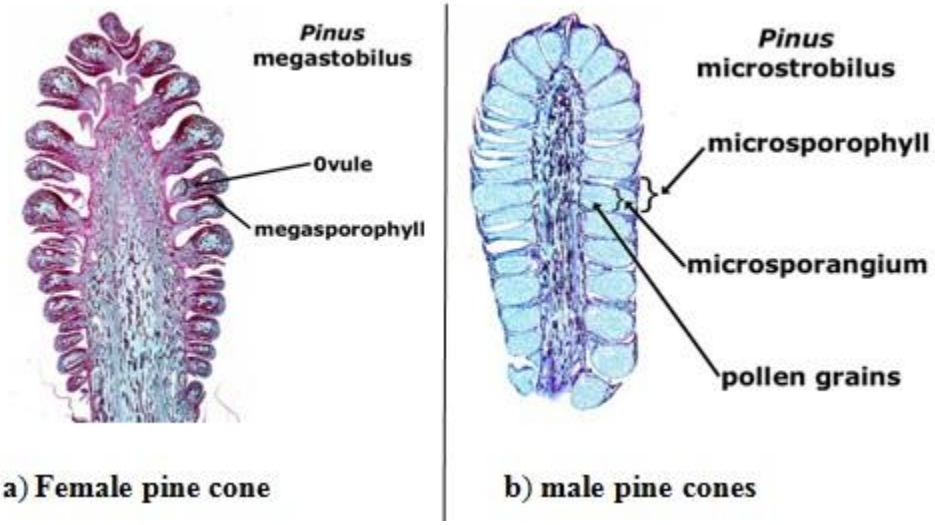
CLASSIFICATION OF LIVING THINGS

DIVISION CONIFEROPHYTA

Coniferophyta is a division containing cone- bearing plants with needle shaped leaves



The smaller male cones produce a yellowish powder called **pollen**. It contains the male sex cells of gametes. The large female cone bears small seed like structure called **ovules.** This contains female gametes.

The male cone is comparable to a flower but consisting only of pollen producing structures. The pollen is formed on the leaf like scales of the cone. The female cone is comparable to a flavor but with ovule forming parts only. The ovules are attached to the leaf scales of the cone

The distinguish features and characteristics of the organism in this Division *are*

1. They are mostly shrubs and trees, with needle shaped leaves
2. Their reproductive structures are cones
3. The ovules are not enclosed inside an ovary wall
4. The dominant generation is the sporophyte
5. The majority are evergreen. (they keep their leaves all year round)
6. They are widely distributed. (are commonly found in areas with cold climate)

Advantages

- Conifers are relatively fast growing tress
- Are grown in plantations and produce useful timber (softwood)
- They are used extensively in the building industry, paper making and in furniture making

- The trunks of conifers grow very tall and straight. They are often used as telegram poles

DIVISION ANGIOSPERMOPHYTA

(FLOWERING PLANTS)

This division contains wide variety of forms, but all have common distinctive features as you will see

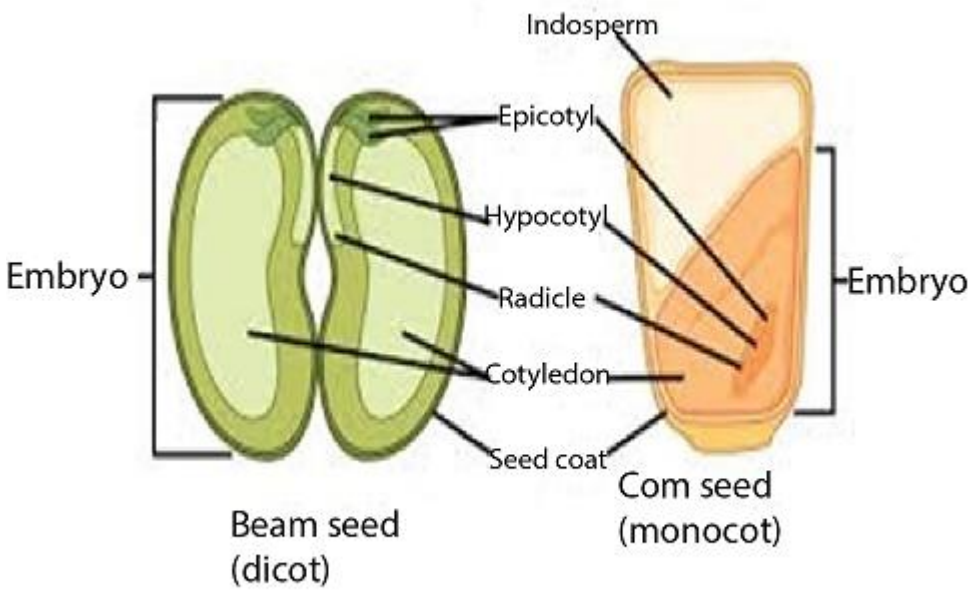
There are two classes of angiosperms

1. Monocotyledoneae
2. Dicotyledonae

The feature of angiosperms is leaves, stem, roots and flowers.

Nearly all angiosperms have the same structure in their feature modified according to type and function

1. **Sepal**: protects the flower parts when it is in bud
2. **Petals**: are often brightly colored to attract insect to pollinate the flower
3. **Stamen**: produce the male gametes
4. **Carpel**: produce the female gametes



- The flower of angiosperms has male structure called **stamens**. These have a structure called **filament** support **anthers** which produce **pollen**
- The female structures are called carpels. A carpel is compared of stigma, style and ovary. The ovules are formed inside the ovary. Once a carpel has been pollinated and ovule present successfully fertilized the carpel becomes a fruit and the ovules become seeds.

The Distinguishing features of Angiosperms are

1.Their reproductive structure are flowers

- When anthers and carpels are found in the same flower e.g. Delonix region the flower is said to be bisexual. Some plants produce uni sexual flower (maize produce) produce male flower that can release pollen and female flowers that produce ovules.

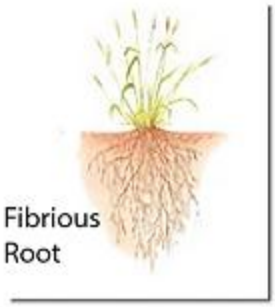
2. Ovules are enclosed in an ovary and hence the seeds are enclosed in a fruit.

