are prolific breeders. During reproduction, snails pair or copulate to inseminate each other and to fertilize each other. Fertilization is internal. Eggs are laid in shallow top soil when the weather is warm and damp. After 2-4 weeks of favourable weather, the egg hatch and the young one emerges. A snail may lay up to 100 eggs and it can be as often as once in a month.

WEEK 4

DIGESTIVE SYSTEM



Digestive system includes the alimentary tract of canal and all the organs and glands associated with the digestion and assimilation of food in animals. Digestion is the breaking down of large molecules of food into simple and absorbable form for use by the animals.

Parts and types of alimentary tracts: A typical mammalian alimentary tract of canal includes the following parts: mouth, pharynx, oesophagus or gullet, stomach, small intestine or ileum, caecum, appendix, large intestine or colon, rectum and anus.

Types of Alimentary Tracts of Some Animals

Planarian: The planarian is a free-living flatworm that feeds on aquatic animals called zooplanktons. It has a simple alimentary canal with one opening – the mouth

Tapeworm: The tapeworm is found in the intestine of some mammals as endoparasite. It has no alimentary canal as it feeds on digested food of the host. It absorbs the digested food from the host by simple diffusion.

Earthworm: The Alimentary tract of the earthworm is a tube with two openings: the mouth – through which food enters and the anus through which food enters and the anus through which undigested food leaves the body. The alimentary canal of the earthworm includes the following parts: mouth, pharynx, oesophagus, crop, gizzard, intestine, caecum rectum and anus.

Grasshopper or cockroach: The grasshopper feeds on green vegetable while the cockroach feeds on household materials like books, sugar, food etc. the alimentary canal of a grasshopper or cockroach includes the mouth (mandibles) salivary gland, oesophagus, crops gizzard, mid-gut, caecum,

Bird: The digestive system of the bird includes the beak, moth pharynx oesophagus, crop, proventriculus, gizzard, intestine, caecum, rectum and anus (cloaca).

The bird has no teeth but the food such as fruits; grains etc are picked up by the beak.

Alimentary canal and digestion of food in man: The alimentary canal of man includes the mouth, oesophagus, stomach, duodenum, small intestine or ileum, caecum, appendix large intestine or colon, rectum and anus.

The description and importance of the parts are as follows:

Mouth: The alimentary canal of man starts from the mouth. The mouth contains the teeth, salivary gland and tongue. The teeth are used to cut, grind or chew food into tiny particles. The salivary gland secrets saliva which contains an enzyme called ptyalin. The ptyalin breaks down starch into maltose.

Oesophagus or Gullet: The oesophagus connects the mouth to the stomach. The food swallowed is passed down through the oesophagus by a peristaltic movement into the stomach. In the stomach, the gastric gland secretes gastric juice which contains two enzymes – rennin and pepsin. The rennin acts on milk (or it helps to curdle milk) while the pepsin breaks down proteins to peptones. The gastric gland also secretes hydrochloric acid (HCl) which creates pancreas which secretes pancreatic juice that contains three enzymes. These enzymes are:

i. **Amylase:** This converts starch to maltose
ii. **Lipase**: Lipase converts fats and oils to fatty acids and glycerol.
iii. **Trypsin**: It converts proteins and peptones to polypeptides.

The digestion of fats and oil is aided by a green alkaline liquid called bile which is secreted by the liver and stored in the gall bladder. The bile helps in the emulsification of fats. The small intestine or ileum is found between the duodenum and the large intestine. Two major events take place in the small intestine these events are (a) digestion and (b) absorption of the digested food.

Digestion: The intestinal wall secretes intestinal juice which contains the following enzymes – lipase, erepsin, maltase, sucrase and lactase. The lipase converts fats and oil to fatty acids and glycerol, maltase converts maltose to two unit of glucose, sucrase converts sucrose to glucose and fructose while lactase converts lactose to glucose and galactose.

Absorption of digested food: The end products of digestion of food (amino acids, glucose, fatty acids and glycerol) are absorbed in the small intestine by tiny finger-like structures called villi (singular villus).

Caecum and appendix: In man, the function of caecum is to absorb salts and electrolytes into the body from liquids while the function of the appendix is for the production of molecules that helps to direct the movement of lymphocytes to various locations in the body.

Large Intestine: the undigested food passes into the colon or large intestine. This absorption of water concentrates the wastes products and make them into faeces. The faecesis passed into the rectum and finally out of the body through the anus.

Modifications and Mechanism of Feeding in some Animals

1. **Absorbing Mechanism, e.g. tapeworm:** The tapeworm is an endoparasite which carries out parasitic feeding on its host i.e. the man. It has no mouth but absorbs digested food from the intestine of its host.
2. **Biting and chewing mechanism, e.g. grasshopper or cockroach**: The grasshopper or cockroach has mouth parts adapted for biting and chewing
3. **Sucking mechanisms**: There are three popular organisms which exhibit sucking mechanism. These are mosquito, Butterfly and Housefly. These insects have different modifications of mouth parts adapted feeding on food through the mechanism of sucking.
4. **Grinding mechanism:** Grinding mechanism is common among mammals, e.g. man, cattle, sheep, goat etc. These animals are capable of grinding the food before swallowing. This grinding is aided by the presence of hard and strong teeth made of enamel and dentine.

WEEK 5

Feeding Habits

Organisms exhibit different feeding habits. These are:

1. **Filter Feeding:** Filter feeder which is also called microphagous feeder feeds on very tiny organisms which cannot be easily picked to the

satisfaction of the feeder. Examples of filters are mosquito larva, mussel, ducks, prawns etc.

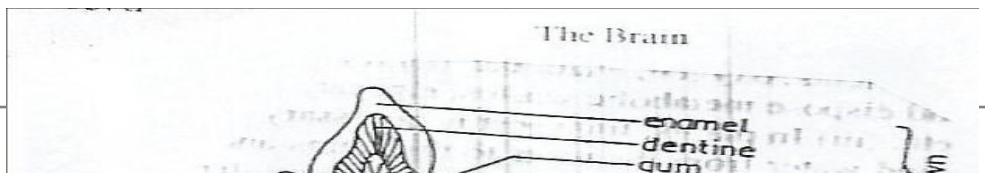
2. **Fluid Feeding:** Animals which feed on any fluid materials are classified as fluid feeders. There are two major groups of fluid feeders. These are:
   - **i. Wallowers:** These organisms rest within or wallow in their food e.g. the tapeworm in the intestine of man
   - **ii. Suckers:** Suckers are organisms, mainly insect, which feed by sucking fluid from plants and animals. Examples of suckers are bug, mosquito, butterfly, aphid, tse-tse fly and housefly.
3. **Saprophytic Feeding:** Saprophytes are mainly non-green plants which do not have chloroplasts and therefore cannot manufacture their own food. They then feed on dead and decaying organic matter from which they derive their food. Examples of saprophytes are rhizopus, mushroom, mucor
4. Parasitic feeding: Parasitic feeding is found in both plants and animals. Animal parasites are tapeworm, roundworm, liver fluke, louse, tick and guinea worm while plants parasites are cassytha, dodder and mistletoe. Parasites are structurally modified organisms that depend wholly or partially on other living organisms for their food and survival.

Dentition: Dentition refer to the number, arrangement and conformation of teeth in an organism.

Types of dentition: There are two main types of dentition, these are:

(a) **Homodont dentition:** The organisms have the same type of teeth. All the teeth are of the same shape, size and functions. Examples of homodont dentition are found in fishes, amphibians and reptiles.

(b) **Heterodont dentition:** The organism possesses teeth of different shapes, sizes and functions. Examples of organisms,.havingheterodont dentition are mammals, e.g. rabbits, man, dog, cattle etc. The mammals generally have four different types of teeth. These are incisors, canines, premolars and molars. Mammals again have two sets of teeth. These are milk teeth and permanent teeth.



Dental formula: The dental formula refers to the numbers and types of teeth present in the mouth of an animal.

The dental formula of man: i= $\frac{2}{2}$, c= $\frac{1}{1}$, p=$\frac{2}{2}$, m=$\frac{3}{3}$= 32

Man is an omnivore. i.e. he feeds on both flesh and vegetable and the teeth, 32 in number is adapted to the kind of diet it feed on.

The dental formula of dog: i= $\frac{3}{3}$, c= $\frac{1}{1}$, p=$\frac{4}{4}$, m=$\frac{2}{3}$= 42

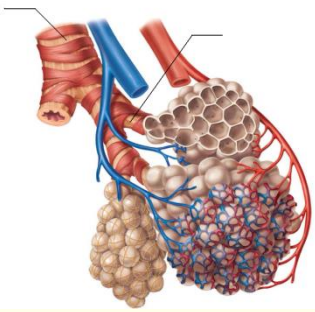
Dog is a carnivorous animal, i.e. it feed on flesh hence its teeth, 42 in number is adapted to the kind of food it eats.

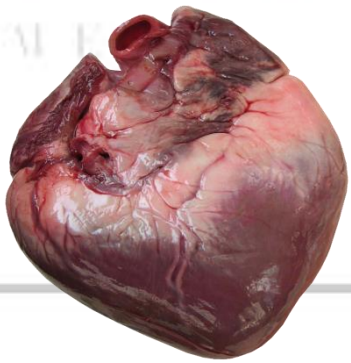
The dental formula of rabbit:: i= $\frac{2}{1}$, c= $\frac{0}{0}$, p=$\frac{3}{2}$, m=$\frac{3}{3}$= 28

The rabbit is a herbivorous animal, i.e. it feeds mainly on vegetable hence its teeth, 28 in number is adapted to the kind of food it eats

WEEK 7

TRANSPORT SYSTEM





HEART OF MAN

Needs for transpiration: The need for transportation in living organism include: (i) Transport is necessary for every cell of the organism to obtain all

the essential materials for its metabolism. E.g. nutrients, oxygen, water etc (ii) it is also necessary to remove and dispose metabolic wastes, e.g. carbon dioxide, water, urea etc. (iii) in plants, transport is necessary to move minerals salts and water from the roots to the stems and leaves.

Transport in lower organisms: In lower or unicellular organisms such as Amoeba, paramecium, Euglena and Chiamydomonas, the surface area to volume ratio (SA/V) of the body is large. As a result, essential nutrient like food, oxygen and water as well as excretory products, e.g. water, carbon dioxide, etc move in and out of the body by diffusion. Diffusion, therefore, is most effective when the surface area is large while the thickness or volume is small.

Materials for transport in animals: Materials that are transported in animals include: (i) Oxygen (ii) Carbon dioxide (iii) Urea (iv) Excess salts (v)water (vi) Amino acids (vii) Vitamins (viii) sugars (ix) fatty acids and glycerol (x) mineral salts (xi) Hormones (xii) Antibodies.

Materials for transport in plants: Materials that are transported in plants include: (i) Manufactured food (ii) Excretory products (iii) water (iv) Oxygen (v) Nitrogenous waste products/ latex (vi) Amino acids (vii) Glucose (viii) Lipids (ix) Auxins or hormones (x) Mineral salt

Media of Transportation: The four major media of transportation are:

(1) **Cytoplasm:** cytoplasm is used as the medium of transportation of materials in lower unicellular organisms such as Amoeba and Paramecium

(2) **Cell sap or latex:** Cell sap or latex is used as the medium of transportation of materials in plants

(3) **Blood:** The blood is a powerful medium of transportation of materials in most animals especially vertebrates.

(4) **Lymph:** Lymph is one of the media of transportation in higher animals.

Transport system in man: transport system in mammals especially man provides an efficient way of distribution of materials within the body. This is made possible by blood and lymph which represent the media of transportation in man.

Composition and structure of blood: The blood is a tissue in a fluid form. An adult man has about 5-6litres of blood. The blood is made up of two major components: (i) the blood cells or corpuscles which are solid and (ii) the plasma which is liquid.

Blood cells or corpuscles: There are types of blood cells or corpuscles. These are (a) Red blood cells (erythrocytes) (b) white blood cells (leucocytes) (c) Blood platelets (thrombocytes)

Red blood cells (Erythrocytes): The red blood cells also called erythrocytes are small, round and biconcave or disc-like in shape. They have no nucleus. One cubic litre of blood has about 5½ million red blood cells. Their normal life span is about 120 days (4month) before they are destroyed by the liver. The red blood cells are mainly produced by the bone marrow The red colour of the cells is due to the presence of iron compound called haemoglobin.

Function: The pigments, haemoglobin in the red blood cells help to transport oxygen from the lungs to the body cells.

White bloods cells (Leucocytes): The white blood cells which are also called (Leucocytes) are irregular and amoeboid is shape. They are made in the red bone marrow, the lymph nodes or the spleen.

Function: The white blood cells help to defend the body against diseases.

Blood platelets (Thrombocytes): The blood platelets, also called thromobocytes, are tiny, irregular cell fragments without nucleus they are produced in the red bone marrow.

Functions: Plasma aid in the component of the blood. It is a pale yellow liquid, made up mainly of water (about 90% water). Many substances are dissolved in it including plasma protein, antibodies, hormones, enzymes, gases, digested food, salt and other waste products.

Functions: It helps to transport the substances that are dissolved in it as well as the cells that float in it.

Lymph: The lymph is a colourless liquid associated with the lymphatic system. It is a fluid, similar in composition to the tissue fluid but contain extra lymphocytes. It has no red cells.

Function of Lymph: (1) the lymph aid body defence. (2) Absorption of fatty acids and glycerol

Function of blood: The mammalian blood performs a number of functions which include: (1) Transport oxygen (2) Temperature regulation (3) transportation of digested food (4) transportation of excretory products (5) transportation of hormones (6) Defence against infection (7) production of antibodies (8) blood clotting (9) transport of water

Body defence Functions of the Blood: The blood is able to defend the body against disease-causing organisms such as bacteria, viruses etc in four major ways: these are (1) clumping (2) neutralization (3) engulfing (4) clotting

Process of blood clotting: when the body sustains an injury in which a blood vessel is cut, the process of clotting takes place as follows (i) platelets plug are formed due to exposure of damaged blood vessels to air (ii) the platelets release a chemical which causes involuntary muscles in the walls of the damaged blood vessels to constrict and so reducing blood flows. (iii) In case the damage is so great to be sealed by a plug, the platelets release an enzyme called thrombokinase or thromboplastin. (iv)The thrombokinasecionverts an inactive prothrombin into an active enzyme called thrombin. (v) The thrombin in the presence of calcium salt (Ca^{++} ions) converts fibrinogen into fibrin. (vi) The fibrin forms a mesh of fine threads which traps blood cells forming a clot that covers the wounds. (vii) The mesh of fibrin blocks the cut in the blood vessel and prevents further bleeding.

The clot dries to form a scab which drop off after a new skin tissue is formed in the injured area.

WEEK 8

CIRCULATORY SYSTEMS IN MAMMALS

Types of circulatory system: circulatory systems in animals can be grouped into three major categories:

(1) Closed and opened circulatory systems

(i) Closed circulatory system: The closed circulatory systems are made up of blood vessels called arteries from the heart which branch many times into small units called capillaries but eventually join up with other vessels

called veins that are connected to the heart. By this design, blood is therefore always confined within the cavities of the vessels and the heart and never comes into directs contact with the cells of the body.

(ii) Opened Circulatory System: In the system, the blood vessels lead out of the heart but end in blood spaces, the blood comes into direct contact with the cells after which it is returned to the heart. Arthropods and some molluses have opened circulatory systems.

(2) Single and Double circulatory systems

(i) Single Circulatory System: in a single circulatory system, the blood only passes through the heart once every time it makes one complete movement round the body.

(ii) Double Circulatory System: in double circulatory system, the blood only passes through the heart twice every time it makes one complete movement round the body

(3) Pulmonary and systemic circulation

(i) Pulmonary Circulation: The pulmonary circulation involves the movement of blood between the heard and the lungs.

(ii) System Circulation: The systemic circulation involves the movement of blood between the heard and all other parts of the body besides the lungs

Blood vessel and the heart: The circulation of blood in mammals is made possible with the aid of blood vessels and the heart.

Blood Vessel: The blood vessels are the tubes within the body through which the blood flows away or to the heart. There are three major types of blood vessel. There are arteries, veins and capillaries.