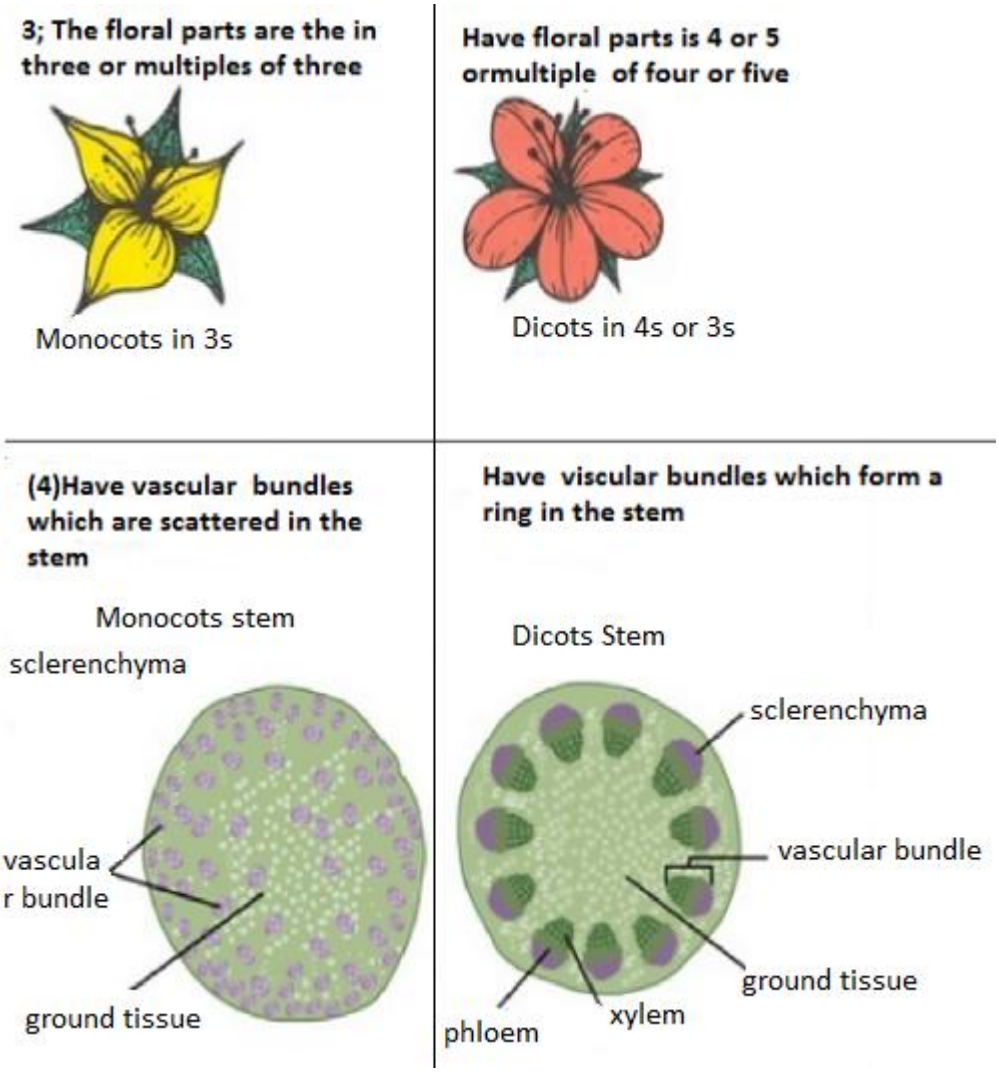
3. Angiosperms vary greatly in form, size and habitat.

- They can be woody e.g. coconut tree, non- woody (maize plants) some are very small such as groundnut plants while others are very large such as baobab trees

4. They occur in wide range of terrestrial (land) and aquatic (usually fresh water) habitat

Comparing Monocots and Dicots

Monocots plants	Dicots plant
1; Have fibrous root system 	Have tap root system 
2;Have leaves with parallel venation  (a)	Have leaves with (reticulate)net venation  (b)



A bean seed or groundnut seed has 2 cotyledons and is described as **dicotyledonous**. The maize grain has only one cotyledon and is described as **cotyledonous**

Examples of monocotyledons are maize, coconut, millet, palms, Grasse and orchids.

Examples of dicotyledons are beans, castor, groundnuts, mango, hibiscus plants and balsam plant.

Definitions

1. **MONOCOTYLEDON PLANTS**.

    - Are plants whose seeds have one seed each. (One cotyledon)

2. **DICOTYLEDON PLANTS**

- Are plants whose seeds have two seeds (two cotyledons)

A. DISTINCTIVE FEATURE OF MONOCOTYLEDONS

1. Their seeds have one cotyledon.

2. The vascular bundles of the stem are scattered

3. The petals are arranged in groups of leaves

4. Leaves have veins running parallel to one another

5. Most have fibrous root system.

B.DISTINCTIVE FEATURE OF DICOTYLEDON

1. Their seeds have 2 cotyledons.

2. The vascular bundles of the stem and root are arranged regularly

3. The petals are arranged mostly in groups of 5 or more

4. The leaves have veins arranged in a branched network

5. Most have tap root system

Advantage of Angiosperms

1. Are used for timber

2. Are used as a source of charcoal and wood

3. Are used for manufacturing papers

4. Some angiosperms provide medicine (e.g.: neem tree and foxglove)

5. Some flowering plants are used for decorations

6. Angiosperms can be used in production of certain industrial chemicals plastics, rubber, and tannins.

7. Angiosperms can be a good source of organic manure for the production of our crops when they decay.

8. Are used for manufacturing resins.

Disadvantages of Angiosperms

1. Some flowering plants may be allergic to man (e.g. Pollens are allergic to people)

2. The potted plants in the house compete with man for oxygen

3. Some plants are poisonous to man. (E.g. certain type of cassava)

MOVEMENT

Movement is the act of changing position/ posture by the whole organism or part of the organism

Types of movement

1. Movement of curvature (growth movement)

2. Movement of locomotion

1. MOVEMENT OF LOCOMOTION

This is the type of movement where by the whole organism moves from one place to another

Movement in locomotion is shown in all animals and some protoctists exhibit variety of movements. Animals and some protoctists exhibit variety of movements, these are

1. Amoeboic
2. Ciliary
3. Muscular
4. Flagella

I. AMOEBA MOVEMENT

Is the type of movement exhibited by some protozoans such as **Amoeba** and **white blood cell** (WBC); amoeba movement is caused by streaming of the cytoplasm towards a peripheral region of the cell resulting into projections known as **PSEUDOPODIUM**

The cytoplasm steaming into these projections is withdrawn from others and flows in one direction to bring about movement**CILIARY**

II. MOVEMENT

This is the type of movement where by some (protozoan) organism use cilia for movement

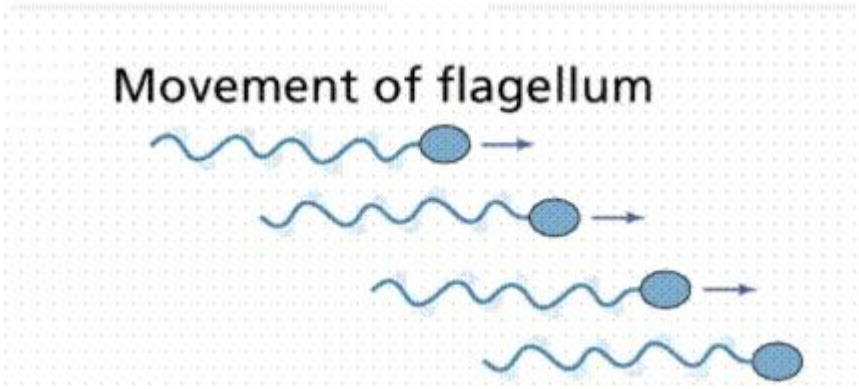
These protozoans are paramecium and larvae of some aquatic animals. The body of such organism is covered by thousands of small hair like structures called cilia. Movement is brought about by word noted backward and forward beating of cilia. The backward pushing of water (propels) pushes the organism forward

III. FLAGELLAR MOVEMENT

This is the type of movement exhibited by some organisms which possess flagella.

Such organisms include Euglena, chlamydomonas, trypanosome and some bacteria.

Flagella are very similar in structure to cilia but are much longer than in euglena, the whipping of the flagellum cause the swirling of the water around the organism. This swirling makes the organism rotate at the same time move forward



IV. MUSCULAR MOVEMENT

This is the type of movement exhibited by the contraction and relaxation of muscles. Since muscles alone cannot bring about fast movement, most animals have a firm and hard base for support and attachment of muscle. This firm and hard base is called **skeleton**.

Importance of movement in animal and plant

- Organism moves in search of food and shelter

• Organism move away from a negative stimulus, e.g. predator, chemical, fires, to secure protection.

• Movement enables animal to come together for mating

• Movement enables organism to move towards the positive stimulus for instance growth factor such as light, gravity and water.

MOVEMENT OF THE HUMAN BODY

Contraction and relaxation of muscles cause muscular movement in vertebrates animals such as man.

Movement of the human body is made possible by supportive structure like skeleton which provides attachment of muscles and other body organs. The body is supported by skeleton. The muscle fibres become shorter on contraction. Muscles are paired producing movement in opposite direction.

One muscle contracts while the other is relaxed, this is called **antagonisticaction**

THE HUMAN SKELETON

Skeleton is a frame work of tissue supporting a human or animal's body

The human/ mammalian skeleton consist of the following major parts

1) Skull

2) Vertebral column

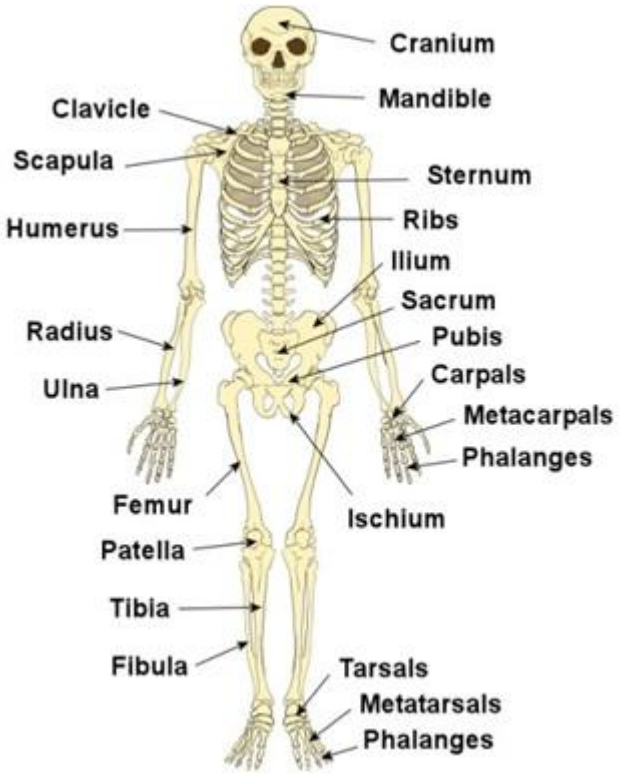
3) Limb

4) Girdles

The human skeleton is made up of separate units which are joined together; the points of junctions where 2 units meet are called **joints**

The skull sternum,ribs and the vertebral column form the **axial skeleton**. The limbs and limbs girdles form **appendicular skeleton**

THE HUMAN SKELETON



TYPES OF SKELETON

There are 3 types of skeleton

I. Hydrostatic skeleton

II. Exoskeleton

III. Endoskeleton

I. **HYDROSTATIC SKELETON**

This is a skeleton found in soft bodied animals. The body tube is filled with fluid that produce pressure when muscles around it contract bring about movement e.g. Earthworm

II. **EXOSKELETON**

These are skeleton found outside of the body which is typical arthropods e.g. insect

III. **ENDOSKELETON**

This is a raid frame work of bones cartilages surrounded by muscles that contract and relax bringing about a movement.

Bone – is the one of the hardest tissue and found only in vertebrate.

Cartilage – is softer and more flexible tissue than bones. In animal cartilage found in nose, part of ear and on the end of bones

FUNCTIONS OF SKELETON

1. Support

The skeleton provides a rigid frame work which supports softer parts of the body. (Provides attachment for muscles and body organs)

2. Locomotion

The skeleton enables the organism to move from one place to another.

3. Protection

It protects delicate internal organs. Example the skull protects the brain. The sternum protects spinal cord and ribcage protects the lungs and heart.

4. Formation of blood cells

Red blood cells and white blood cell are made/ manufactured in the bone marrow.

5. Shape

The skeleton gives animals a definite shape

6. It stores minerals such as calcium and phosphorus

The human skeleton system is divided into two major parts

1. The Axial skeleton
2. The Appendicular skeleton.

1. THE AXIAL SKELETON

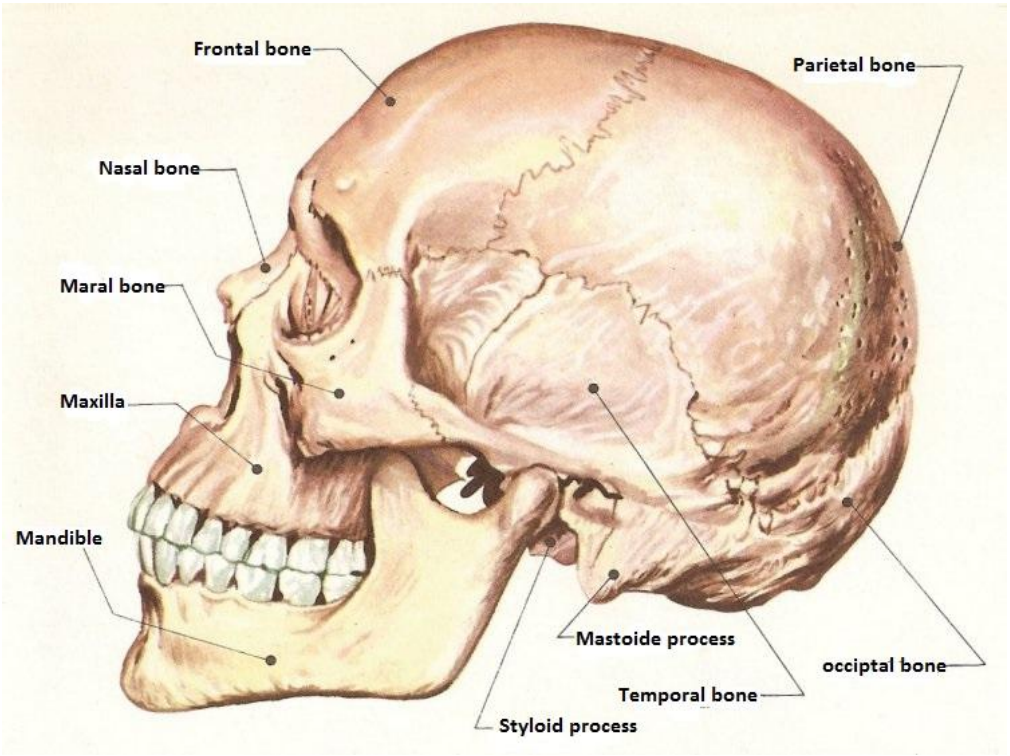
The axial skeleton consist of four parts which are

1. The skull
2. Ribcage
3. Vertebral
4. Sternum

The skull

Is made up of small bones joined together to form the cranium. The bones are joined together by irregular edges called **sutures** which are **immovable joints**

- It acts like a box enclosing and protecting the brain, parts of the inner ear, nose and eyes.
- It consists of the upper and lower jaw / bones which hold teeth
- Parts of the skull form hollows which protect the eyes (orbits) and ears
- The main function of the skull is to protect the **brain**, **olfactory organs**, **middle and inner ear** and **the eyes**.



1. **Ribcage and sternum**

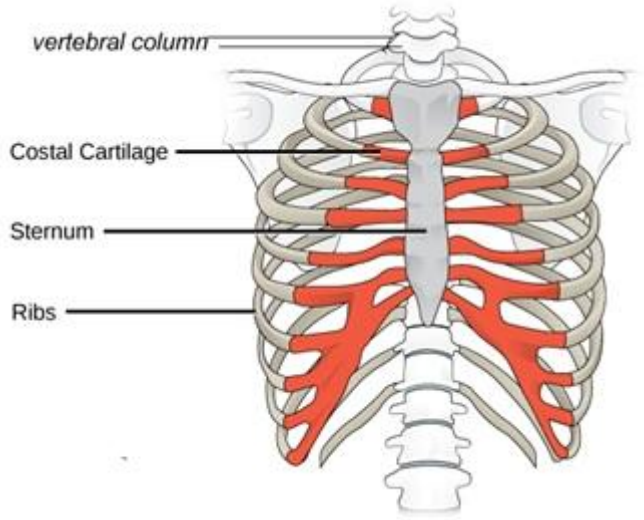
Skull is composed of bones of the sternum and the ribs. These bones form a thoracic cage which encloses the thoracic cavity, protecting heart, lungs and major blood vessels.