Differences between Artery and Vein

S/N	ARTERY	VEIN
i.	It has thick/muscular wall	It has thin/less muscular wall
ii.	It has elastic wall	Its wall is non elastic
iii.	It carries blood away from the heart	It carries blood to the heart
iv.	It carries oxygenated blood, except	It carries deoxygenated blood,

	the pulmonary artery	except pulmonary vein
v.	Blood in it is pink or bright red in colour.	Blood in it is dark red in colour
vi.	It is situated deep in the muscles	It is superficially located or situated
vii.	It has small lumen	It has large lumen
viii.	Pressure is high	Pressure is low
ix.	Pulse is readily detectable	Pulse is not readily detectable
x.	It has no valve except semiluna	It has valves

WEEK 9

The Heart: The human heart is a muscular and the most powerful organ responsible for the pumping of blood round the body.

Heartbeat: The heartbeat is caused by alternate contraction and relaxation of the four muscular chambers of the hearts. The heartbeat is caused by alternate contraction and relaxation of the four muscular chambers of the heart. The heartbeat occurs in two stages which are the diastole and systole.

Processes which aid transportation in plants: Transportation of materials in plants is aided by the following processes: (i) Translocation (ii) Transpiration (iii) Absorption of water and mineral salts (iv) Transport of water in the xylem tissue.

Translocation: Translocation is the process by which manufactured food substances are transported from where they are manufactured to tissues where they are needed or stored. Translocation normally begins from the leaves to other parts of the plant. Phloem is the tissue through which these manufactured food substances are translocated.

Substance or material commonly translocated in plants include sugar, glucose or carbohydrates oil, resins, proteins of amino acids, alkaloids and hormones.

Transpiration: Transpiration is defined as the removal of excess water from plant into the atmosphere in form of water vapour. Plants are capable of loosing excess water through:

(i) The stomata in the leaves and this is called stomata transpiration

(ii) Through the lenticels in the stem and this is called lenticular transpiration

(iii) Through the cuticle of the leaf surface in what is called cuticular transpiration.

Factors affecting the rate of transpiration

(1) The size of the stomata pores (2) Humidity (3) Temperature (4) Light

(5) Wind (6) Soil Water

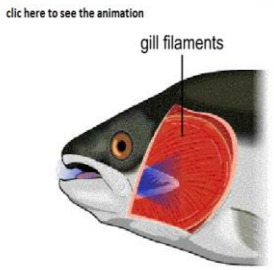
Importance of Transpiration in Plant

i. It enables plants to absorb water and mineral salts from the soil.

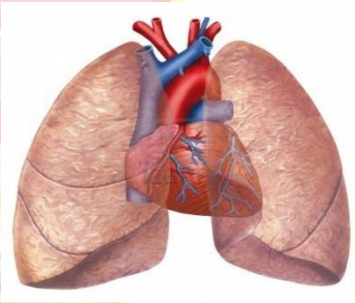
ii. It facilitates the movement of soil water. (ii) The evaporation of water due to transpiration from the plants, cools the plants.

iii. It helps to remove excess water from the plants.

WEEK 1
2ND TERM
RESPIRATORY SYSTEMS



GILL OF FISH



HUMAN LUNGS

Respiration is defined as a biochemical activity of the cell in which glucose is broken down by a series of reactions controlled by enzymes to release energy.

Phases or stages of Respiration

Respiration takes place in two phases or stages. These are external and internal (tissue) respiration.

(1) **External Respiration (Breathing):** External respiration or breathing is defined as the exchange of gases between the environment and the respiratory organ of living organisms. In other words, external respiratory simply involves the breathing in of air or oxygen into the lungs. This is simply called inspiration or inhalation and the breathing out of carbon dioxide and water vapour into the atmosphere is otherwise called expiration or exhalation.

(2) **Internal (Tissue) respiration:** Internal or tissue respiration is defined as the oxidation of organic food substances within the cells leading to the release of energy, carbon dioxide and water. In other word, tissue respiration takes place when the oxygen taken in is used up by the individual cell in the body for the Oxidation of food substances. Carbon dioxide, water and energy are given out by these cells in return.

$C_6H_{12}O_6 + 60_2 \longrightarrow 6H_2O + 6CO_2 + Energy$

(Glucose) (Oxygen) (Water) (Carbon dioxide) ATP

Types of respiratory systems: organisms adopt different types of respiratory systems depending on their types, complexity, size and the habitat in which they are found.

Organisms and their respiratory systems

S/N	Organisms	Respiratory system/organ
(i)	Unicellular organisms, e.g. Amoeba and paramecium	Body surface
(ii)	Hydra and tapeworm	Cell membrane
(iii)	Earth worm	Wet skin or body surface
(iv)	Fishes, e.g. tilapia	Gills
(v)	Arthropod, e.g. insects	Tracheal System
(vi)	Arachnids e.g. Spiders	Lung books
(vii)	Tadpoles	Gills
(viii)	Amphibians, e.g. toads and frogs	Mouth, skin and lungs
(ix)	Aves, e.g. lizard	Lungs
(x)	Mammals	Lungs
(xi)	Flowering plants	Stomata and lenticels

Mechanism of Respiratory System in Higher Animals

Fish: The organ for respiratory system or gaseous exchange is the gill. The gills are located at both sides of the head region.

The gills which are in three or four are arranged in the gill chamber. Each gill consists of a gill filament (where gaseous exchange takes place), gill raker (which helps to stop food particles from entrying the gill chamber) and the gill arch (on which the gill filaments are built). The gill chamber is closed externally by operculum.

Mechanism of respiration in mammals: The mechanism of breathing in mammals including man involves two phases or stages. These are external and internal or tissue respiration.

External respiration (breathing): External respiration simply involves the breathing in of air or oxygen into the lungs. This is also called inspiration or inhalation and the breathing out of air (carbon dioxide and water vapour) into the atmosphere or environment is otherwise called expiration or exhalation.

Process of inspiration or inhalation in man: The following processes are involved during inspiration in man: (i) The thoracic cavity first increases in volume. (ii) The diaphragm contracts and becomes flattened. (iii) The intercostals muscles contract. (iv) The sternum is moved forward. (v) The ribs are moved upwards and outwards. (vi) There is an increase in the volume and a decrease or a fall in the pressure of thoracic cavity. (vii) Consequently, air from outside is drawn into the lungs or alveoli through the nose, trachea, bronchus and bronchioles leading to an increase in the size of the lungs.

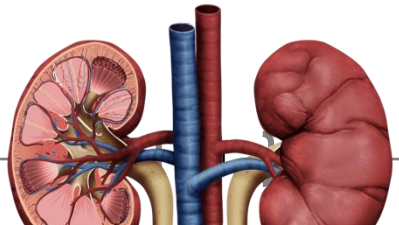
Gaseous exchange: Inspiration is followed by gaseous exchange diffusion of oxygen in the inspired air into the blood capillaries and carbon dioxide and water vapour are able to diffuse out because the alveoli possess all the conditions necessary for all respiratory surfaces.

Process of expiration or exhalation in man: The following process are involved during expiration or exhalation in man: (i) The thoracic cavity first decreases in volume. (ii) The diaphragm relaxes and assumes its dome-shape. (iii) The intercostal muscles relax. (iv)The sternum now moves inwards (v) the ribs are moved downwards and inwards. (vi)There is a decrease in the volume and an increase in the pressure of the thoracic cavity. (vii) Consequently, air containing waste products like carbon dioxide and water vapour from inside the alveoli or lungs are forced out through bronchioles, bronchi, trachea, and finally to outside through the nose. This finally leads to a decrease in the size of the lungs.

Respiratory system in plants: Plants do not have special respiratory organs for gaseous exchange. However, gases move in and out of the plants through the stomata and lenticels.

WEEK 2

EXCRETORY SYSTEMS



HUMAN KIDNEY

Excretion is defined as the process by which waste products of metabolism are removed from the body of living things.

Importance of Excretion

i. The excretory products are harmful to the body and so must be removed

ii. Some are poisonous and must never be allowed to accumulate within the body.

iii. Excretion helps to maintain water balance in the body.

iv. Excretion also helps to maintain salt balance, i.e. homeostasis in the body.

v. Waste product when not removed can interfere with normal metabolic activities of the body.

Excretory system or organs of some organisms

S/N	ORGANISM	EXCRETORY SYSTEMS/ORGANS
1.	Protozoa, e.g. Amoeba	Contractile vacuole, by diffusion
2.	Flatworms, e.g. Tapeworm	Flame cells
3.	Annelids, e.g. earthworms	Nephridia
4.	Insects	Malphighian tubules
5.	Crustaceans	Green glands
6.	Fishes	Kidneys
7.	Amphibians, e.g. toad	Kidneys
8.	Reptiles	kidneys
9.	Birds	Kidneys and lungs
10.	Mammals	Kidneys, skin, liver and lungs
11.	Flowering plants	Stomata and lenticels

Excretion in mammals: There are four types of excretory organs used by mammals. These are lungs, skin, liver and kidneys.

Structure of the kidney: The mammalian kidney is a bean-shaped and reddish brown organ located in the posterior end of the abdomen. The right kidney is slightly lower in the body than the left.

The structure of the urinary tubule: The urinary tubule or nephron is the functional unit of the kidney. Each urinary tubule starts in the cortex as a cup-shaped structure called the Bowman's capsule. The capsule opens into a short coiled tube referred to as the proximal convoluted tubule. Then it straightens out as it passes into the medulla where it makes a U-shaped loop called the Henle's loop before re-entrying the cortex. In the cortex, the tubule becomes coiled again to form the distal convoluted tubule. The tubule bends once again and completes its course in the medulla.

Mechanism of Excretion in Mammals (Formation of Urine):

The processes involved in the formation of urine occur in three phases which are:

1. **Ultra filtration:** In the first phase, blood is brought to the kidney by renal arteries. As it circulates through the capillaries or glomerulus of each Bowman's capsule, water, urea, nitrogenous compounds, mineral salts, sugars, glucose and plasma solutes are filtered into the capsule. This process of filtering materials from the glomerulus into the Bowman's capsule is called ultra filtration.
2. **Selective reabsorption:** At the proximal convoluted tubule and henle's loop, some water, sugars, amino acids and salts which are useful to the body are reabsorbed into the blood capillaries against concentration gradient or by active transport. This process of reabsorbing useful materials back into the blood is called selective reabsorption.
3. **Hormonal secretion:** The fluid in the tubule becomes more concentrated as it flows through the distal tubule where more water is reabsorbed by the action of **Anti-diuretic Hormone (ADH)** and urine is finally formed.

WEEK 3

Excretion in flowering plants: The flowering plants have no special excretory organs. Waste materials are disposed off through various parts of

the plant. Plant wastes, i.e., excretory products, include water, carbon dioxide, oxygen, tannin, acids, resins, mucilage, latex, alkaloids, crystals or salts, oils, gum and anthocyanin. The main excretory organs of flowering plants are the stomata in the leaves and lenticels in the stem.

WEEK 4

NUTRIENT CYCLING IN NATURE

The popular and well known nutrient cycles are nitrogen cycle, carbon cycle, water cycle and decomposition in nature.

The nitrogen cycle: The cycle involve the following processes through which nitrates are added to the soil (a) The process in which atmospheric nitrogen is converted into nitrates which is called nitrogen fixation. During lightening, oxygen combine with nitrogen to form oxides of nitrogen which get into the soil where they form nitrates. (b) Nitrifying bacteria: These are the bacteria in the soil which converts decaying remains of organisms into soil nitrates. When plants and animals die, they decay and release ammonium compounds. The bacteria are (i) Nitrosomonas which converts ammonium compounds to nitrites (ii) Nitrobacters: These converts nitrites to nitrates.

Water Cycle: The processes or pathways of water cycling include the following:

1. Water vapour in the cloud condenses and precipitates as rainfall, snow, hail or sleet.
2. Some of the rain water runs off the ground into streams, lakes, ponds, rivers and oceans.
3. Some of the water percolates or sinks into the soil unit it reaches the rocky layer. It then moves sideways until it breaks out as spring which may flow into rivers, streams, oceans etc.
4. Some of the water from these water bodies and soil get back to the atmosphere or cloud by evaporation.

5. Some of the rain water that sinks into the soil are absorbed by plants for their metabolic activities especially photosynthesis and building of protoplasm.
6. Some of the water absorbed by plans is lost to the atmosphere through transpiration, respiration and excretion.
7. Animals obtain this water through the food they eat and drink
8. Some of the water obtained by animals is returned back to the atmosphere as a result of respiration, urination, sweating, defaecation etc.
9. When plants and animals die, decomposers, release water from their dead bodies into the atmosphere during decomposition.

Carbon cycle: Carbon cycle involves the series of processes which contribute to the circulation of carbon in nature.

Process of carbon cycling

These processes are: (i) Carbon dioxide is removed from the air mainly by photosynthesis during which plants use it to manufacture their food (ii) Carbon is lost in form of carbonates of calcium and magnesium through leaching and drainage.

The atmosphere gains carbon dioxide through: (a) Burning of fuel like coal and wood; (b) The action of volcanoes which releases carbon dioxide; (c) The respiration by plant and animals; (d) The death, decay and putrefaction of plants and animals.

Importance of carbon in nature: (i) Plant uses carbon dioxide obtained from the air to manufacture their food during photosynthesis. (ii) It provides carbon which is the major building block of all organic matter (iii) It helps to purity the atmosphere and maintain atmospheric level of carbon dioxide.

Water cycle: Water cycle is defined as the continuous movement of water from the atmosphere to the earth and from the earth to the atmosphere.

Process of water cycling in Nature

The atmosphere receives water through: (i) Evaporation from oceans and land (ii) Transpiration from plants (iii) Breathing or respiration by plants and animals.

The land receives water through: (i) Rainfall or precipitation (ii) infiltration and percolation

WEEK 7

ASSOCIATIONS

Types of Biological Associations:

Symbiosis: Symbiosis is a close association between two organisms in which both of them benefit from each other.

Examples of symbiotic association are (a) Alga and fungus in lichen (b) protozoa in the intestine of termites (c) Nitrogen fixing bacteria in the root nodules of leguminous plants.

Commensalism: Commensalism is an association between two organisms living together in which only one (commensal) benefits from the association while the other is neither benefited nor is harmed. Examples of commensalism are (a) Remora fish and shark (b) oyster and crab (c) Men and intestinal bacterial.

Parasitism: Parasitism is a close association between two organisms in which one, known as the parasite, lives in or on and feeds as the expense of the other organism which is known as the host. The parasite benefits from the association while the host usually suffers harm or may die.

Examples of parasitism are (a) Man and the tapeworm (b) mistletoe and flowering plant.

Predation: Predation is a types of association between two organisms in which the **predator** kills the other, called the **prey** and directly feeds on it.

Examples of predation are (a) The hawk and chicks of domestic fowls (b) the lion and goat

Competition: Competition involves the interactions among two organisms of the same or different species in which one out grows the other and survives while the other can neither grow nor survive. It is called **intra-specific competition** while it is called **inter-specific competition** if it is between members of different species.

Examples of competitive association are (a) Flowering plants and grasses (b) Domestic fowls and the young chicks.

WEEK 8

Tolerance: Tolerance is the ability of living organisms to withstand or tolerates little unfavourable changes in the environment which affect their survival

Tolerance Range: Tolerance range is defined as the range between the minimum and maximum limits to which organisms can tolerate certain changes in their environment so as to survive.

Geographic Range: Geographic range refers to the area where a species of organism can only be found within the minimum and maximum limits of its tolerance.

WEEK 9

Adaptation: Adaptation is defined as the ability of an organisms to live successfully in a particular habitat as a result of its structure, appearance and behaviour.

Animal Adaptation

(1) Adaptation of Animals to Aquatic Habits

(i) Possession of streamline body for easy movement in water, e.g. Tilapia fish and toad

(ii) Possession of fins for movement as in the case of fish and webbed toes as in toad

(iii) Possession of gills for gaseous exchange in fish and tadpoles

(iv) Possession of swim bladder for the purpose of buoyancy in water, e.g. Tilapia fish.

(2) Adaptation of Animal to Terrestrial Habitat

(i) Possession of powerful limbs for movement, e.g. mammals

(ii) Possession of lungs for gaseous exchange, e.g. mammals, birds, reptiles and cooling, e.g. mammals

(iii) Possession of sweat glands for excretion and cooling, e.g. mammals.

(3) Adaptation of Animal to Aboreal habitat

(i) Possession of wings for flight, e.g. birds

(ii) Possession of hallow bones to make them light, e.g. birds

(iii) Possession of bright colour as well as camouflage, e.g. chameleon

Plants Adaptation

(1) Adaptation of plants to Aquatic Habitat

(i) Possession of waxy cuticles on leaves to prevent wetting, e.g. water lettuce
(ii) Possession of land stem and flower stalk to expose the flowers and leaves, e.g. water lily
(iii) Possession of adventitious roots, e.g. water lettuce

(2) Adaptation of plants to terrestrial Habitat

(i) Possession of extensive root system for anchorage and water absorption e.g. mahogany
(ii) Possession of thick barks on the stems to protect internal tissues
(iii) Possession of numerous leaves to enhance better photosynthesis

Special Adaptation of Some Organisms

WEEK 10

POLLUTION

Pollution: Pollution is defined as the release of toxic or harmful substance into the environment by the nature forces or man and other animals to an extent that cause biological damage to man and his resources. The harmful substances that cause pollution in the environment are called **pollutants**.