It consists of 12 pairs of ribs joined to thoracic vertebrae at the back and sternum at the front.

The last 2 ribs are not joined at the sternum are known as **floating ribs.**

This arrangement enables a protective cage bones to be formed which enclose the heart and lung. Between the ribs are intercostals muscles. The ribs are associated with the axial skeleton

The sternum consists of small bones known as **Sternebrae**. The sternum forms part of the ribcage and provides surface for attachment of ribs



III.Vertebral column

This is the main axis of the body.

It is made up of small bones (33) known as **Vertebrae.** Between two adjacent vertebrae is a **cartilage** known as intervertebrate disk which act as shock absorbers, and reduce friction

The main function of the vertebral column is to support the body and support the spinal cord. The backbones have five types of vertebrae, which are:

a) Cervical

b) Thoracic

c) Lumber

d) Sacral

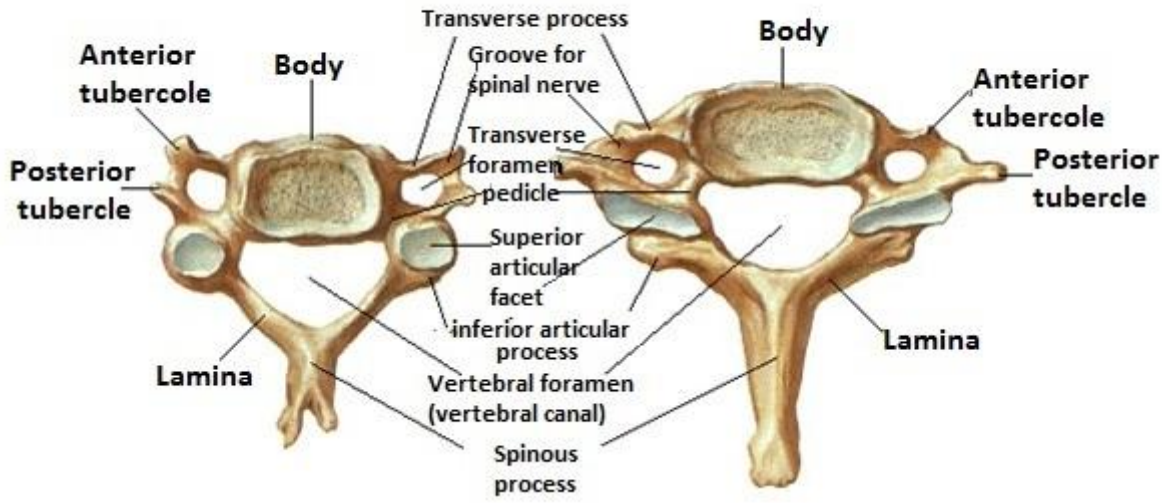
e) Caudal

a) Cervical vertebrae

There are 7 short cervical vertebrae, found in the neck region. The first is below the skull is *atlas* followed by the *axis.*

Atlas articulates with the skull to allow nodding movement of head.

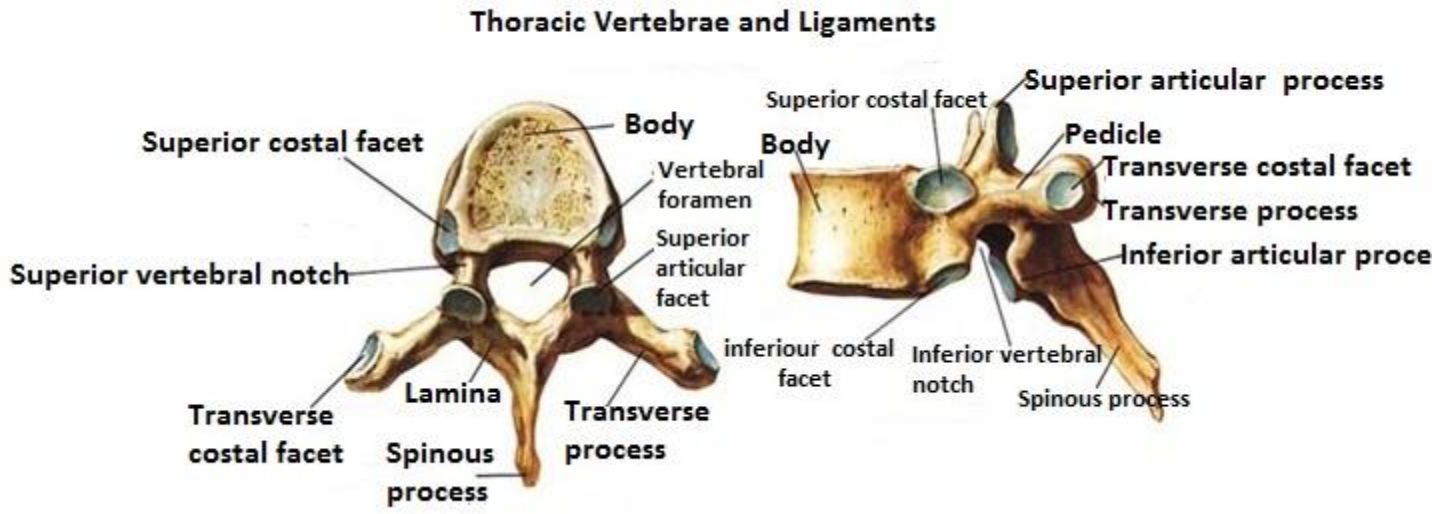
The axis allows rotational movement of the atlas which acts as a pivot. This allows turning / side to sideways movement of the head. (Shake the head to say no), also cervical vertebrae support the head region and protect blood vessels that pass through their canals. They also provide surface for the attachment of the neck muscles



b) Thoracic vertebrae

Are found in the chest region, they are 12 vertebrae. The thoracic vertebrae with the ribs and sternum form the thoracic cage.

The main role of the thoracic cage is to protect the heart, lungs and major blood vessels also plays major role on breath movement

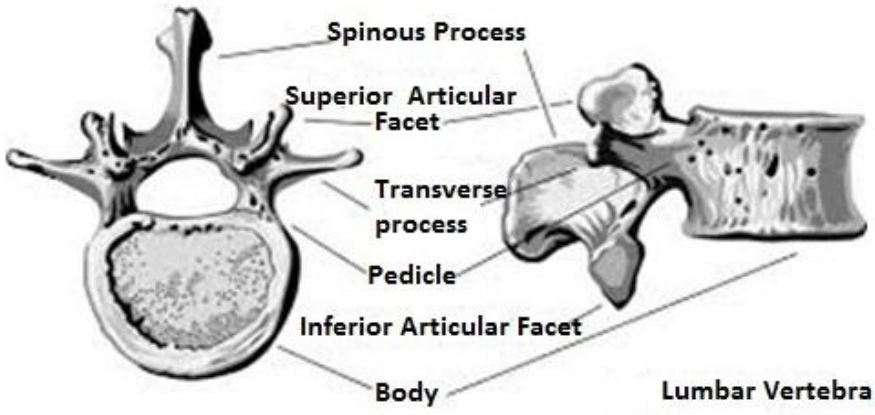


c) Lumbar vertebrae

There are five (5) lumbar vertebrae in human, seven in rabbits and six (6) in rats

They are short bones found in the abdominal region. Lumbar vertebrae have a number of projections that provide surface for attachment of abdominal muscles and muscles of the lower half of the back. The large thick Centrum gives support to the upper half of the body.