Types of pollution

(a) **Air Pollution:** The major air pollution, their sources, harmful effects and their control are outlined below:

S/N	AIR POLLUTION	SOURCES	EFFECTS
1.	Carbon monoxide	Burning of fuel in cars and other combustion engines and some industrial processes	It causes suffocation because it combines with hemoglobin and reduces its ability to carry oxygen which result in death
2.	Sulphur dioxide	Burning from vehicle's exhaust coal mining and cement factory	(i) It causes impaired health such as the irritation of eyes lungs and skin, cough and other respiratory tract diseases. (ii) It can cause acid rain.
3.	Nitrogen oxides	Electrical discharge in air and industrial processes	(i) It forms nitric acid with water in air to form acid rain which corrodes metallic objects (ii) It irritates the skin and respiratory system
4.	Smoke and soot	Burning of substance from	(i) Particles can damage lungs and cause

		industries, machines and coal into the air	discomfort (ii) Soot can cover the leaves of plant thereby reducing photosynthesis (iii) Smoke reduces visibility (iv) It blackens paints on building
5.	Dust Particles	Mining, quarries, machines and industrial process	(i) It irritates respiratory system and cause respiratory diseases such as catarrh and cough (ii) It reduces visibility (iii) Pollen grains containing dust can affect the lungs resulting in asthma.

Control of air pollution: (i) Condition must be created for complete combustion of fuel in internal combustion engines. (ii) Chemical waste should be discharged into the air through fumes chambers (iii) Industries should be sited far away from residential area. (iv) Air should be provided for the miners to the one during mining and for the people in the mining areas.

Noise pollution: The major noise pollution, their sources, harmful effect and their control are outlined below:

Pollutant: Noise

Sources: (i) Factory or industrial noise (ii) Aeroplane or aviation noise (iii) railway engine or locomotive noise (iv) Car horns and sirens (v) High pitched musical sound from loud speaker of drumming (vi) nose from heavy guns or cannon shots (vii) Thunder noise (vii) Noise from generators

Effect of noise pollution: (i) It causes loss off hearing or deafness (ii) Noise can cause emotional disorder, anxiety or lack of concentration (iii) Noise can also cause high blood pressure or hypertension (iv) It causes general irritation or short temperedness.

Control: (i) There should be reduction of noise from loud speakers and car sirens (ii) Legislation should be made against the use of loud speaker in public places (iii) Ban on the use of heavy guns must be placed. (iv) Railways and airports should be sited far away from residential area.

Land pollution: The major land pollution, their sources, harmful effect and their control are listed below:

S/N	LAND POLLUTION	SOURCES	EFFECTS
1.	Refuse	Home, offices industries and markets	(i) It causes offensive odour when the refuse decay (ii) It can cause respiratory disorder.
2.	Sewage	Homes and offices	(i) It results in offensive odour (ii) It serves as breeding ground for disease causing organism
3.	Metal scraps	Abandoned vehicles and machines	(i) It occupies land space (ii) It prevents proper land use
4.	Pesticides and fertilizers	Pesticides spray on crops and fertilizers used in soils	(i) They destroy useful soil organisms (ii) Excess fertilizers can cause soil acidity (iii) It can cause the death of aquatic organisms e.g. fishes
5.	Chemicals, e.g. toxic waste	Chemical waste from industries	(i) These are poisonous to plant and animals

Control of land pollution: (i) Refuse should be burnt in incinerators (ii) Urban wastes should be properly burnt or buried (iii) Sewage should be properly treated before disposal (iv) Legislation should be made by government against dumping of harmful or toxic wastes.

Land pollution: The major land pollutions, their sources, harmful effects and their control are discussed below.

S/N	WATER POLLUTION	SOURCES	EFFECTS
1.	Sewage	City sewage system	(i) It supports the growth of pathogens that can cause diseases, e.g. cholera (ii) It makes water unfit for human consumption (iii) It can kill aquatic organisms (iv) It produces unpleasant odours
2.	Pesticides and fertilizers	Washed by erosion from farms to rivers, stream or ponds	(i) It makes water unfit for human consumption (ii) It leads to rapid vegetative growth of water plants which makes fishing and movement impossible, e.g. Algae bloom (iii) It can destroy aquatic organisms e.g. fish and sea birds
3.	Chemical waste	Industries and ships at harbor	(i) It can kill aquatic organisms (ii) It makes water unfit for human consumption (iii) It can accumulate in human body and become toxic later, e.g. lead and mercury
4.	Excreta of feaces	Human and animals	(i) It produces unpleasant odour (ii) It serves as a medium for the breeding of

			pathogens
5.	Crude Oil (Oil spillage)	Oil drilling, loading and unloading of oil tankers	(i) It destroys aquatic plants and animals (ii) It makes water unfit for human consumption (iii) Food chain is affected (iv) It leads to migration of animals

Control of water pollution: (i) There should be efficient and proper sewage disposal system. (ii) Dumping of refuse or petrochemical by product into rivers, streams or seas should be avoided, (iii) there should be efficient techniques to deal with or prevent oil spillage. (iv) Industries should be sited far away from residential areas.

Method of purifying water: Method involved in purifying water include: (i) boiling (ii) addition of chemicals e.g. alum or chlorine (iii) Filtration (iv) Distillation (v) Sedimentation and boiling (vi) Sterilization, e.g by using U.v. light

Conservation of natural resources: Conservation is defined as the planned and control exploitation as well as judicious use of natural resources to ensure their continuous availability and to preserve the quality or original nature of the environment. In order to ensure continuous use and availability.

Reasons for conservation: (1) to prevent of nature environment or to allow fro continued use of natural resources for man's benefits (2) to preserve rare and valuable species of plants and animals for the future generation or to save them from extinction or permanent destruction. (3) To preserve naturally beautiful sceneries for their aesthetic values. (4) To promote the recycling of some scarce mineral resources, e.g. water

Natural resources that need to be conserved: Natural resources that need to be conserved include wildlife, water, forest, soil, air and mineral resources

THIRD TERM
WEEK 1

Method of Conserving Natural Resources:

(1) **Wild life:** (i) Establishment of game or forest reserves (ii) Establishment of Zoological gardens (iii) Control of hunting to prevent extinction of some animal species

(2) **Water:** (i) Trapping or storage of water in tanks or wells (ii) damming of rivers to allow for more effective management of water (iii) Treatment and recycling of used water

(3) **Forest:** (i) cutting of trees without destroying the undergrowth (ii) Reforestations or encouraging the planting of trees (iii) prevention of bush burning or careless forest fires.

(4) **Soil:** (i) prevention of overgrazing which may cause soil erosion (ii) prevention of indiscriminate felling of trees or deforestation (iii) adoption of better farming practices, e.g. crop rotation so as to prevent erosion leaching, water logging or acidity.

(5) **Air:** (i) prevention of effluents from factories or factory chimneys which may pollute the air or cause acid rain (ii) prevention of fumes from automobile or thermal plants which may affect aerial life or render air unfit for organisms (iii) proper treatment and disposal of sewage

(6) **Mineral Resources:** (i) there should be legislation against indiscriminate mining of mineral resources, (ii) effective and efficient extraction methods of mining should be adopted to prevent wastage. (iii) there should be efficient utilization of available mineral resources for man's use

Importance and Benefits of Conservation of Natural Resources

Benefits of wildlife resources conservation: (i) it provides food for human consumption, e.g. meat, fish, eggs etc. (ii) it generates revenue for government.(iii) it serves as tourist centre for pleasure and relaxation.

Benefits of forest resources conservation: (i) forests are sources of food supply e.g. fruit, vegetables, meats etc. (ii) forest are source of timber for construction purpose, (iii) forests provide medicinal herbs.

Benefits of soil resources conservation: (i) Air provides oxygen used in respiration by plants and animals. (ii) it provides carbon dioxide used by pants for photosynthesis. (iii) air also provide gaseous nitrogen used by plant to manufacture proteins

Benefits of mineral resources conservation:)(i) mineral resources provide fuel, e.g. coal, petroleum and natural gas, for use. (ii) they are used for

construction purpose, e.g. iron, zinc, aluminum, (iii0 some are used for industrial development, e.g. diamond, iron, copper, sliveretc

Ways of ensuring the Conservation of Natural Resources

1. Establishment of agencies for conservation
2. Establishment of game reserves or national parks
3. Making of conservation laws, edicts or decrees
4. Conservation education
5. Setting standards for pollution control

Problems and Difficulties Associated with Conservation

(i) Soil erosion cause by natural wind, rainfall and run-off

(ii) Land, air and water pollution

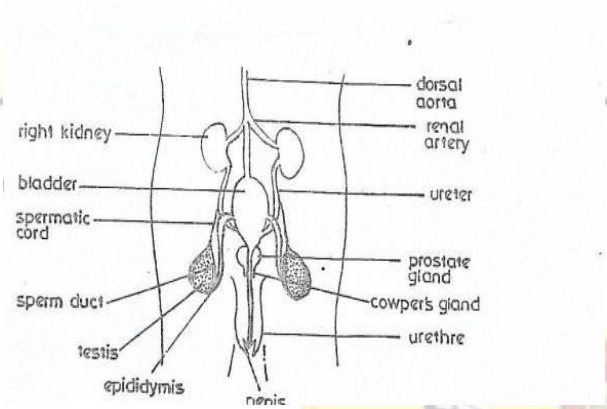
(iii) Occurrence of natural disaster such as earthquake and floods

(iv) Overgrazing caused by domestic livestock

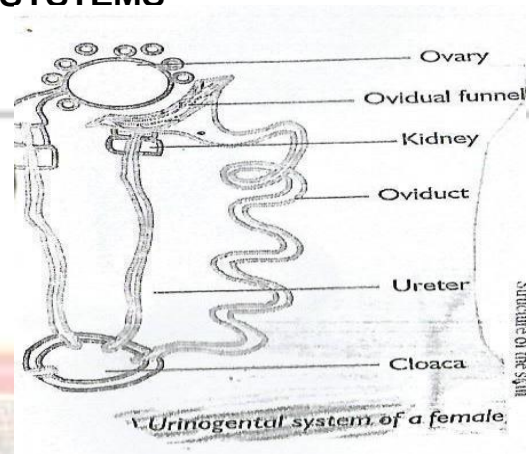
(v) Indiscriminate hunting, leading to eradication of wildlife

WEEK 2

REPRODUCTIVE SYSTEMS



MAN REPRODUCTIVE ORGANS



BIRD REPRODUCTIVE ORGANS

Reproduction is defined as the ability of living things to give rise to new individuals of the same species. There are types of reproduction which are:

i. Sexual Reproductive
ii. Asexual Reproductive

Reproductive System in Fish

Fishes are aquatic vertebrates that reproduce sexually. The reproductive system of both male and female fish is located within the abdomen. Some fishes live together in large numbers and they are unisexual. Their females can pass out up to ten million eggs at a time; male will be stimulated to shed their sperms, but many eggs will not be fertilized. Fertilization in fish is external except in cartilaginous fish like elasmo branch that undergoes internal fertilization. In many species of fish, once the eggs are laid, there is no parental care but if there is, it is usually carried out by male.

The male and the female fish display courtship and copulation take place. The female receives sperm from the male in its cloacae.

The male reproductive system Tilapia, a bony fish consists of two testes which are elongated and are suspended in abdominal cavity of the fish. Each testis is located on each side of the alimentary canal and is joined posteriorly where they have a single duct which opens at the genital aperture. The female Tilapia consists dorsal wall in the abdominal cavity. They are enclosed in a sac which leads by a single duct to the genital aperture.

WEEK 3

Reproductive System in Reptiles

Reptiles are completely terrestrial vertebrates. They exist as both male and female and so reproduce sexually unlike the fish which breeds in water. Fertilization in reptiles is internal in which after mating, the female lays fertilized eggs.

The eggs are produced in the ovaries and are passed down the oviducts which open to the outside at the cloaca. When the egg is released, it consists of the sex cell and its nucleus with some yolk as food supply. As the egg travels down the oviduct, albumen and shell materials are secreted on the egg by special glands. Sexual display or courtship serves to bring both sexes closer together for the purpose of mating.

Male reptile havecopulatory apparatus. After fertilization, the eggs remain and grow to a certain stage inside the female's body. Fully matured eggs are laid in the soil where they develop using their store of food and water and the heat of the sun.

When due, they hatch into small versions of the adult.

The young fend for themselves into adulthood. The Male Agama lizard has two ovoid testes located in the abdomen. The right testis is slightly anterior in position to the left testis. Tiny tubes called vas deferens lead sperm cells to a coiled epididymis which lies along the outer edge of the testis.

Each epididymis passes over the ventral surface of the kidneys on its side and opens into the posterior chamber near the two protrusiblepenis. Penis is a hollow cylindrical structure which releases sperms into the female body for fertilization.

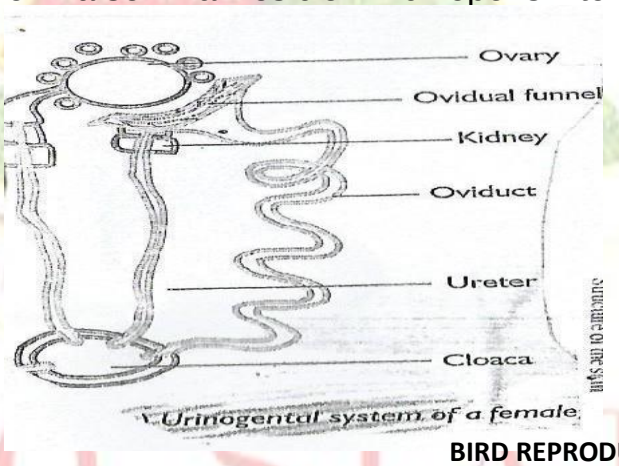
The female Agama lizard has two ovaries that are located in the abdomen. Eggs from the ovaries are discharged into the abdominal space. Each oviduct is a thin walled, wide and twisted tube. the oviduct opens posteriorly into the cloaca near the openings of the uterers. During copulation, the protrusible penis of the male penetrates through the female cloaca into the opening of the oviduct to discharge the seminal fluid which contain the sperm.

WEEK 4

Reproductive system in birds

Like reptiles, fertilization in birds is internal, birds are completely terrestrial animals. After mating, the females lay fertilized eggs. Eggs are produced in the ovaries and are passed down the oviduct which opens to the outside at the cloaca. In female bird, only the left oviduct is developed. It has a very wide funnel for receiving the large eggs from the ovary while the right oviduct is vertigial due to the large size of the eggs. When the egg is released, it consists of the sex cell and its nucleus with some yolk as food supply. As the egg travels down the oviduct, albumen and shell material are secreted on the egg by special glands.

The male reproductive system of birds have two large and ovoid tsetse which are attached to the outer edges of the kidneys. A vas deferens leads from each testis towards the hind end alongside the ureter. The testis is opened posteriorly to form a seminal vesicle which opens into the cloaca.



BIRD REPRODUCTIVE SYSTEM

Structure and functions of the male mammalian reproductive system

The male mammalian reproductive system, e.g. man, consists of the following structures:

(i) **Testes (testis-singular):** All male mammals have two oval-shaped testes inside two sacs of skin (scrotal sacs).

Functions: (i) The testes produce the sperms. (ii) They also produce the male sex hormone (testosterone)

(ii) **Seminiferous tubules:** These are located within the testes

Function: These are points where sperms are produced within the testes.

(iii) **Epididymis:** Epidydimis is also found within the testes. It is a long, coiled tube.

Function: Epidydimis collects and stores sperms temporarily until they mature.

(iv) Vas deferens or sperm duct: Sperm duct is a narrow tube which leads from the epididymis to the seminal vesicle.

Function: (i) it carries or conducts sperms from epididymis to the seminal vesicle.

(v) Seminal vesicle: The seminal vesicle is a small sac where sperms are stored.

Functions: (i) it stores sperms until they are ejaculated. (ii) it secretes part of the seminal fluid.

(vi) **Prostate gland:** the prostate gland is connected to the urethra through many tubules.

Function: it secretes part of the seminal fluid which activates the sperms.

(vii) **Cowper's gland:** Cowper's gland is located very close to the prostate gland.

Function: it secretes a part of the seminal fluid.

(viii) **Urethra:** The urethra is a narrow tube which prolonged into the penis.

Functions: (i) it aids the passage of sperm into vagina. (ii) It aids the passage of urine out of the body.

(ix) **Penis:** the penis is an intermittent organ for introducing sperms into the female reproductive organ (vagina).

Function: it helps to introduce the sperm into the vagina of the female animal.

Structures and functions of female mammalian reproductive system: the female mammalian reproductive system consists of the following structures:

(i) Ovaries: there are two ovaries in a woman located on the dorsal surface of the abdominal cavity.

Functions: (i) ovary produces the eggs or ova. (ii) it produces female sex hormones called oestrogen and progesterone.

(ii) **Oviduct or fallopian tube:** the oviduct or fallopian tube is a long narrow tube with a funnel-shaped opening which receives eggs(ova) releases by the ovary.

Functions: (i) fertilization takes place in the oviduct

(iii) Uterus or womb: the uterus is a muscular organ in whose cavity the zygote develops into a baby.

Function: this is the part in which the embryo or foetus develops.

(iv) **Vagina:** the vagina is a muscular tube that leads from the uterus to the outside of the body.

Functions: (i) it receives sperms from penis during sexual intercourse.

(v) **Cervix:** the cervix is a ring of muscle with tiny aperture that closes the lower end of the uterus where it joins the vagina.

Function: it controls the opening and closing of the vagina especially during birth.

(vi) Vulva: the vulva is the collective name for all the external parts of the female reproductive organ.

Functions: (i) it allows the passage of penis into the vagina. (ii) it permits passage of foetus during birth.

(vii) Clitoris: The clitoris is a small sensitive organ which corresponds to the penis in the male

Function: It helps to stimulate the female during sexual intercourse

Structures of mammalian gametes: The reproductive sex cells are also known as gametes. The formation of gametes of gemetogenisis takes place in the gonads.

Male Gametes: The male sex cells or gametes called sperms are produced in the testes by a process called spermatogenesis. The gametes is unicellular in nature.

The sperm or spermatozoon consists of a head which contains the nucleus, a middles piece and a whip-like tail or flagellum.

A human sperm is about 0.05mm long and microscopic and is usually smaller than the egg (ovum)

Female gametes: The female sex cell or gametes called the egg or ova are produced in the ovaries by a process called oogenesis. The human female gametes are larger than the sperms. Each ovum is about 0.1mm in diameter. It consists of the cytoplasm, a nucleus in the centre, granules and yolk droplets. The yolk provides a source of nourishment for the embryo, especially at the early stages of development.

Comparison of reproduction in vertebrates

Types of mammals vertebrate	Fish	Amphibian	Reptiles	Birds	
Time of Breeding	Seasonal	Seasonal	Seasonal	Seasonal	Seasonal except in humans
No of egg laid	Very many	Many	Few	Few	Few
Mode of fertilization	External	External	Internal	Internal	Internal
Feeding of embryo	From yolk and albumen	From yolk and albumen	From yolk and albumen	From yolk and albumen	From mother through placenta
Mode of zygote growth	Mostly oviparous	Mostly oviparous	Mostly oviparous	Mostly oviparous	Mostly viviparous
Parental care	Mostly none	None	None	Occurs for a short time	Occurs for a long time

WEEK 7

Reproductive System in Flowering Plants

The flower is the reproductive structure of flowering plants.

The structure of a flower: A flower is a cluster of modified leaves which is borne on a shortened stem. The flower stalk of pedicel. The flower is made up of four floral parts. These are (i) The calyx (ii) The corolla (iii) the androecuim (iv) The gynoecium.

i. **The calyx**: The calyx consists of sepals which are usually small and green. This protects the flower which is in the bud. The outermost whorl of a flower is made up of three to five sepals. They may be separated (Polysepalous) or joined to form a cup (gamosepalous)

ii. **The corolla:** The petal collectively known as the corolla form the second whorl or floral part inside the sepals. In many plants, they are the eye-catching part of the flower. Most flowers have four to ten petal which may be separated (polypetalous) or joined to form a tube (gamopetalous). Generally, petals are brightly coloured and scented which attract pollen transferring animals (pollinators).

iii. **Androecium:** The androecium is the male reproductive organs of a flower. The whorl inside the petals is a group of stamens collectively known as androecium. Most stamens have:

(i) A long slender stalk called the filament.

(ii) A swollen end called the anther.

iv. Gynoecium: The gynoecium is the female reproductiveorgan of a flower. It is the innermost whorl of the floral parts of the flower. The gynoecium consists of carpels.

Apistil with a single carpel is described a monocarpous, e.g. flamboyant, while one with two or more carpels is known as polycarpous, e.g. Hibiscus. When the carpels are free from one another, the pistil is said to be apocarpous, e.g. rose flower, but when they are fused together, it is described as syncarpous, e.g. lilies.

Pistils have the followings (i) ovary (ii) style and (iii) stigma.

The ovary contains one or more ovoid structures called ovules. Each ovule houses a female gametes or egg cell. After fertilization, the ovary develops into a fruit while the ovules develop into seeds.

Summary of Parts of a Flower and their Functions

S/N	PART OF A FLOWER	FUNCTION
i.	Pedicel	Attaches the flower to the stem
ii.	Receptacle	Carries and holds together the other parts of the flower
iii.	Sepals (calyx)	Enclose and protect the other floral parts when the flower is in the bud stage. If brightly coloured, they also attract insects, if green, they make plant food

		(photosynthesis).
iv.	Petals (Corolla)	Attract insect which pollinate flower
v.	Filament	Holds or carries the anther
vi.	Anther	Contains the pollen grains
vii.	Pollen grains	Produce the male gametes that fertilise the ovules
viii.	Stigma	Receives pollen grain at pollination
ix.	Style	Connects the stigma to the ovary, and it is the passage for the pollen tube to reach the ovules
x.	Ovary	Contains the ovules, develops into fruits
xi.	Ovules	Produce the female gametes, develop into seeds.

Types of Ovary

1. **Superior Ovary:** An ovary is described as superior when is placed above the other floral parts, namely: the calyx corolla and stamens on the receptacle e.g. Hibiscus. The flower having this type of superior ovary is described as hypogenous flower.
2. **Half inferior ovary:** An ovary is described as half inferior when the ovary lies inside a cup-shaped receptacle and other floral parts appear to be attached slightly above it or almost at the same level, e.g. rose flower. The flower having this type of half inferior ovary is described as perigynous flower.
3. **Inferior ovary:** An ovary is described as inferior when it is placed below the other floral parts, namely the calyx, corolla and stamens on the receptacle. That is, other floral parts are above it on the receptacle, e.g. cana lily, sunflower. The flower having this type of inferior ovary is described epigynous flower.

Terms Used in Describing Flowers

(i) **Inflorescence:** Inflorescence is a group of flowers which attached themselves to a common stalk or axis, e.g. pride of Barbados.

(ii) **Solitary flower:** A solitary flower is one that is attached singly either to the leaf axis or the tip of a branch, e.g. Hibiscus and pawpaw flower.

(iii) **Perfect flower:** A perfect flower is one that has both carpals and stamens in it, e.g. pride of Barbados.

(iv) **Imperfect flower:** An imperfect flower is one in which either stamens or carpals are naturally missing, e.g. maize flower.

(v) **Complete flower:** A complete flower is the type that has naturally all the four floral parts namely; calyx corolla, androccium and gynoecium e.g. Hibiscus, pride of Barbados.

(vi) **Incomplete flower:** An incomplete flower is the type which lacks one or more of the floral parts, e.g. maize and pawpaw flowers.

(vii) **Regular flower:** A flower is regular if it has all members of a whorl on it, i.e. petals identical in shape and size, and are evenly arranged on the receptacle. Such a flower can be cut vertically into two similar halves through any one of several vertical places (radial symmetry) and is described as actinomorphic flower, e.g. Hibiscus.

(viii) **Irregular flower:** An irregular flower is one in when the members of a whorl, e.g. petals, are not similar either because some parts are fused, some are smaller than others or because one or more parts are missing. The flower can be cut vertically into two similar halves through only one plane (bilateral symmetry) and is described as zygomorphic flower, e.g. pride of Barbados and Delonix.

(ix) **Auxiliary flowers:** Auxiliary flower are the those which are borne in the axils of leaves.

(x) **Terminal flowers:** Terminal flower are borne at the end of stems or branches

(xi) **Bisexual flower:** A bisexual flower also called a hermaphrodite has both the carpals (female) and stamens (male) on it, e.g. pride of Barbados, Hibiscus.

(xii) **Unisexual flower:** A unisexual flower is the type that has either stamens or carpels as its sexual parts. A flower that has only carpels is female flower and such flower is described a pistillate, e.g. maize,

pawpaw. On the other hand, any flower that has only stamens is a male flower hence it is described as staminate, e.g. pawpaw, maize.

(xiii) **Monoecious Flower:** when male and female flower are found on the same plants, the plants is said to be monoecious, e.g. oil palm, maize.

(xiv) **Dioecious flower:** when male and female flowers are found on different plants, the plant is said to be dioecious, e.g. pawpaw.

(xv) **Essential parts of a flower:** the stamens and carpels are regarded as the essential parts of the flower because they produce the gametes required for fertilization to take place resulting in the formation of seeds or fruits.

(xvi) **Non-essential parts of a flower:** the petals and the sepals are regarded as the non-essential parts of a flower because they are not required for gamete production in flowers.

Placentation in flowering plants: Placentation is defined as the arrangement of the ovules within the ovary. There are various ways in which the ovules are attached to the ridges of the ovary. These ovules are attached to the ovary by fleshy structures called placentae (singular placente) though short stalks called funicles kinds of placement.

1. **Marginal Placentation:** In marginal plecentation, the ovules are attached to the placenta along one margin of the ovary. Examples are bean, cowpea, pride of Barbados etc.
2. **Parietal placetation:** In this arrangement, the ovules are attached to the sides of a syncarpous ovary having a single chamber e.g. pawpaw.
3. **Free-central placentation**:In this type of arrangement, the ovules are borne on a knob which project from the base of the ovary, e.g. cana lily.
4. **Axile placentation:** In an axile placement, the carpels of a syncarpous ovary meet in the centre of form the placenta to which the ovules are attached, e.g. tomato.
5. **Basal placentation:** In basal placentation, the ovules are attached to the base of a syncarpous ovary, e.g. sunflower.

WEEK 9

POLLINATION IN PLANTS: Pollination is defined as the transfer of mature pollen grains from the anthers of one flower to the mature stigma of the same flower or another flower of the same plant or closely related species.

Types of pollination

There are two types of pollination. These are self pollination and cross pollination.

Self Pollination: Self pollination is the transfer of mature pollen grains from the anther of a flower to the stigma of the same flower or to that of another flower of the same plant, e.g. pea, cotton, tomato.

Cross pollination: Cross pollination is the transfer of mature pollen grains from the anther of a flower to the stigma of a flower of another plant of the same or closely related species, e.g. morning glory, Hibiscus, pride or Barbados.

Agent of pollination: Agents of pollination include insects, wind, water and other animals like snails, bird, bat and man.

Conditions or devices which aid self pollination: Some plants have condition or device which aid self pollination to take place. These conditions are homogamy and cleistogamy.

Homogamy: Homogamy refers to the ripening of the anthers and stigmas of a bisexual flower at the same time.

Cleistogamy: Cleistogamy is defined as a condition in which ripe pollen grains are deposited on the stigma which becomes ripened at the same time.

Conditions or devices which may aid cross pollination to take place. These are dichogamy, unisexuality and self-sterility.

Dichogamy: Dichogamy refers to the ripening of the anthers and stigmas of a bisexual flower at different times. Dichogamy occurs in two ways. These are protandry and protogyny.

(a) Protandry: Protandry refers to the condition in which the anther of a flower mature earlier than the stigma of that flower or other flower of that same plant so that the mature pollen grains are only useful to flower of other plants which have mature stigma to receive them.

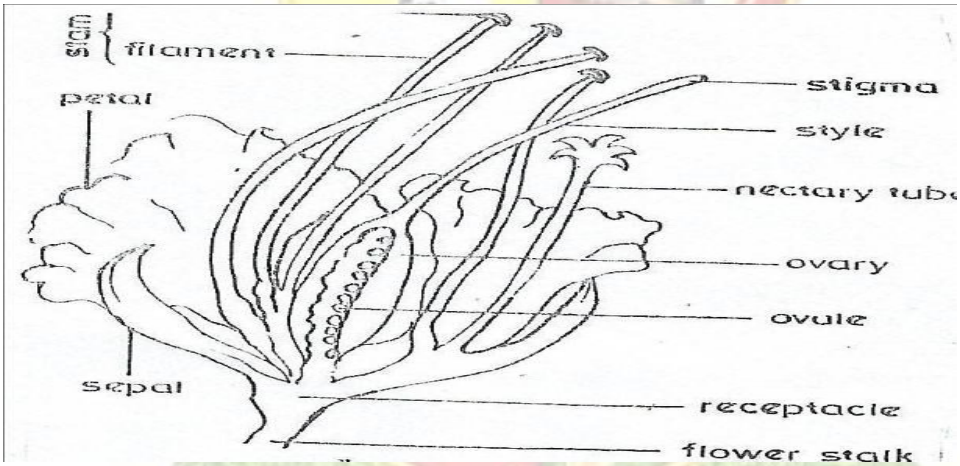
(b) **Protogyny**: Protogyny refers to the condition in which he stigma of flowers of the same plant so that it can only receive pollen grains from flower of other plants.

(c) **Unisexuality:**Unisexuality is a situation in which some plants bear only male or female flower and not both on the same plant. E.g. pawpaw

Self-sterility: Self sterility refers to situation in which some plants make themselves sterile.

WEEK 10

Major Agent of Pollination



Two major agents or pollinations are wind and insects.

Characteristics of insect pollinated flowers:(i) They have large conspicuous petals/sepals (ii) Flower are usually brightly coloured (iii) They posses scent (iv) Nectar is also present. (v) Pollen grains are rough, sickly and relatively few. (iv) The stigma is flat with sticky surface to enable it receive pollen grains.

Examples include Hibiscus, Delonix, cowpea, crotalaria pride of Barbados etc.

Characteristics of wind pollinated flower:(i) They have small, inconspicuous petals/ sepals (ii) flower are usually dull coloured (iii) There is absence of scent (iv) There is absence of nectar (v) Large quantity of pollen grains are produced. (vi) Pollen grains are small, smooth, light and not sticky (vii) stigma is elongated an sticky with large surface area.

Examples are maize, guinea grass, rice, millet and wheat.

Differences between insect Pollinated Flower and Wind Pollinated flower

S/N	INSECT POLLINATED FLOWER	WIND POLLINATED FLOWER
i.	Flower are usually large and conspicuous	Flower are usually small and inconspicuous
ii.	Flower are usually brightly coloured	Flowers are usually dull coloured
iii.	There is presence of scent	There is absence of scent
iv.	Nectars are present	Nectars are absent
v.	Pollen grain are rough sticky and relatively few	Pollen grains are light, smooth and very numerous
vi.	Anthers may or may not be enclosed by the petals	Filaments are long so that anthers hang outside the flower.

S.S.THREE

WEEK 1

REGULATION OF INTERNAL ENVIRONMENT

Homeostasis: Homeostasis is defined as the maintenance of a fairly constant internal environment in an organism.

Parts involved in homeostasis: Part of the body which are involved in homeostasis are: (i) kidneys (ii) liver (iii) skin (iv) Dustless glands (hormones) (v) brain. (The brain has overall control of the homeostasis processes in the body).

Functions of the kidneys: (1) Osmoregulation (2) Excretion (3) Maintenance of acid base balance.

Diseases of the kidneys

(1) Diuresis: Diuresis is a condition in which the cells of the kidney tubules are not reabsorbing water from the glomerular filtrate and as a result, a large amount of water is passed out in urine.

Effects of diuresis: (i) It lead to excretion of large amount of urine (ii) Diuresis leads to loss of weight (iii) it also leads to emaciation

Remedy: (i) Surgical operation should be performed on the patient (ii) Drugs such as diuretics should be administered to get rid of excess water in the body.

(2) Nephritis: Nephritis is a condition in which the blood vessels in Bowman's capsule (Glomerular) become inflamed and porous as a result of which they cannot carry out the function of ultra-filtration completely.

Effects of Nephritis

(i) Inflammation of the kidney (ii) presence of amino acids in urine (iii) weakness of the body (iv) fever and (v) pains.