Lumbar vertebrae permit bending, sideways movement and rotation of the trunk. This is the region where large muscles of the abdomen are attached



d) Sacral vertebrae

Sacral vertebral are focused together to form the sacrum, they are found in the sacral region. Sacrum provides a large surface area of the attachment of muscles of the back.

e) Caudal vertebrae

These are found in the tail region. The number of caudal vertebrae varies from one animal to another depending on the size of the tail. In man there is no external tail, there are four caudal vertebrae which are used to form which is (no functions)

2) THE APPENDICULAR SKELETON

The appendicular skeleton is composed of the appendage limbs which are attached to the axial skeleton

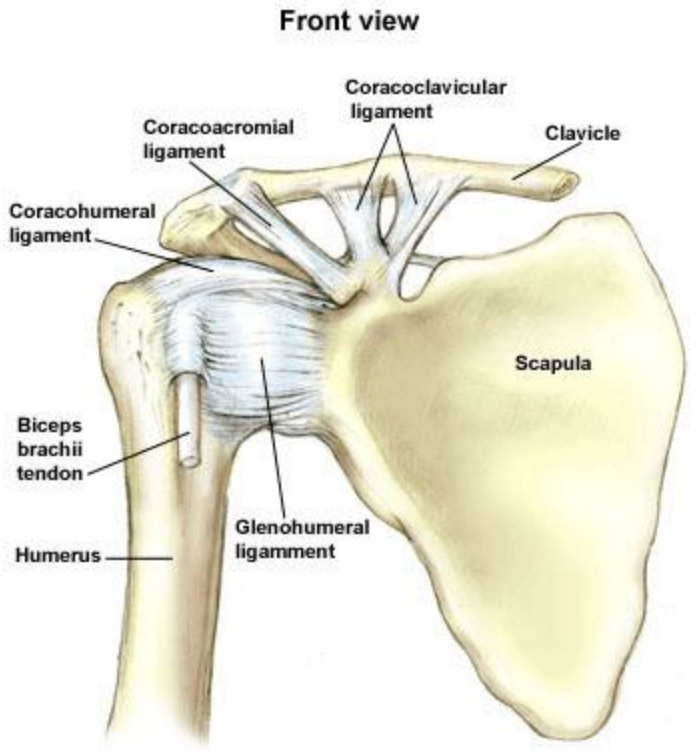
There are 2 types of limbs namely

1. Fore limbs
2. Hind limbs

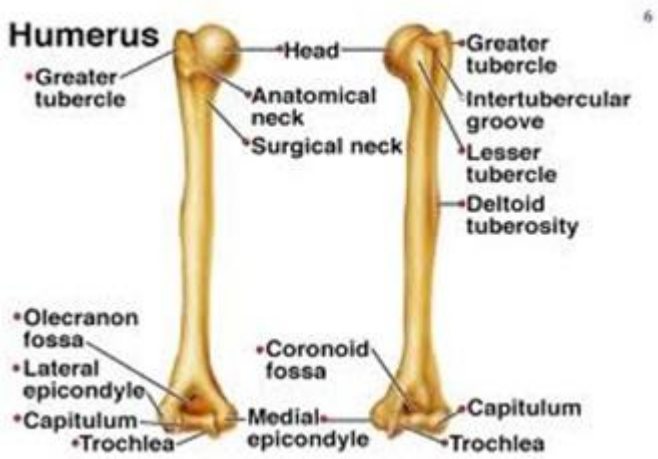
I. FORELIMBS

Forelimbs are attached to the axial skeleton to the anterior part of the body. Forelimbs comprise the following parts

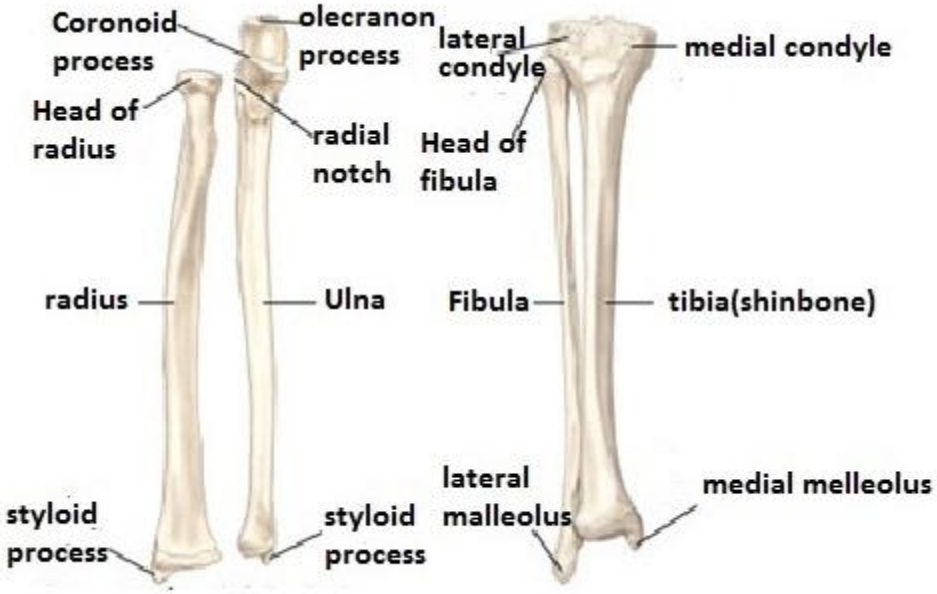
Pectoral girdle



b) Humerus – Is long bone of the upper arm and provide surface for attachment of muscle



c) Ulna and Radius



d) **Carpals, metacarpals and phalanges**

- Carpals are nine small bones which form the **wrist**. They articulate with radius and ulna at the upper and metacarpus at the lower ends

i) They allow free movement of hands and wrist.

ii) They provide surface for attachment of wrist muscles

Metacarpals are five slightly elongated bones which are found in the palm

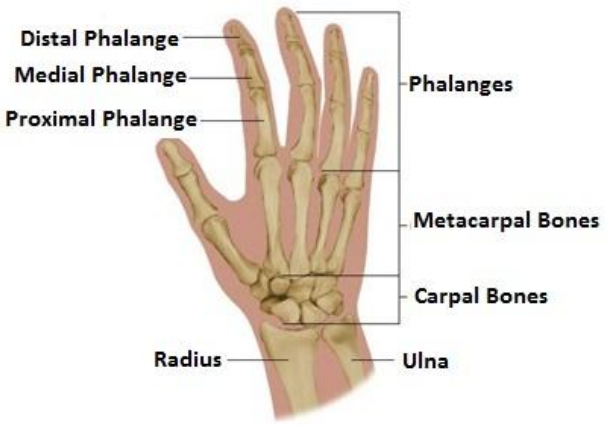
- Each of them articulate with phalange of finger bone

1) They provide surface of attachments of palms muscles

2) They support and maintain shape of the arm.

Phalanges

Phalanges form the skeleton of the fingers



2. **HIND LIMBS**

Hind limbs are attached to the axial skeleton to the posterior part of the body. Hind limbs comprise of the following

a) Pelvic girdle

Is made up of several bones found around the hip region; It contains 2 halves, the left and right. Each half lies on either side of the vertebral column. In this way it supports the hind limbs.

Pelvic girdles have two bones known as pubic bones, each pubic bone comprises of three (3) bones known as **ischium**, **ilum** and **pubis**. The ischium and ilium are fused together

The size of the pubic cavity is very important in females during birth. Causing the widening of the female girdle.

- The pelvic girdle forms a protective cage around vital organs such as female reproductive organs.
- It also supports legs, articulating with the head of femur to form hip joint.
- It articulates with sacrum and provides for a tail where it is present.

b) **Femur**

Is a long bone on the upper part of the hind limb (on the thigh region)

- The head of femur fits in the pelvic girdle to form hip joint
- It articulates with tibia at lower end to form knee joint
- It provides surface for the attachment of leg muscles and it supports the thigh.

c) **Tibia and fibula**

These are long bones of the lower

- Tibia is a very long bone, found on the side of the big toe. It may be free or partly fused to the smaller fibula which lies alongside it.
- Fibula is much smaller in size and fused to the tibia in the lower part of the leg.