(3) Kidney stones: A Kidney stone is caused by some diseased growths within the tubules.

Effects of kidney stones:

(i) It obstructs the passage of urine (ii) Pain is experienced on passing out urine.

Remedy

(i) Surgery called Diabinese can be performed. This involves the opening up of the kidney to remove the stones.

(4) Dropsy or Oedema: Dropsy is a condition in which the cells of Bowman's capsules are unable to absorb water from the blood in the tubules.

Effects of Oedema(i) It leads to swelling in faces and ankles.

(ii) It causes sluggishness.

Remedy:

(i) The patient should seek medical treatment by specialist doctor

(ii) (ii) There should be reduction in the intake of water

(iii) Kidney transplant can be performed if the condition is critical.

The Liver:The Liver is one of the most important organs in the body of a mammal. Its average weight is about 1.25kg. The liver lies below the diaphragm and it is located on the right side of the abdomen. The liver is dark-red in colour.

Functions of the liver:

(1) Regulation of blood sugar (2) Detoxication (3) Regulation of blood protein

(4) Production of bile (5) Formation of red blood cells (6) Production of heat

(7) Regulation of lipids (8) Manufacture of essential proteins (9) Breakdown of

red blood cells (10) Storage of vitamins (11) Storage of iron (12) Reservoir of blood.

Diseases of the Liver

(1) **Diabetes mellitus:** This diseases is caused as a result of the inability of the liver cells to convert excess glucose in the blood to glycogen. This is as result of the failure of the pancreas to produce hormone called insulin.

Effects of diabetes mellitus:

(i) It results to continuous dehydration. (ii) It may cause exhaustion or muscular weakness. (iii) it may lead to blurovision.

Remedy:

(i) Drugs like Diahinese should be used

(ii) There must be regular doses of insulin injection

(iii) Carbohydrates food must be avoided.

(2) **Infective hepatitis:** This is the inflammation of the liver.

Effects of infective hepatitis: (i) It leads to loss of appetite (ii) It causes severe headache and nausea.

Remedy:(i) Drugs must be administered (ii) Patient should be placed on special diet.

(3) **Gall stones:** Gall stones are hard objects which are formed in the bile duct and block the passage of the bile.

Effects of gall stones:

(i) Gall stones lead to yellowing of the skin and eyes

(ii) It results to inability to digest fats and oil properly.

Remedy:(1) Drugs must be effectively administered (ii) The stones may be dissolved by oral feeding on a bile acid.

(4) **Cancer of the liver:** This is a distorted form of production of liver cells.

Effects of cancer of the liver:

(i) It leads to general weakness of the body

(ii) The body is exhausted.

Remedy:(i) Surgery can be done if detected early in life. (ii) The cancer can be destroyed by the use of radiation (radiology or chemotherapy.

(5) **Cirrhosis of the liver:** This is a serious liver disease in which the damaged liver cells become replaced by dead and useless fibrous tissue.

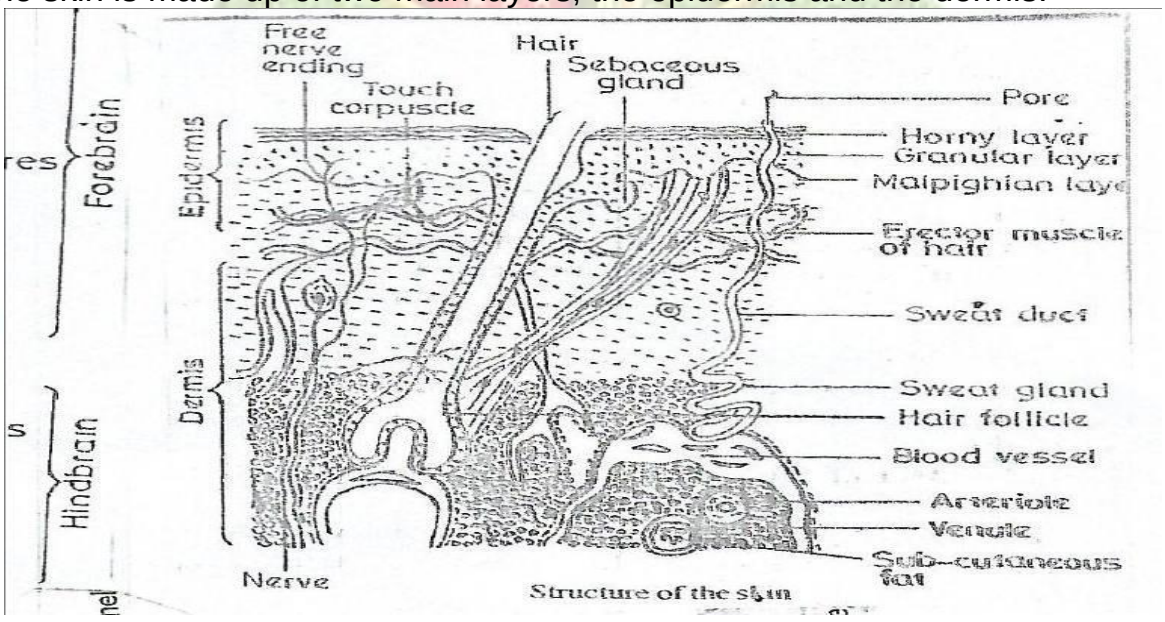
Effects of Cirrhosis:(i) It results to general weakness of body (ii) It leads to loss of appetite.

Remedy: (i) Patient should avoid alcoholic drinks (ii) Surgery may be done on the patient.

Week 2

The skin: The skin of mammals is the largest organ of the body; it covers the entire surface of the body. Apart from bones and cartilages, the skin is the toughest tissue in the body.

The skin is made up of two main layers, the epidermis and the dermis.



The Epidermis:The epidermis is the outer layer of the skin. It is made up of three layers. These are cornified layer, granular layer and malpighian layer.

Dermis:The dermis is composed mainly of connective tissues containing blood capillaries, hair follicles, sweat glands, sebaceous glands, sensory nerve endings and fat cells.

Functions of the skin

The important functions of the skin include: (1) Protection (2) Excretion (3) Sensitivity (4) Production of vitamin D (5) Production of milk (6) Storage of food (7) Regulation of body temperature (i) Poikilothermic animals (ii) Homoeothermic animals.

***Regulation of body temperature by the skin*:** The mammalian skin helps to regulate the body temperature in specific ways as explained below:

On a hot day, weather or environment: A mammal keeps its body temperature constant. A rise in body temperature as a result of rise in environmental temperature stimulates the following processes to get rid of excess body that: (i) Vasodilation (ii) Sweating (iii) Decreasing metabolic rate (iv) Lowering of hairs.

On a cold day, weather or environment: A mammal is able to keep its body temperature constant. A fall in body temperature as a result of a fall in environmental temperature stimulates the following processes to produce and conserve heat: (i) vasoconstriction (ii) sweating (iii) increasing metabolic rate (iv) raising of hairs.

Care of the skin: Major care of the skin include: (1) regular cleaning (2) exposure to fresh air (3) eating of balanced diet (4) regular exercise (5) dressing of wounds or cuts (6) proper treatment of skin diseases (7) wearing of clean clothes (8) avoidance of the use of injurious chemicals

Animal hormones

Hormones are organic chemicals or biochemical substances produced in minute quantities in one part of an organism and transported to the site of action where they exact specific effect to control body metabolism. The main endocrine glands found in most vertebrate are:

(i) Pituitary gland (ii) Thyroid gland (iii) Parathyroid (iv) Adrenal gland (v) Pancrea (vi) Glands of the gonads. Some of the major hormones, the glands from which they originate and their effects.

Endocrine	Location	Hormone secreted	Function/Effect
1. Pituitary gland	Base of the mid-brain	(i) Prolactin	It stimulates and controls milk production by mammary glands.
		(ii) Oxytocin	It controls the flow of milk in the mammary glands and contraction of uterine walls.
		(iii) Antidiuretic hormone (ADH)	It stimulates the kidney tubules to reabsorb water from the glomeralar filtrate.
2. Thyroid gland	Anterior region of the neck	Thyroxine	(i) It regulates the rate of metabolism especially respiration. (ii) It stimulates mental and physical growth and development in young animals. (iii) It controls metamorphosis in tadposis.
3. Parathyroid	Anterior part of the neck near the thyroid gland.	Parathormone	It controls the level of calcium content in the blood.
4. Pancreas group of cells in the pancreas called islets of Langerhans	Loop of the duodenum	(i) Insulin (ii) Glucagon	(i) it maintains blood sugar level. It converts glucose to glucogen by stimulating the liver thereby lowering blood sugar level. (ii) it increase blood sugar.
5. Adrenal gland	At the top of the kidneys	Adrenaline	(i) It increases heartbeat and respiration. (ii) It increases sugar content of blood. (iii) it aids dilation of the pupils. (iv) It increases the muscular tone. (v) it is responsible for shivering during cold. (vi) It prepares the body for emergency, and it is therefore called emergency hormone. (vii) It is associated with fear and anxiety.
6. Stomach	Epithelium of the stomach	Gastrin	It activates the gastric gland to produce gastric juice.
7. Testes	Scrotum	Testosterone	(i) it stimulates the appearance of secondary sexual characters in males at puberty. (ii) It stimulates the production of spermatozoa by the testes.
8. Ovaries	Within the ovaries	(i) Oestrogen	(i) It stimulates the development of female secondary characters at puberty.

		(ii) Progesterone	(ii) It prepares the uterus for the attachment of the embryo. (iii) It maintains the foetus during its development in the uterus, hence it is called pregnancy hormone.

Plant Hormones

Types of plant hormones: The major or well known plant hormones are auxins, gibberelin, cytokinin, floregens, abscisic acid, ethane (ethylene), traumatin, dormin, formin etc.

Auxins: The most important naturally occurring auxin is indole acetic acid (IAA). It is produced at the apices of shoots and is transported in one direction away from the tip.

Functions or effects of auxins on plants: The functions or effects of auxins on plants include the following: (1) Fast growth of shoot (2) It causes apical dorminance. (3) Prevention of lateral growth (4) It induces flowering (5) Retention of fruits (6) it induces root formation (7) It breaks dormancy in seeds. (8) it induces pathenocarpy (9) Delay abscission or leaf fall.(10) It induces fruit ripening.

Modern application of auxin in agriculture: Auxins, both natural and synthetic ones, are widely used in agriculture and horticulture. Some of the uses are: (1) Weed control (2) Crop harvesting and control (3) Root initiation (4) Formation of fruit (5) Ripening of fruits (6) Preservation of stored products.

Gibberellins: gibberellins are produced in young foliage leaves and roots, apices of roots and stems as well as in embryos.

Functions or effects of gibberellins: (i) It controls growth in plants (ii) It induces the production of fruit without fertilization (iii) it helps to break dormancy in seed (iv) It stimulates dwarf bean plants to grow into large plants (v) it stimulates the growth of roots.

Abscisic acid: The abscisic acid is a hormone produced in mature green leaves, fruits and root caps. It is a growth inhibitor of buds (ii) It induces dormancy (especially when environmental conditions are unfavourable) (iii) It brings about ageing in leaves (iv) It may play certain role in abscission (v) it controls the opening and closing of stomata.

Ethene (Ethylene) gas: Ethene gas is a simple hydrocarbon produced in leaves, stems and young fruits.

Functions or effects of ethene: (i) It retards lateral bud development. (ii) It hastens the ripening of fruits (iii) it inhibits stem elongation (iv) It accelerates abscission of leaves, flowers and fruits.

Floregens: Floregens is found in flowers and fruits of plants.

Functions or effect of floregens: (i) It controls initiation of flowers in plants.

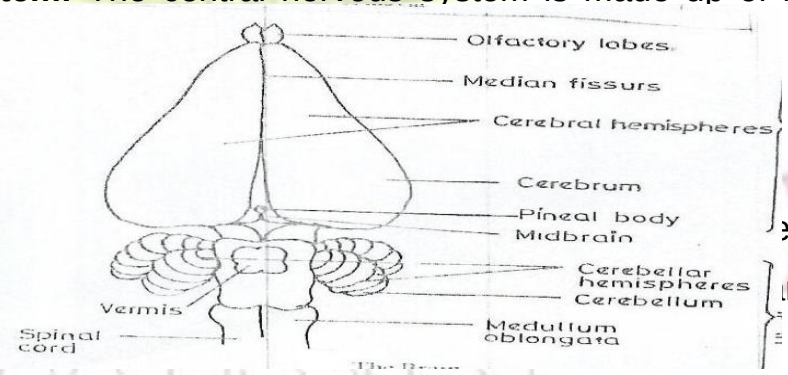
WEEK 3

NERVOUS CO-ORDINATION

Meaning of co-ordination: Co-ordination is the process by which all the actions of different parts of the body of an organism are harmonized so that they can work together to achieve definite objectives.

Nervous systems in mammals: The nervous system of a mammal is made up of two parts: (i) The central nervous system (CNS) which consists of the brain and the spinal cord, (ii) The peripheral nervous system (PNS) which consists of the rest of the nervous tissues found thoughout the body. It consists of the somatic system and autonomic nervous system. Autonomic nervous system is further divided into parasympathetic and sympathetic.

Central nervous system: The central nervous system is made up of brain and the spinal cord.



The brain: The brain ed by the skull or cranium. re (i) forebrain (ii) midbrain

Forbrain: The forebrain is made up of two main parts. These are cerebrum and olfactory lobes and two minor parts called thalami and hypothalami.

(i) **The Cerebrum:** The cerebrum is the largest part of the brain and it is made up of hemispheres. Which are the right and left hemispheres

Functions: (i) The cerebrum controls all voluntary actions, e.g. movement of legs, arms, speech etc. (ii) It is the seat of intelligence, consciousness,

learning, memory, imagination, reasoning, judgement as well as the interpretation of sensation.

(ii) **Olfactory lobes:** Olfactory lobes are located anteriorly at the fore brain. They are a pair of small structures.

Function: The olfactory lobe receives sensory impulses of smell.

(iii) **Thalami:** The thalami (singular: thalamus) are two ovoid structures attached to the back of the forebrain.

Function: (i) Thalamus helps in experiencing sensation (ii) It is the seat of consciousness or awareness.

(iv) **Hypothalamus:** The hypothalamus is found just below the thalami.

Functions: (i) Hypothalamus controls sleep and alertness (ii) It controls appetite or feeding (iii) It controls body temperature.

Mid-brain: The mid-brain consists of a small and inconspicuous part of the brain. It is a very short region consisting of optic lobes, pineal body and pituitary gland

Functions: (I) The optic lobes receive sensory impulses from the eye. It is the site of vision or sight (ii) it connects the forebrain to the bind brain and thereby assist in transmission of impulses.

Hind brain: The hind brain together with the mid-brain co-ordinates most of the body's automatic involuntary activities. The hind brain is composed of the cerebellum. The pons varolli and the medulla oblongata.

(i) **Cerebellum:** The cerebellum is a thick and convoluted portion of the hind brian.

Functions: (i) Cerebellum controls posture or balance of the body (ii) It co-ordinates the various muscle actions in involuntary responses. (iii) It receives impulses from auditory organs (semi-circular canals of the ear) and skin.

(ii) **Pons varolli:** This is a broad band of fibres that connect the lateral cerebellar hemispheres.

(iii) **Medulla oblongata:** This is the posterior end of the brain that continues into the spinal cord.

Functions: (i) The medulla oblongata controls many involuntary actions or movements of the body especially those concerned with respiration, heartbeat

and digestion. (ii) it also controls the construction and dilation of the blood vessels thus regulating blood pressure.

The Spinal Cord

Structure: The spinal cord is a made up of a soft tissue which runs from the medulla oblongata to the tail region. It is protected by the bones of the vertebral column but passes through the neural canal. The spinal cord consists of thousands of neurons clustered to form a cylinder of nervous tissue.

Functions of the spinal cord: (i) The spinal cord co-ordinates simple reflex actions like the knee jerk and automatic reflexes such as sweating. (ii) It acts as a pathway between the spinal erves and the brain.

The Peripheral nervous system: The peripheral nervous system (PNS) includes all nerves outside the brain and spinal cord

Types of peripheral nerves: There are two types of peripheral nerves. These are: (a) Spinal nerves: These are nerves which are connected to the spinal cord (b) Cranial nerves: These nerves are connected to the brain.

The peripheral nervous system is sub-divided into two systems. These are the somatic nervous system (SNS) and the autonomic nervous system (ANS).