  A small round bone is called patella/ knee cap lies in front of the knee joint, it prevents the leg from bending up wards at the knee.

- The tibia and fibula supports the front part of the leg below knee
- They provide surface for attachment of the knee (shin) muscles.
- They articulate with femur to form knee joint, and with metatarsals to form the ankle joint.
- Red blood cells are manufactured in the tibia and fibula bone marrow.

d) **Tarsals, metatarsals and phalanges**

- **Tarsals** are six (6) small bones in the ankle. Two of them are elongated and one projects backwards to form a heel bone. The tarsals provide surface for attachment of ankle muscle. The heel bone prevents the foot from bending backwards.

- Metatarsals

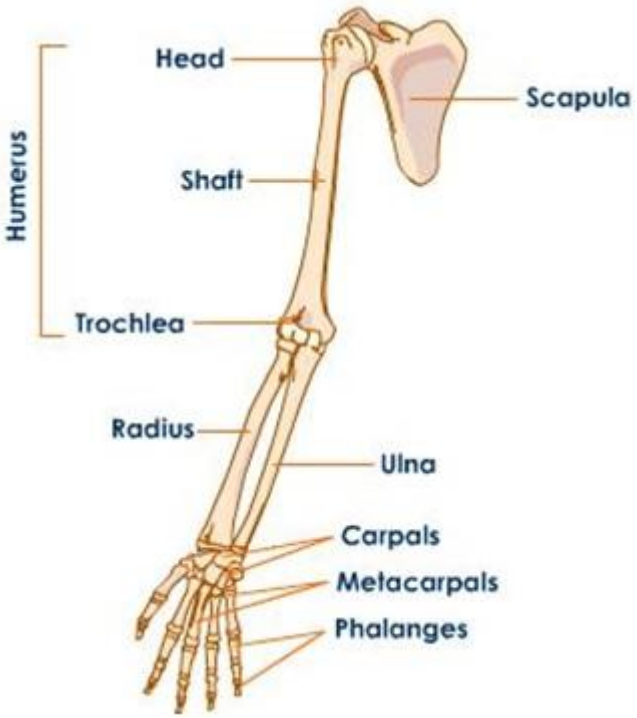
These are elongated bones in foot.

There are 5 in humans and in most animals. Each one leads to a phalange. The metatarsals provide surface for attachments of foot muscles, they also support and maintain the shape of the foot.

Functions

- Tarsals articulate with fibula to form the ankle joint
- Tarsals articulate with metatarsals to form the foot
- Metatarsals articulate with phalanges to form toes

SKELETON OF HUMAN FORE LIMB

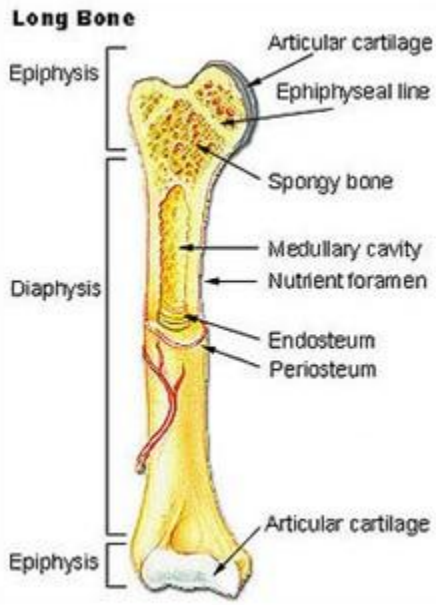


SKELETON OF HUMAN HIND LIMB

DEFINITIONS OF TERMS

1. **Bone**

This is a hard, tough connective tissue composed of minerals salts; calcium and phosphate.



2. Cartilage

This is a soft bone found in the trachea, ear, and nose and at the end of the bones especially at joints to reduce friction.

3. Ligaments

These are fibrous tissues which join one bone to another. Ligaments are elastic to allow movement at a joint.

4. Tendon

This is a tough connective tissue which attaches a muscle to bone. Tendons are inelastic to firmly attach muscles to the bones

5. Joints

This is area/region where bones meet. Joints provide articulation between bones making movement possible

Types of joints

1) Movable joints

2) Immovable joints

1. **Fixed/ immovable joints**

These are joints that do not allow movement of bones. E.g. Pelvic girdles and sutures (bones found in the skull)

2. **Movable joints**

These are joints which allow movement of bones E.g. Hip joint and shoulder joint

Types of movable joints

These are classified according to movement of bones at joint in different shapes or structure.

There are four types of movable joints

a) Ball and Socket joints

b) Hinge joints

c) Glinding joints

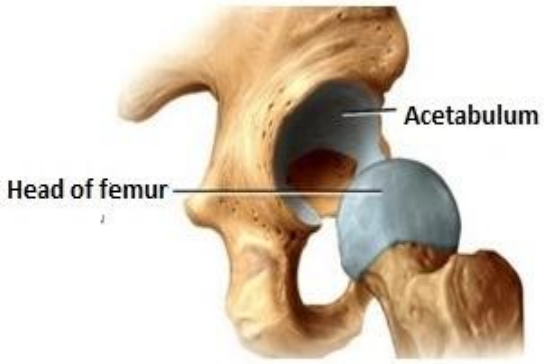
d) Pivot joints (peg and socket joints)

a) Ball and Socket joint

Is the type of movable joint which allow movement of bones to take place in many direction.

These types of joints allow the greatest flexibility of all joints e.g. hip joint, shoulder joint

It is called the ball and socket joints because the round head which looks like a ball of one bone it's a socket of another bone. At the shoulder, the rounded head of the Humerus fits into the socket of the pectoral bone. Some joints have synovial fluid which reduces friction by lubricating the bones, e.g. hip joint shoulder and knee join



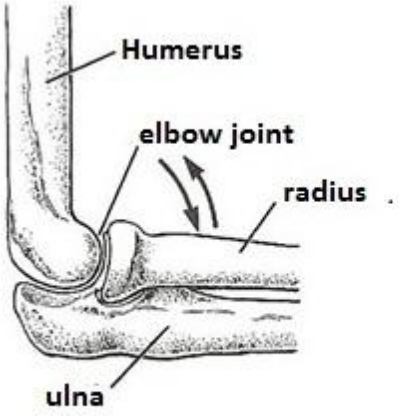
b) Glinding joints (sliding)

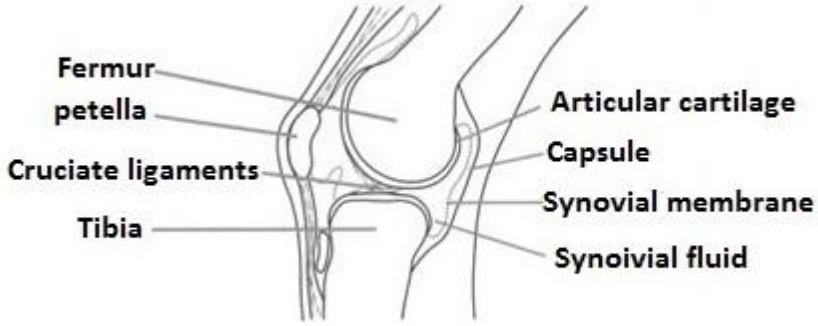
These are bones that occur between the vertebrae. This type of joints found where two or more bones surface move over each other. It allows movement in two directions. It occurs at the wrist and ankle and allows hand and foot to be moved up and down or to be rotated only slightly.