Somatic nervous system: The somatic nervous system (SNS) controls activities which are mainly voluntary. It deals mainly with external stimuli and their responses.

Autonomic nervous system: The autonomic system (ANS) is concerned with the control of the body's involuntary activities, e.g. heartbeat, breathing, digestion and secretion of sweat.

The autonomic nervous system consists of two parts, namely: the sympathetic and parasympathetic nervous system.

The sympathetic nervous system: The sympathetic nervous system consists of nerves which connect internal organs to the thoracic and lumber areas of the spinal cord. The SNS stimulates many parts of the body for necessary action in times of danger.

Functions of sympathetic nervous system: The parasympathetic nervous system consists of nerves which connect internal organs to the 10th cranial nerve and the sacral region of the spinal cord. This system stimulates the same organs as the sympathetic system but its action is opposite (antagonistic) to the sympathetic system.

Function of parasympathetic nervous system: (i) It slows down heartbeat (ii) It dilates arteries (iii) It constricts the bronchioles (iv) It constricts the iris.

The nerve cell or Neurone: The nerve cell or neurone is defined as the basic unit of nervous system which is responsible for the transmission of impulses within the body. The neurone is the structural and functional unit of the nervous system.

THE NEURONE

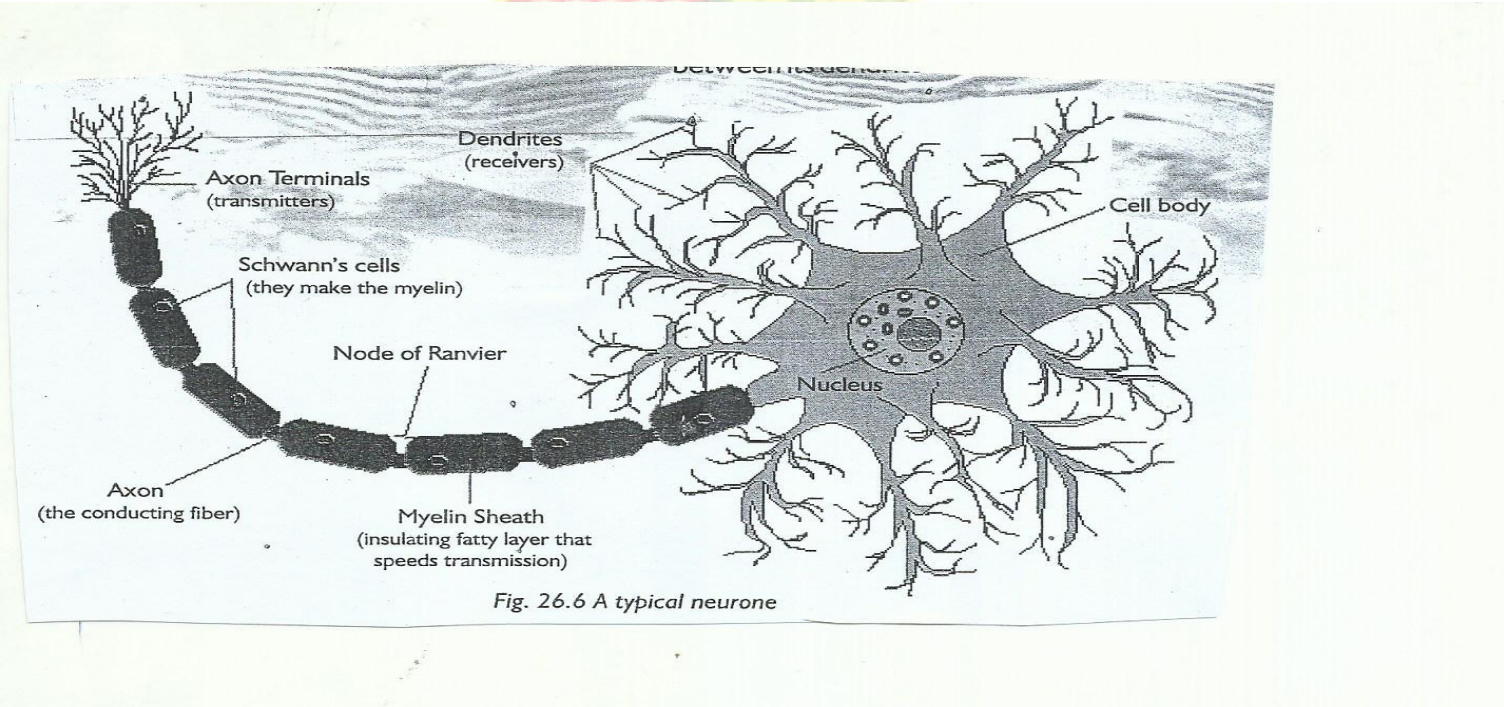


Fig. 26.6 A typical neurone

Structure of a neurone: A neurone or nerve cell consists of three major parts: The cell body, dendrites and the axon. Some neurons have dendron.

Classification of neurons: There are three types of neurones. These are sensory, motor and intermediate neurones.

(1) **Sensory (afferent) neurone:** The sensory or afferent neurone transmits impulses from the sensory cell or receptor towards the central nervous system (spinal cord and brain).

(2) **Motor (efferent) neurone:** The motor or efferent neurone transmits impulses away from the central nervous system to the effector organ, e.g. muscles and glands.

(3) **Intermediate (association) neurone:** The intermediate, association, connector or relay neurone joins the sensory neurone with the motor neurone.

Process by which neurones transmit impulses: The mechanism of transmission of impulses through a nerve fibre can be categorized into three phases. These are resting potential, the action potential and repolarisation phase.

The transmission of nerve impulse involves fibre transmission which is electrical and transmission through synapse which is chemical.

(a) **Resting potential:** The resting potential is the stage when no impulse is passing through the fibre. A nerve fibre is electrically polarized with a net positive charge outside and a net negative charge inside the cell membrane. There are more potassium ions inside than outside, and more sodium ions outside than inside the membrane.

(b) **Action potential:** When a dendrite receives a stimulus, the beginning of the axon is stimulated. This part of the axon becomes temporarily depolarized by the inward flow of sodium ion and the outward flow of potassium ions.

(c) **Repolarisation phase:** Before the on set of repolarisation phase, the inner side of the membrane of the nerve fibre is electropositive relative to the outside. Soon, after the transmission of the impulse (as a wave of repolarisation) the resting potentital is re-established.

The transmission of nerve impulse is unidirectional and obeys the all-or-none law. The all-or-none law states that if the intensity of a stimulus is below a definite threshold, the nerve fibre is not stimulated at all. If the stimulus is up to or above the threshold, the nerve fibre is stimulated to a full action potential.

Transmission of impulse by chemical means: Transmission of nerve impulses across a synapse is chemical. When a nerve impulse reaches the end of an axon, the synaptic knobs at the tips of the end-plate fibres secrete a

chemical substance called acetylcoline. This diffuses across the synaptic gap and stimulates the dendrites of the post-synaptic neurone. The second neurone then continues the transmission of impulse. An enzyme called cholinesterase renders the acetylcholine inactive, thereby preventing it from accumulating at the synaptic gap.

Functions of neurones: (i) The nerves conduct impulses to the brain (i.e. sensory neurone) (ii) The nerves, e.g. motor neurones, conduct impulses to the sense organs. (iii) The spinal nerves (intermediate neurones) integrate the reflex actions.

Reflex and Voluntary Actions

Reflex action: A reflex action is an involuntary or automatic action in response to impulses initiated by a stimulus. In other words, reflex action is a rapid or quick response to stimuli which are not consciously controlled by the brain. It is fast, inborn (instinctive) and stereo-typed.

Examples of reflex actions: (i) Blinking of the eyes (ii) Jerking of the kneel (iii) Salivation (iv) Coughing (v) Peristalsis (vi) Secretion of glands.

Voluntary actions: Voluntary actions are responses to stimuli that are consciously controlled or co-ordinated by the brain.

Examples of voluntary actions: (i) Writing (ii) Dancing (iii) Eating (iv) Driving (v) Singing (vi) Walking.

Simple reflex are: A simple reflex are is the simplest route in the nervous system by which a stimulus is received and a response is made, i.e, the nervous pathway of a reflex action.

Conditioned reflex: Conditioned reflex is a learned response or behavior after birth. Once they are acquired, they can be performed without thinking about them. Most of our behaviors are conditioned reflexes. Examples are walking, driving, reading, writing, swimming etc.

WEEK 4.

SENSE ORGAN

A sense organ is defined as a group of specialized cells, tissues or receptors which is able to receive, perceive or detect stimulus and transmit the information, impulse or message to the central nervous system.

There are five sense organs is human body. These sense organs are eye, ear, nose, tongue and skin.

Sense organs and their functions

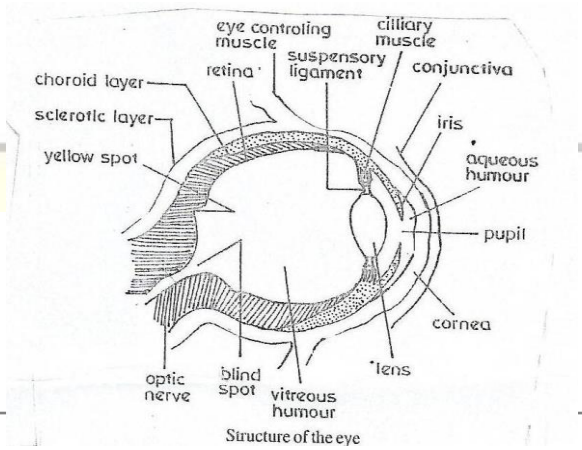
Sense organ	Function
(i) Eye	Sense of sight or vision
(ii) Nose	Sense of smell
(iii) Tongue	Sense of taste
(iv) Ear	Sense of hearing and balance
(v) Skin	Sense of touch, pain, heat or cold, and pressure (feelings).

The skin as a sense organ: The skin is an important sense organ. In the dermis of skin, there are different types of sensory cells or nerve endings each of which receives one of the following.

Stimuli: (i) Pain (ii) heat (iii) cold (iv) touch (v) pressure.

Organ of smell (nose): The organ of smell in human is the nose (olfactory organ). Several sensory nerve endings are found in the roof of the nasal cavity. Human has a poor sense of smell and it easily gets fatigue. It is able to detect smell quickly but within a short time it no longer perceives because it has undergone a fast sensory adaptation.

Organ of taste(tongue): The tongue is the organ responsible for the sense of taste. Sensory cells for taste are grouped into of the tongue. They are the receptors for chemicals in solution from food, drinks, medicine or whatever that is placed on the tongue. The tongue is sensitive to four primary tastes: sweet, sour, salty and bitter. The back of the tongue is sensitive to biter stimuli, the sides of the tongue are sensitive to salty and sour stimuli while the tip is sensitive to sweet sensation.



Structure of the eye

The protective structures of the eye include eye socket, eyelids, eye lashes, tear glands and conjuctivea.

Structure of the eye: The vertical section of the mammalian eye shows the eyeball which is a fluid-filled hollow structure. The wall of the eyeball consists of three layers which are the outermost sclera, the middle choroid and inner retina.

(i) **The scelra or sclerotic layer:** The sclera or sclerotic layer, also called the white eye, is the outermost layer of the eye, it is a thick fibrous connective tissue forming the white of the eye.

Functions: (i) It gives shape and farmness to the eye (ii) It protects and supports the inner parts of the eye

(ii) **Cornea:** The sclerotic layer bulges out in front of the eye to form the transparent cornea.

STRUCTURE OF THE EYE

Functions: (i) It admits light into the eyes (ii) It bends the light rays to bring them to a focus on the retina.

(iii) **Conjunctiva:** Associated with the sclerotic layer is the conjunctiva.

Functions: (i) It serves as a protective shield to the innermost delicate structures(ii) It also allows the passage of light into the eye

(iv) **Optic nerve:** Optic nerve is found at the back of the sclerotic layer. It also penetrates the choroid and retina at a point known as the blind spot which is devoid of light sensitive cells.

Functions: (i) Optic nerve transmits sensory impulses to the brain (ii) it also transmits sensory impulses from the brain.

(v) **Choroid or Middle layer:** The choroid layer is highly vascularised, pigmented and rich in blood capillaries. The blood capillaries may make the layer brownish or reddish. It contains a black pigment.

Functions: (i) It provides food and oxygen to the cells of the eye (ii) The pigment in the layer helps to absorb light rays and prevent light reflection into the eye.

(vi) **Iris:** Closely associated with the choroid layer is the iris.

Function: (i) Iris controls the amount of light passing through the eye.

(vii) **Pupil:** The pupil is also found within the choroid layer in front of the eye. The pupil is the aperture or opening through the iris.

Functions: (i) The pupil is where light enters the eye (ii) It controls the amount of light which enters the eye.

(viii) **Ciliary muscle:** In front of the eye, the choroid layer forms the ciliary muscle. Attached to the cilliary muscle is the suspensory ligaments which hold the lens in place.

Functions: (i) The cilliary muscle alters the focal length (ii) It brings about proper accommodation of the eye.

(ix) **Lens:** The lens is a transparent bi-convex elastic structure which is held in position by the suspensory ligaments.

Functions: (i) It helps to refract light rays that enter the eye (ii) It makes fine adjustment to focus the image of an object on the retina.

(x) **Retina:** The retina is the innermost layer of the eyeball. It is the part of the eye that is sensitive to light. The retina has two types of sensory cells. These are: cones and rods.

Functions: (i) Images are formed on the retina (ii) Retina helps to detect colours of object (iii) Light rays come to a focus on retina.

(xi) **Yellow sport (Fovea contralis):** This is the most sensitive part of the retina.

Functions: (i) It is the point where image is focused (ii) It is the most sensitive part of retina (ii) Fullest visual information is sent to the brain through the yellow spot.

(xii) **Blind spot:** The blind spot is also found on the retina. It is the point where the cells are not sensitive to light. The optic nerve goes out of the eye ball to the brain from the blind spot.

Function: (i) It marks the point where optic nerves leave the eye to the brain.

(xiii) **Aqueous humour:** The aqueous humour is a transparent, watery liquid which fills the space between the cornea and the lens.

Function: (i) It refracts light rays into the retina. (ii) It helps to maintain the spherical shape of the eye.

(xiv) **Vitreous humour:** This is a transparent, jelly-like liquid which fills the space between the lens and the retina.

Functions: (i) It refracts light rays onto the retina (ii) It helps to maintain the spherical shape of the eye.

Functions of the eyes: The eyes perform two major functions. These are image formation and accommodation.

Maintain formation: To form the image of an object on the retina, light rays from the object must pass through the conjunctiva, cornea, aqueous humour, lens and vitreous humour to the retina. All these parts are transparent and contribute to the refraction of light entering the eye, thus enabling the rays to converge at the retina. The image of the object formed on the retina is inverted and smaller than the object. However, the brain interprets the size and orientation of the image correctly.

Accommodation: Accommodation is defined as the ability of the eye to focus (both near and distant) objects on the retina.

Eye Defects and their Corrections

(1) **Short-sightedness (Myopia):** Short-sightedness (myopia) is a condition in which parallel light rays from a distant object are brought to a focus in front of the retina, i.e. the image of a distant object is formed before the retina.

Correction: The defect can be corrected by wearing spectacles fitted with concave or diverging lenses.

(2) **Long-sightedness (Hypermetropia):** Long-sightedness is a condition in which parallel light rays from near objects are brought to a focus behind the retina.

Correction: Hypermetropia is corrected by using spectacles fitted with suitable covex or converging lenses.

(3) **Presbyopia:** Presbyopia is the loss, with age, of the elasticity of the lens and ciliary muscles.

Correction: Presbyopia is corrected by wearing bi-focal lenses (a) combination of convex and concave lenses).

(4) **Astigmatism:** Astigmatism is caused as a result of unequal curvature of the cornea or lens.

Correction: Astigmatism can be corrected by using cylindrical lenses.

Other eye defects include: (i) colour blindness (ii) night blindness (iii) cataract and (iv) conjunctivitis.

Care of the eye: (i) Use clean water to wash face always. (ii) Avoid staying in areas containing fumes or smoke that can irritate the eye (iii) Use a clean handkerchief for cleaning the eyes (iv) Avoid rubbing the eyes with dirty finger (v) Use antibiotic eye drops, e.g. chloramphenicol in case it is inflamed or reddish (vi) Read books with fairly large prints and under correct lighting conditions (vii) Consult a doctor in case of eye infections and if the eye sight is not good so that proper spectacles can be prescribed.

WEEK 5

Organ of hearing: The ear is the organ of hearing as well as the organ of balance in mammals.