They lack fluid between them, and instead they have a layer of cartilage between them that reduce friction

c) Hinge joints

Is a joint which allows only movement of bones to one direction, it is called hinge joint because it operates like the hinge of a door in which a door is allowed to move in one direction only. A joint of this type is found at the elbow, knee, finger, knuckles are between the phalanges of toes.





d) Pivot joint (on the neck)

The skull is pivot at the first cervical vertebra (atlas). The joint allow the head to move sideways. E.g. when a person he shake his head and say no. It allows nodding movement.

Adaptations of joints to movement

- Freely movable joints such as those of the limbs may therefore cause dislocation hence movement joint involves more than one bone. Dislocation and friction is presented by the ligament which holds the bones together.

- It may also cause knocking of bones against each other, and strain in the bones due to compression of the bones are not well protected.

  In freely movable joints such as those of limbs, dislocation is prevented by the ligament which holds together bones.

- Joints which support weight are provided with **cushion**. The cushion absorbs compression due to weight. Cushioning in the joint is provided by the disc (in the intervertebral column) of cartilage as in the case in joints of the vertebrae.

MUSCLES

Muscle is a tissue of consisting of cells that have the capacity to contract and exert a pull

Types of muscles

I. Skeletal muscle (voluntary)

II. Cardiac muscle (involuntary)

III. Smooth muscle (involuntary)

Muscles are tissues that cover the skeleton

The skeleton alone can't bring about locomotion and movement of the body in order to bring about movement there must be muscles. These muscles are attached to the bones. Muscles are composed of many elongated cells called muscles fibres which are able to contract and relax.

During relaxation of muscles can be stretched but they show elasticity which allows the regain to their original size and shape after being stretched.

Muscles are made up of specialized tissues which are known contractile tissue. When these tissues contract, they become shorter and tighter as a result they cause movement

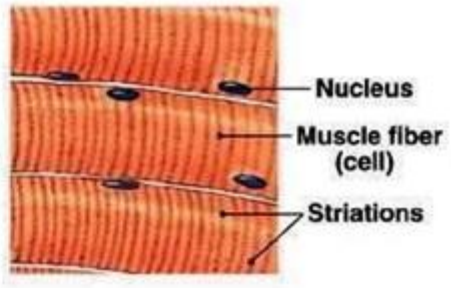
1. SKELETAL MUSCLE

These are muscles which are attached to bones of the skeleton. Are made up of long fibre and cover the skeleton are also known as striated/ voluntary muscles because they are controlled by the will.

Skeleton muscles can contract and relax quickly but get fatigue
quickly

Functions

- Skeletal muscles are concerned with movement of the limbs and parts of the skeleton



2. SMOOTH MUSCLE

These are muscles found on the wall of internal organs

- Such internal organs are alimentary canal, bladder, uterus, sperm ducts and blood vessel e. t. c.
- Smooth muscles are controlled by involuntary nervous system meaning they cannot contract at will. So they are involuntary muscles.
- Smooth muscles contract slowly and they get fatigue relatively slowly

Functions of smooth muscle

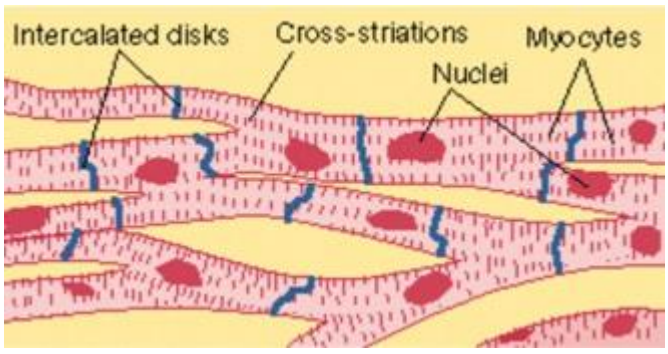
- They contract and relax to cause movement in different organs e.g. peristalsis in the alimentary canal cause movement of the materials through the canal with the help of smooth muscle

3. CARDIAC MUSCLE

These are muscles which are found only in the heart. Their muscles are made up of muscle fibres which branch and connect to each other like a network (interconnecting network)

Cardiac muscle has the capacity to contract and relax through its life without becoming fatigued. (They contract softening from fatigue)

The contractions of these muscles are not (initiated) helped by the nervous system so they are involuntary muscle.



MUSCLE AND MOVEMENT

The skeleton alone cannot bring about locomotion and movement of the body parts such as arms, finger and jaws when the aim is straightened.

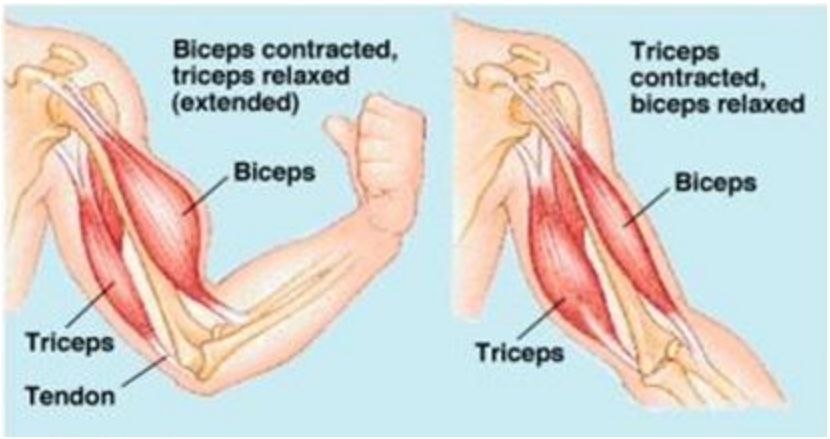
The muscles above the arm become thin while those below become thick. The bending and straightened of the arm is brought by two sets of muscles located above and below the Humerus.

The muscles above the Humerus are called biceps and those at the back are called triceps.

Bending of the arm is brought about by contraction of muscle in which they are called flexor and relaxation of triceps muscles are called extensor for the arm to straighten the triceps contract biceps relax.

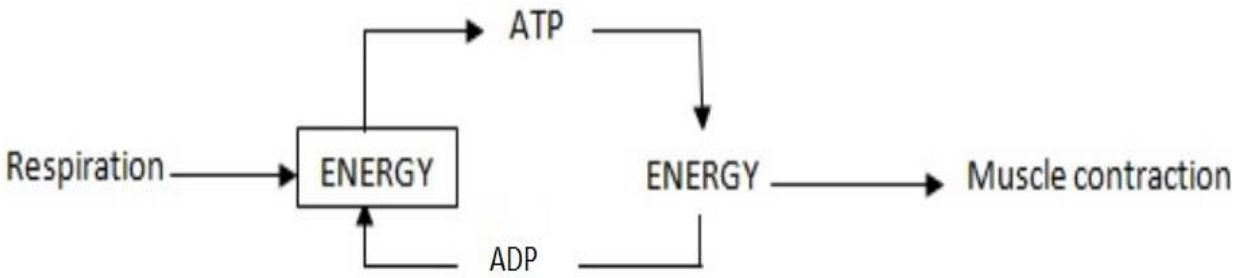
Muscle which work as pair in opposition to one another are called antagonistic pairs. Their antagonistic action is necessary to bring continued movement. Therefore biceps and triceps are known as antagonistic muscles. Muscles are attached to bones at both ends by strong in elastic fibres called tendons.

Contraction and Relaxation of Biceps and Triceps during bending and strengthen of the arm



Muscles contraction

- For muscle to contract, energy is required. This energy is derived from respiration and it is found in the muscle cells in the form of ATP.
- During muscle contraction ATP is broken down to ADP, there by releasing the energy. The released energy is used to cause the muscle tissue to contract.



MUSCLE CRAMPS

These are sudden, involuntary contractions of muscles or groups of muscles.