Structure of the ear: The mammalian ear is divided into three regions namely, the outer ear, the middle ear and the inner ear (labyrinth).

Outer ear: The outer ear consists of the pinna, the auditory meatus or ear tube and the tympanic membrane or ear drum.

(i) **Pinna:** The pinna is made of soft cartilage covered by skin. It is flexible and only found in mammals.

Functions: (i) Pinna collects sound waves and directs them into the auditory meatus. (ii) it detects the direction of sound waves.

(ii) **Auditory meatus or Ear tube:** The auditory meatus is a narrow passage which contains wax-producing glands. It also contains fine hairs.

Function: The auditory meatus prevents the entry of tiny insects, germs and dust.

(iii) **Eardrum or Tympanic membrane:** It is found at the end of the auditory meatus.

Function: It helps to transmit sound waves from the outer ear to the middle ear.

Middle ear: The middle ear is a small air-filled chamber in the skull. It is made up of three tiny soft bones called ear ossicles and the Eusachian tube.

(a) Ear ossicles: The ear ossicles are held in place by muscles. The ear ossicles include the malleus, the stapes and the incus.

Functions: (i) The ossicles transmit vibrations across the tympanic membrane to the oval window (ii) they also magnity the pressure on the oval window several times.

(b) Eustachian tube: The Eustachian tube is a narrow tube found in the middle ear.

Function: The tube allows air from the surroundings to enter leave the middle ear so that the air pressure on both sides of the eardrum is equal.

Inner ear: The inner ear contains a complex of bony passage ways called bony labyrinth filled with a fluid called perilymph within these passageway are membranous sacs and tubes (membranous labyrinth) filled with another fluid called endolymph. This complex of fluid-filled passageways, sacs and tubes form two important sensory structures.

(i) The cochlea which is the organ of hearing;

(ii) The semicircular canals, ultriculus and sacculus which are concerned with balance.

Functions of the ear: The ear performs two major functions. These are hearing and maintenance of balance.

Mechanism involved in hearing: For hearing to take place, the pinna collects sound waves in the air, concentrates them and passed them on through the external auditory canal or meatus. The waves causes the tympanic membrane or eardrum to vibrate. The vibrations are passed on the ear ossicles (malleus, incus and stapes rotunda also vibrates, passing the waves into the cavity of the inner ear or cochlea where the perilymph vibrates and transmitted the waves in the cochlea causing the endolymph of the cochlea to also vibrate. The vibrations are transmitted across the organ corti or sensory nerve cells or basila membrane. Impulses are set up which

stimulate the auditory nerve cells which then transmit the impulses to the brain for interpretation.

Mechanism involved in maintenance of balance: Certain mechanisms are involved in the maintenance of balance. It all begins with the head. Head movement in any direction affects the fluid or endolymph in the corresponding semicircular canal which are at right angle to each other. This forces the sensory cells or gelatinous cupula in the ampulla to set up impulses through the auditory nerve to the brain and intern for interpretation. The brain relays impulses to the body muscles for balancing or determining the position of the body.

Care of the ears: Ears can be cared for through the following ways: (i) The ear should be cleaned regularly with cotton wool. (ii) the use of sharp or pointed objects e.g. biro or pencil while cleaning or scratching the ear should be avoided. (iii) high noise level over a long period of time should be avoided to prevent deafness (iv) a medical doctor should be consulted when there is ear problem.

WEEK 6

ECOLOGY OF POPULATIONS

Ecological Succession: Ecological succession is a long term gradual or progressive series of changes occurring in the structure, composition, variety or diversity and number of species in an area till a stable or climax community is established.

Climax community: A climax community in ecological succession is established when a stable or unchanging community is attained or established, thus the community is in equilibrium with the environment. In climax community, the vegetation reaches is highest development and the same species of plant and animals re – occur from year to year.

General Characteristics of succession: (1) Succession occur in newly formed habitat (2) Increase in number of organisms (3) Succession is orderly and progressive (4) Competition among organisms (5) Diversity of organism (6) Plant form the pioneer organisms.

Outcome of succession: (1) Replacement by complex organisms (2) Changes in the physical environment (3) fast eeplacement (4) Attainment of equilibrium point (5) Climax community form the final stage.

TYPES OR FORMS OF SUCCESSION

Primary succession: Primary succession starts on bare surfaces which have not previously borne vegetation. It usually starts with lower organism and takes a long time to reach a climax community. Example of primary succession are found in ponds, vegetation on rocks, mangrove forest, stuarye.t.c.

Secondary succession: Secondary succession starts on already colonized surface. It may start with fairly complex organisms and it takes a shorter time or duration to reach a climax community. Examples of secondary succession are found in abandoned farmlands and grassland.

Major community in a plant succession: There are three major communities in a plant succession. These include: (1) pioneers or early colonizers (2) Developmental, intermediate or transitory communities (3) Climax community

Overcrowding

Overcrowding is defined as a situation which occurs when a population in a given habitat increases beyond a point where the resources in the habitat such as space and food are not enough to support all the individuals in the population.

Factors that may cause overcrowding: Increase in birth rate (Natality) (2) Increase in food supply (3) Decrease in death rate (Mortality) (4) Immigration (5) Lack of dispersal (6) Social habits (7) Inadequate space

Effects of Overcrowding: (1) Shortage of space (2) Shortage of food (3) competition (4) Anti – social behaviour (5) Spread of diseases (6) Preying on each other (7) Death of organism

Adaptations to avoid overcrowding: Plants and animal have develop various means to avoid overcrowding. Such means and ways include: (1)

Territorial behaviour (2) Dispersal of seeds and fruits (3) Emigration (4) Swarming (5) Production of Chemical by plants (6) production of canopies

Causes of food shortage: (1) overpopulation (2) Poor storage facilities (3) flood (4) Drought (5) Pests (6) Diseases (7) Poor harvest.

EFFECTS OF FOOD SHORTAGE ON THE SIZE OF A POPULATION

The scarcity of a particular type of food shortage on the size of a population include: (1) Competition (2) Emigration (3) Decline in the rate of a production.

BALANCE IN NATURE

Factors Affecting Population: A number of factors referred to as environment resistance control the population of organism in a particular habitat. These factors are classified as abiotic and biotic factors.

Abiotic factors affecting a population include: (1) Food (2) Competition (3) Natality (4) Motality (5) Dispersal (6) Parasites (7) Pathogens (8) Predator

Family Planning and Birth Control: Family Planning is a device by which couples (husband and wife) determine the number of children they want and ehen they want them. Birth control on the other hand, refers to the method used to prevent a woman from becoming pregnant, for as long as she wishes.

Birth control or family planning device: Birth control or family planning devices include the following:

(1) Withdrawal method: By this method, the man pull his penis out of the woman vagina before the ejaculation of spermatozoa occurs.

(2) Rhythm method or safe period: This involves the calculation of safe periods for each woman.

(3) Use of condom (sheath): This is a rubber sheat which the man wears over the penis before sexual intercourse.

(4) Cap (Diaphram): This is a rubber protective cap worn by women

(5) Spermicidal cream or tablet: A spermicidal cream or tablet is one that kills spermatozoa. A woman applies such a cream or tablet right inside the vagina 5 – 10 minutes before sexual intercourse.

(6) Intra – uterine device (IUD): This may be a metal or plastic coil or loop that is inserted into the uterus of the woman. It is usually done by a doctor

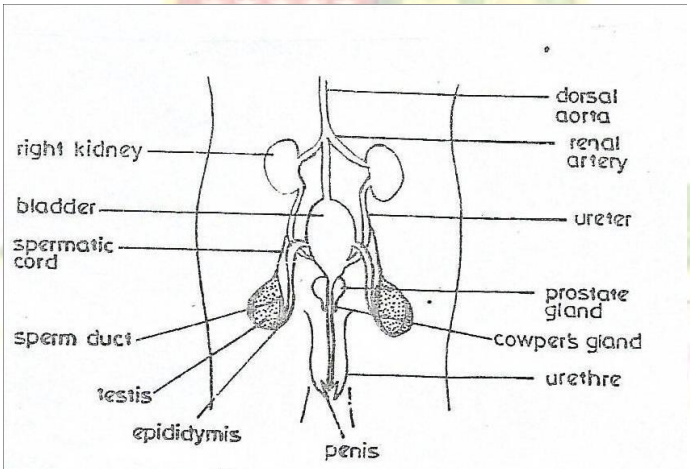
(7) Contraceptive pill: This is a tablet which is taken daily by the woman. The pill contains hormones which prevent ovulation.

(8) Injection: An injection is usually given to the woman every three or six month intervals. The injection contains hormones which prevent ovulation.

(9) Sterilisation: Sterilisation is done by couples who do not want more children.

WEEK 7

REPRODUCTIVE SYSTEM



Male reprodutive system

Reproduction is defines as the ability of living organisms to give rise to new individual of the same species. There are two main types of reproduction which are asexual and sexual reproduction.

Structure and functions of the male mammalian reproductive system: The male mammalian reproduce system, e.g. man, consists of the following structures:

(i) Testes (testis - singular) – All male mammals have two oval shaped testes inside two sacs of skin (scrotal sacs)

Functions: (i) The testes produce the sperms (ii) They also produce the male sex hormones (testosterone)

(ii) Seminiferous tubules: These are located within the testes.

Function: These are points where sperm are produced within the testes.

(iii) Epididymis: Epididymis is also found within the testes. It is a long, coiled tube

Function: epididymis collects and stores sperms temporarily until they mature.

(iv) Vas deferens or sperm duct: sperm duct is a narrow tube which leads from the epididymis to the seminal vesicle

Function: it carries or conduct sperms from epididymis to the sperms are stored.

v. Seminal vesicle: the seminal vesicle is a small sac where sperms are stored

functions: (i) it stores until the are ejaculated. (ii) it secrets part of the seminal fluid.

vi. Prostate gland: the prostate gland is connected to the unthra through many tubules.

Functions: it secrets part of the seminal fluid which activate the sperms.

vii. Cowper's gland: Cowper's gland is located very close to the prostate gland.

Function: It secretes a part of the seminal fluid

viii. Urethra: The urethra is a narrow tube which prolonged into the penis

Functions: (i) it aids the passage of sperm into vagina. (ii) it aids the passage of urine out of the body.

ix. Penis: the penis is an intoromittent organ for introducing sperms into the female reproductive organ (vagina)

Function: it helps to introduce the sperm into the vagina of the female animal.

Structures and functions of female mammalian reproductive system: the female mammalian reproductive system consists of the following structures:

(i) **Ovaries:** there are two ovaries in a woman located on the dorsal surface of the abdominal cavity,

Functions: (i) ovary produces the eggs or ova. (ii) It produces female sex hormones called oestrogen and progesterone.

(ii) **Oviduct or fallopian tube:** the oviduct or fallopian tube is a long narrow tube with a funnel- shaped opening which receives eggs (ova) released by the ovary.

Functions: (i) fertilization takes pace in the oviduct.

(iii) **Uterus or womb:** the uterus is a muscular organ in whose cavity the zygote develops into a baby.

Functions: this is the part in which the embryo or feotus develops. Uterus to the outside of the body.

(iv) **Vagina:** The vagina is a muscular tube that leads from ther uterus to the outside of the body.

Functions: (i) it receives sperms from penis during sexual intercourse.

(v) **Cervix:** the cervix is a ring of muscle with tiny aperture that closes the lower end of the uterus where it joins the vagina.

Functions: it controls the opening and closing of the vagina especially during birth

(vi) **Vulva:** the vulva is the collective name for all the external parts of the female reproductive organ.

Functions: (i) it allows the passage of penis into vagina. (ii) it permits passage of foetus during birth.

(vii) **Clitoris:** the clitoris is a small sensitive organ which corresponds to the penis in the male.

Functions: it helps to stimulate the female during sexual intercourse.

Structures of mammalian gametes: The reproductive sex cells are also known as gametes. The formation of gametes or gametogenisis takes place in the gonads.

Male gametes: the male sex cells or gametes called sperms are produced in the testes by a process called spermatogenesis. The gamete is unicellular in nature.

The sperm or spermatozoa consist of a head which contains the nucleus, a middle piece and a whip-like tail or flagellum. A human sperm is about 0.05mm long and microscopic and is usually sperm than the egg (ovum).

Female gametes: the female sex cells or gametes called the eggs or ova are produced in the ovaries by a process called oogenesis. The human female gametes are larger than the sperms. Each ovum is about 0.1mm in diameter. It consists of the cytoplasm, a nucleus in the centre, granules and yolk droplets. The yolk provides a source of nourishment for the embryo, especially at the early stages of development.

Comparison of reproduction in vertebrates

Type of mammals vertebrate	Fish	Amphibia	Reptiles	Birds	
Time of breading	Seasonal	Seasonal	Seasonal	Seasonal	Seasonal except on humans
No of eggs laid	Very many	Many	Few	Few	Few
Mode of fertilization	External	External	Internal	Internal	Internal
Feeding of embryo	From yolk and albumen	From yolk and albumen	From yolk and albumen	From yolk and albumen	From mother through placenta
Mode of zygote growth	Mostly oviparous	Mostly oviparous	Mostly oviparous	Mostly oviparous	Mostly viviparous
Parental care	Mostly none	None	None	Occurs for a short time	Occurs for a long time

WEEK 9

FRUIT

A fruit is a mature fertilized ovary of a flower containing one or more seeds.

Structure of a fruit: The structure of a typical fruit e.g. mango is made up of an outer covering called the epicarp, middle layer called the mesocarp and an inner layer called the endocarp. Within the endocarp is the seed(s). The epicarp, mesocarp and endocarp of a fruit is collectively called the pericarp.

Classification of fruits: The following are the common ways of classifying fruit: (1) True and false fruits (2) Simple, aggregate and composite (multiple) fruits (3) Fleshy and dry fruits (4) Dehiscent and indehiscent fruits.

True and false fruits: A true fruit is the type of fruit that develops solely from a fertilized ovary. Examples include mango, orange and cowpea.

A false fruit is the type of fruit that is formed from ovary and other floral parts as well. Examples of false fruits are apple, pineapple and cashew.

Simple Aggregate and Composite Fruits

Meaning of simple fruit: A simple fruit develops from a flower with a single ovary e.g. cowpea, pawpaw.

Meaning of aggregate fruit: An aggregate fruit is one which develops from a single flower with several ovaries. Examples of aggregate fruits are kola, custard, apple and strawberry.

Meaning of composite fruit: A composite or multiple fruit develops from an inflorescence (several flowers) or flowers positioned very close to one another. Here, all the fruitlets and the floral parts are fused together to form a single large false fruit. Example of this is pineapple.

Fleshy and dry fruits: Fruits may be classified into fleshy or dery usually according to the nature of their pericarps.

Fleshy fruits: A fleshy fruit is the type of fruit in which the whole pericarps or at least one of its layer is thick, soft and fleshy (succulent) expecially when it is riped.

Types of fleshy fruits

(i) **Drupe:** Common examples of drupe are mango, coconut and palm nut.

(ii) **Berry:** Examples of berries are tomatoes and orange melon, guava, pepper and pawpaw.

(iii) **Pome:** Examples of pome are apples and pears.

(iv) **Sorosis:** The pineapple and breadfruits are examples of sorosis.

Dry fruit: A dry fruit is the type of fruit in which the pericarp becomes dry, hard and woody of fibrous when the fruit ripens. There are many types of dry fruits. Read more about dry fruits under dry dehiscent fruits.

Dehiscent and indehiscent Fruits

Fruit may also be grouped into dehiscent or indehiscent depending on weather their pericarps split when ripe or not.

Practically, all fleshy fruits are indehiscent while dry fruits may be dehiscent or indehiscent.

Dry dehiscent fruits: Dry dehiscent fruits are the fruits which split to release their seed when ripe, leaving the fruit walls on the plant.

Types of dry dehiscent fruits are:

(i) **Legume or Pod:** Example of legumes are found in the legume family such as cowpea, crotolaria, soya beans. Pride of Barbados, flamboyant e.t.c.

(ii) **Capsule:** Example of capsule are castor oil fruit, para-rubber fruit, okro fruit and cotton

(iii) **Follicle:** Examples of follicle are the silk cotton and kola

(iv) **Schizorcarp:** Examples of schizocarp are Desmodium and Cassia.

Dry indehiscent fruits: Dry indehiscent fruits are fruits which dot not split open when mature or ripe but usually fall to the ground where the pericarp eventually decays to re lease the seeds.

Types of dry indehiscent fruits are:

(i) Nut e.g. cashew nut (ii) caryopsis e.g. Tridax fruit and Emilia. (iii) Achene e.g. strawberry and sunflower (iv) samara e.g. the combretum and pterocarpus (African arose wood)

Dispersal of seeds and fruits: Dispersal is defined as the transfer of a seed or fruit from the parent plant to other places where the seed may germinate.

Agents of dispersal of seeds and fruits: Agent of dispersal of seeds and fruits refer to any means by which seeds and fruit are removed from parent plants to other places.

Agents of dispersal of seed and fruits include: wind, animals, water, human, explosive mechanism.

WEEK 10

REPRODUCTIVE BEHAVIOUR

Courtship behaviour in animals: courtship behaviour consists of instinct behaviour in response to certain external stimuli in animals.

Importance of Courtship Behaviour in Reproduction

Courtship behaviour normally aids reproduction in animals in the following ways:

(i) Courtship brings the male and female together.

(ii) It prepares male and female for possible mating

(iii) Courtship stimulates egg laying and sperm release in the partners.

(iv) Courtship during the process enhances fertilization or reproduction.

Types or Forms of Courtship Behaviour in Animals

The types or forms of courtship behaviour which are found in animals include pairing, display, territoriality, and seasonal migration.

Pairing: Pairinginvolves two animals, usually a male and a female, which separate themselves from others in a group to form a mating pair. E.g. pairing in termites, fish, toad and human.

Display: display is an elaborate process involving a series of fixed patterns of movements or attractive exhibitions between mating partners.

Types of display: display can take any of the following forms: (i) dancing e.g. human beings, (ii) singing e.g. human beings birds, (iii) croaking e.g. toad, (iv) Nest making, e.g. birds,

Territoriality: Territoriality is a form of behaviour in which a member of a species marks out a fixed area and defends it against intruders of the same species. This behaviour pattern is exhibited by most vertebrates except the amphibians.

Seasonal migration: seasonal migration is the movement of animals from one place to another which eventually return to the original place. Many species of animals migrate with seasons in connection with breeding and escaping unfavorable conditions. Examples of organisms which exhibit seasonal migration are fish, birds and insects.

WEEK 11

BIOLOGY OF HEREDITY (GENETICS)

Meaning of Genetics, Heredity and Variation

Genetics: Genetics is defined as the scientific study of heredity and variation in living things.

Heredity: heredity or inheritance is defined as the transmission and expression of characters or traits in organisms from parents to the offspring

Transmission and Expression of Characters in Organisms

Different characters or traits are transmitted from parents to offspring or progeny and from generation to generation

Transmittable Character in Human Beings

(i) body stature or shape
(ii) shape of head, nose and ear
(iii) size of noise, head and ear
(iv) colour of skin, hair and eye
(v) characteristic of voice or speech
(vi) intelligence
(vii) height of human
(viii) blood grouping
(ix) baldness
(x) tongue rolling

Transmittable Characters in Plants

(i) height of plant
(ii) size or weight of fruit
(iii) size leaf
(iv) taste of fruit

(v) food content of fruit

(vi) colour of leaf, flower, fruits or seeds.

Some Important Terms Used in Genetics

(i) Genes: Genes are hereditary units or basic units or inheritance. They are located in chromosomes and are responsible for the transmission of characters from parents to offspring.

(ii) Chromosomes: chromosomes are rod or thread-like bodies found in the nucleus of a cell. The chromosomes house or contain the genes.

(iii) Characters or traits: These are the inheritable attributes or feature possess by an organism, e.g. seed colour, seed size, plant height etc in plants.

(iv) Gamete: Gamete is a matured sex cell which takes part in sexual reproduction. There are two types: male gamete or spermatozoon (in animals) and pollen grains (in plants). Gametes are usually haploid.

(v) Zygote: Zygote is a single cell formed as a result of the union of a male gamete with a female gamete. Gamete is usually diploid

(vi) Allelomorphs: Allelomorphs are pairs of genes on the position of a chromosome (i.e. locus) that control contrasting characters. A pair of allelomorphs are called allelic pair while each member of the pair is the allele of the other.

(vii) Phenotype: Phenotype is the sum total of all observable features of an organism i.e the physical, physiological and behavioural traits, e.g height, weight, skin colure e.t.c.

(viii) Genotype: This term is used to describe those trait or sum total of the genes inherited from both parents. In other words, the genotype of an individual is his genetic make – up or constitution. Genotype includes both the dominant and the recessive traits that form the genetic make – up of an individual.

(ix) Dominant character: dominant character is expressed in an offspring when two individuals with contrasting characters or traits are crossed.

(x) **Recessive character:** This is the character or trait from one parent which is masked or does not produce the effect in the presence of dominant character.

(xi) **homozygous:** An individual is said to be homozygous if it has two similar genes for the same character, i.e it has two identical alleles at the same position on a pair of chromosome: the pair of genes controlling a given pair of contrasting characteristic are identical

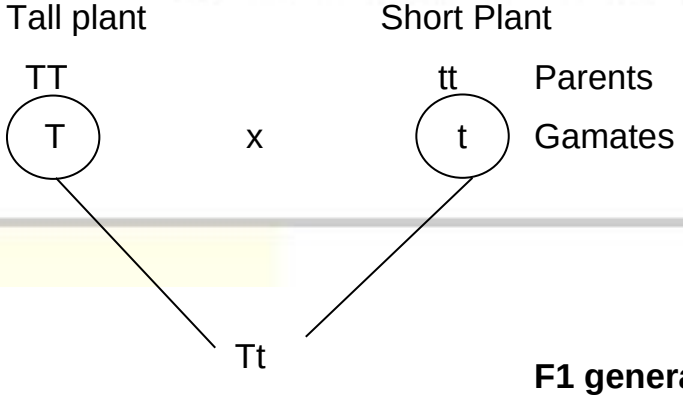
(xii) **Heterozygous:** An individual is said to be heterozygous if the two members of a pair of genes controlling a pair of contrasting character are different, i.e it has two different or contrasting alleles located on the same position on a pair of chromosomes.

(xiii) **Filial generation:** The offspring of parents make up the filial generation. The first, second and third generation of offspring are known as the first, second and third of filial generation respectively, too F_1 generation give rise to F_2 generation.

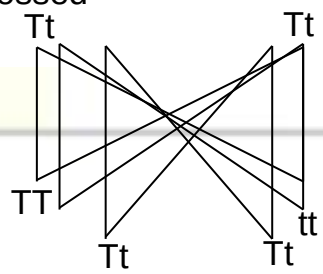
(xiv) **Mendel's Experiments;** Gregor Mendel carried out several experimentson how hereditary characters were transmitted from generation to generation. he worked with the garden pea (pisumsativum). His major aim was to find out the pattern of inheritance of difference characteristics of the pea plant.

Mendel First Law of Inheritance

This first law is also called the law of segregation of genes. The law states that genes are responsible for the development of the individual and that they are independently transmitted from one generation to another without undergoing any alteration.



When F1 is crossed



Explanation: As seen above, all offsprings in the F_1 generation are all tall. It shows that the genes for tallness (TT) is dominant over the recessive genes (tt).

In the F_2 generation, three of the offspring are tall while only one is short (tt).

From Mendel's first law of segregation of genes, the actual segregation occurs in the F_2 generation. The Phenotypic and genotypic ratios in F_2 generation can be summarized as follows:

(i) Phenotypic ratio = 3:1 (i.e 3 tall and 1 short)

(ii) Genotypic ratio = 1:2:1 (i.e. 1 TT, 2Tt, ltt)

Note: Letters are used to represent the genotypes of the traits. In the case of complete dominance. The capital letter from one of the first letter of the dominant trait is used to denote the dominant gene. The small letter form it is used to represent the recessive gene.

Since tallness in the plant is dominant over shortness,

(i) T represent gene for tallness (ii) TT represents genotype of the pure breeding short plant, homozygous for tallest (iii) t represents gene for shortness. (iv) tt represents genotype of the pure breeding short plant, homozygous for shortness (v) A cross between two organisms is shown by a multiplication sign (x). (vi) Each gamete is represented by only one encircled letter i.e. (T) or (t) depending on the trait being discussed. This is in compliance with Mendel's law of segregation of germinal units (vii) A heterozygous individuals is represented by one dominant gene and the one recessive gene i.e. Tt. such individuals are called carriers of a traits.

Mendel's Second Law of Inheritance: This second law is also called the law of independent assortment of genes.

Mendel's Second law of independent assortment of genes state that each character behaves as a separate unit and it is inherited in independent assortment of any other character.

Determination of Sex in Human Beings:

In human beings, there are 23 pair (46) chromosomes in each body cell of these, 22 pairs are called autosomes and have no direct effect on the sex of the individual. One pair is directly concerned with sex determination. This one pair (two chromosomes) is referred to as sex determinants. In the male there are X and Y chromosomes while in female both are X chromosomes. All eggs contain one X chromosome each. At fertilization, the combination of an egg with a sperm carrying either an X or a Y chromosome occurs by chance. the chances of an egg combining with either of the two types of sperm are equal. if a sperm with an X chromosome combines with an egg (having X chromosome), the zygote has two X chromosomes and form a female baby. But if a sperm with a y chromosomes combines with an egg (having X chromosome), the zygote has X and Y chromosomes and form a male baby

Chromosomes: the basis of heredity: Chromosomes are rod or thread-like bodies found in the nucleus of a cell.

Function: the chromosomes houses or contains the genes which are responsible for the transmission of characters from parents to offspring.

Appearance: Chromosomes can be seen with a microscope only during cell division (mitosis or meiosis). They appear at the beginning of cell division a long slender threads. As cell division progress, they shorten (condense) and thicken. After sometime, each chromosome is observed to be made up of two threads called chromatics, held together at the centromere.

Probability in Genetics

Probability is a branch of mathematics which can be applied to thos e events that depend entirely o chance.

Mathematically,

Probability= No of times an events occurs

Total number of trails

for example, a common event which depends on chance is the tossing of an unbiased coin. If a coin is tossed upwards, there are two ways the coin can fall. the coin may fall with the head up or with the tail up. the probability that the coin will fall with the head up is one out of 2, i.e. 50% or 1/2 .

probability is usually expressed in units ranging from 0-1.

Mendel's works are based on probability. two principles are necessary to understand the importance of probability in genetic. these are: (i) the result of one trial of a chanced event does not affect the result of latter trials of same event. (ii) the chance that two independent events will occur together simultaneously is the product of their chances of occurring separately.

Application of Probability to the Formation of Gametes

Suppose a plant has the genotype AA, what kind of gamete will it produce and in what proportion? Since only one of a pair of chromosomes got segregated during meiosis, the probable gamete produced from the AA parent plant is ½ A and ½ A. If the parent plants is heterozygous (A) (a), the probable gamete will be ½ A x ½ a.

Sex linkage in human beings: Characteristics whose genes are carried on the x chromosomes of the sex chromosomes are said to be sex-linked. Genes on the same chromosome are said to be linked because they tend to be inherited together. A sex-linked gene is a gene located on the x chromosome. Such genes are inherited along with such x chromosomes.

example of sex-link characteristics are (i) colour blindness (ii) hemophilia (iii) baldness (iv) sickle cell anemia (v) albinism

Application of the principle of heredity: Genetics is useful in many fields of humans endeavour. Among its application are: (a) Cross fertilization and self fertilization

(c) Application of Genetics in Agriculture: The knowledge of the principles of heredity (genetics) is used in animals and crop husbandry

to produce desirable breeds of animals and varieties of crop. the application is as follows:

1. To increase yield (2) to improve quality of product (3) Development of early maturing varieties (4) development of disease resistant varieties (5) to obtain uniformly of plants (6) to produce crps and animals that can adapt to climatic conditions

(d) Application of Genetics in medicine

Genetics has contributed immensely in various fields of medicine. ***These includes:***

1. Determination of the paternity of a child
2. Blood transfusion
3. Marriage counseling
4. Diagnosis of diseases
5. Crime detection
6. Development of test tube babies
7. Choosing the sex of a baby
8. Knowing the sex of a baby

VARIATIONS IN POPULATION

Definitions of Population and variation

Population: A population is defined as a group of organisms of the same species living in a specified are within a given period of time.

Variation: Variation is defined as the differences which exist between individuals of the same species.

Types of Variations: Two types of variation are identified. These are morphological variation and physiological variation.

Morphological Variation: Morphological variation refers to the noticeable physical appearance of individuals of the same species. In human beings, morphological variations include: (i) height of the body, (ii) shape of various parts of a body such as head, mouth, nose, jaw, eyes, ears, legs and hands. (iii) Fingerprint, (iv) size of various parts of the body such as head, eyes hands, neck,

In plants, morphological variation include: (i) height of plants, (ii) shape of various parts of the plants such as stem, roots, leaves, flowers, fruits, (iii) size of various parts of the plants such as stem, roots, leaves, fruits,, flowers.

Physiological variation: physiological variation relates to the differences in the ways individuals of the same species behave or react to conditions in their environment. in other words, it relates to the functioning of the body.

Examples of physiological or discontinuous variation in human being are: (i) behaviour (iii) ability to close one eye and keep the other open: (iv) Ability to move the ears without moving the head (v) ability to taste a chemical substance called phenylthiocarbamide (PTC) (vi) differences in blood group (viii) fingerprints.

fingerprints are impressions of the ridges on the ends of our fingers and thumbs. These ridges form patterns that can be sorted into several distinctive groups. Every human beings belong to one of these four groups of fingerprints. These are (i) arch (ii) loop (iii)whorl (iv) compound.

Examples of Discontinuous Variation In Plant

(i) Colour of leaves (ii) colour of flowers (iii) colour of fruits (iv) colour of seeds (v) shape of seeds and fruits.

Causes of Variations: There are two major factors which may cause variation in living organisms. the factors are genetic differences and influence of the environment.

Application of Variation: variation has wide application in human life. these Application include: (1) crime detection (2) blood transfusion (3) determination of paternity (4) in medicine (5) in agriculture (6) classification of human race

WEEK ONE **2ND TERM**

EVOLUTION

Organic evolution is define as the sum total of adaptive change from pre-existing or old from that have taken place over a long time, resulting in diversity of forms, structures and function among organisms.

Evidences of evolution: There are many evidence to show that evolution has taken place. These are: (1) Fossil records (2) Evidence from geographical

distribution (3) Evidence from comparative anatomy (4) Evidence from domesticated organisms.

Theories of evolution: The theories of evolution are attempts to explain how evolutions have taken place. Two of such theories are:

Lamarck's theory of evolution: Jean Lamarck, a French zoologist was the first to suggest that organisms undergo evolution. His theory which was propounded in 1801 is also called the theory of use and disuse.

Lamarck's contributions or postulates are as follows:

(i) That great changes in environment result in corresponding changes in the species: (ii) that these changes cause the organism to form new structures or habit to adjust to the new prevailing environment: (iii) that organisms then develop specialized characters by use and disuse of organs. (iv) that frequently used organs become well developed while ones not used degenerate and become atrophied or useless (v) that the well developed or dorminant acquired characters are inheritable.

(ii) **Darwin's theory of evolution:** Charles Darwin, a British naturalist in 1859 also propounded another theory of evolution. His theory is known as Darwin's theory of natural selection.

Darwin's contribution or postulates are as follows:

(i) that species have the ability to produce large number of offspring into the environment with limited resources

(ii) that this process then leads to competition by these offspring

(iii) that the survivors must have inherited the usefull traits;

(iv) they then reproduce and pass on these good traits to their offspring

(v) those that could not survive the struggle die off or are eliminated

(vi) this process leads to the survival of the fittest or natural selection

(vii) that there is great variability with population as this process continue through many generations

(viii) that the population gradually became better adapted to the environment leading to the origin of new species.

It should be noted that Dawin's theory is popularly upheld by many scientists even up till today.

Both Lamarck and Darwin recognized the importance of environment in evolution. It is generally accepted by many scientists that it is by natural selection of the better adapted organisms by chance and the elimination of the much less adapted ones that evolution or changes take place.

Modern evolutionary theory: The modern evolutionary theory can be summarized in the following statements:

(i) There exist variation in a species' population (ii) Some of the variation have special survival advantage (iii) Individuals with favorable variations are more adapted to the environment than others (iv) The individuals have to struggle for existence in the environment (v) The fittest contributed more offspring to the next generation than the unfit ones. This brings about a gradual shift in the features of the population (vi) The main cause of variations are mutation and recombination of genes.

Evolutionary trends in organism: Different evolutionary trends have been identified in plants and animals. simple or unicellular organism appear before the multi-cellular ones (ii) Aquatic to terrestrial life: In both plants and animals, life started in water and then moved on to the land.