The tissue may become hard and knotted cramp in skeletal muscle may occur after a period of prolonged exercise e.g. swimming also it may be caused by lack of salt in the body. Stretching and warming the affected muscles can help to cease the cramp

Causes of muscle cramp

1. Dehydration
2. Lack of magnesium
3. Muscle fatigue
4. Excessive exercise

Prevention of muscle cramps

- Stretching of muscle more often
- Do a lot of physical exercise
- Taking salt through a solution of water

GROWTH OF CURVATURE (MOVEMENT IN PLANTS)

Since most plants remain fixed to the ground, they are incapable of moving from one place to another.

However their leaves stems and roots may show growth responses. These response results in part of the plants growing away from or toward a stimulus is growth of curvature

Growth movement enables plants to obtain their requirement despite of being fixed in one place.

Growth curvature movements are the result of tropic responses

The tropic movement is the case where a plant moves either towards or away from the stimulus. If the response is toward the stimulus is referred to as (+) positive response.

If the response is away from the stimulus it is referred to as (-) negative responses.

Movement or growth of curvature is categorized in two groups. Which are following;

1. Tropic movement or tropism
2. Nastic movement

1. **Tropism** is movement by plant organs in response to unilateral stimulus in which the direction of the movement is related to the direction of the stimulus.

Tropic Movement includes

i) Phototropism

This is the growth movement in response to the source of light

ii) Hydrotropism

This is the movement by which roots growth toward water

iii) Geotropism

This is the movement in response to the stimulus of gravity

iv) Chemotropism

This is the growth movement in response to source of chemicals

v) Haptotropism

Movement due to touch

II**. Nastic movement**

Is referred to as non – directional response.

Example of nastic responses are the opening and closing of flower and leaves of certain plants in response to changes in light intensity and temperature, closing of flowers of carmorous plants when touched. Also closing and opening of dandelion flower in response to changes in humidity.

Tropic and nastic movement of plants are response to external stimulus

Importance of Tropical Movement

- Exposes the leaves of the plant to trap maximum sunlight for photosynthesis
- Enables plants with weak stem to obtain mechanical support

COORDINATION -1

Coordination refers to the linking together of the activities of different organs, so that they work at an appropriate time and rate required by the body

During physical exercise several organs are involved, these include the heart, skeletal muscles, blood vessels and lungs. Hence for any activity to take place smoothly these organs must function in a coordinated manner.

Without coordination body activities become disordered the body may fail to function properly.

Coordination of various organs in the body requires a system which can detect changes in the environment and transfer of information to the appropriate organs so that the body can change in such a way as to ensure its survival.

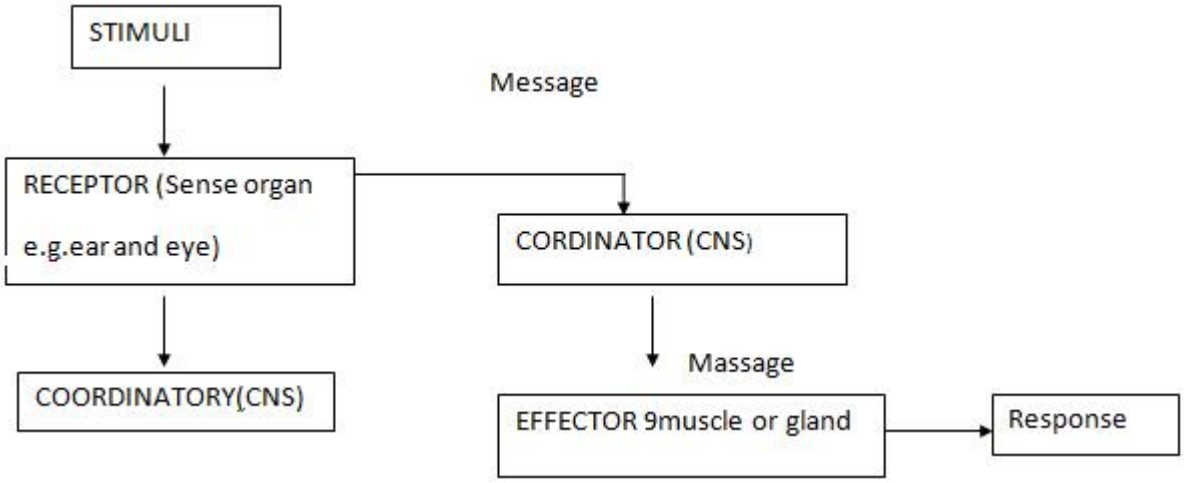
Coordination is affected by nervous system and hormonal coordination. Hormonal coordination involve organs which secrete chemical substance in response to a certain change in the environment both internal and external stimuli

COORDINATION IN ANIMALS

All animals from simple unicellular organism to large multicellular need to coordinate the body activities. All animals respond to changes in their surroundings and react in an appropriate way.

Coordination in animals consists of five components.

The following figure shows the nervous coordination



STIMULUS

Refers to a factor which causes an organism to react (respond)

E.g. Changes in external or internal environment (outside or inside animal body). Example pain, smell, taste and sound

RECEPTORS

Refers to the parts of an animal which detects the changes (stimulus) e.g. tongue, nose, skin, ears and skin. Receptors are called sense organs. A receptor produces a type of message called nerve impulses, which is then transmitted from one part of the body to another.

COORDINATOR

Consists of brain and spinal cord which receive message as sensory nerve impulses from receptors. It coordinates these and generates motor nerve impulses which pass to the appropriate organs of the body which respond. In this way the activities of the body are coordinated

EFFECTOR

Is an organ which receives motor nerve impulses from the brain or spinal cord and brings about an appropriate response e.g. muscles and glands

RESPONSE

Is a body activities provoked by stimulus. E.g. pulling your hand away from a hot object

NERVOUS COORDINATION IN HUMANS

The nervous system includes specialized cells called nerve cells or neurons.

A neuron system includes specialized cells called nerve cell or neurons

A neuron has the following basic properties

- It is highly capable of responding to stimulus. This property is referred to as excitability
- It is highly capable of conducting message (nerve impulses) along it. This property is referred to as a conductivity
- It has a cytoplasm which extending forming long fine thread

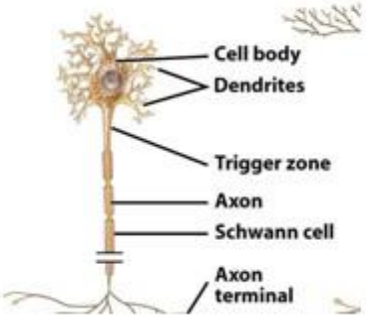
NEURONS

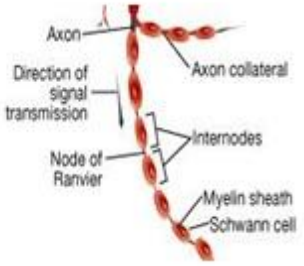
Neurons like other animal cells have a plasma membrane surrounding the cytoplasm.

The cytoplasm contains the nucleus and other organelles and is contained in one part of the cell. This is called the cell body.

- Axon is projection arise from the cell body.
- Axon carries nerve impulses away from the cell body.
- The shorter projections are called dendrites which conduct impulses towards the cell body.
- The axon is made up by cells called Schwann cells, these form a sheath around the axon called Myelin sheath.
- The small gap in between adjacent Schwann cells is called a node of Ranvies
- Myelin sheath serves to insulate axons from one another. Also it prevents impulses in one axon from interfering with impulses in another axon.

  Also nerve impulses travel faster in myelinated than in non myelinated nerve fibres





Classification of neurons

Neurons are classified as

1. Sensory (afferent)
2. Motor (afferent)
3. Relay neurons (Intermediate)

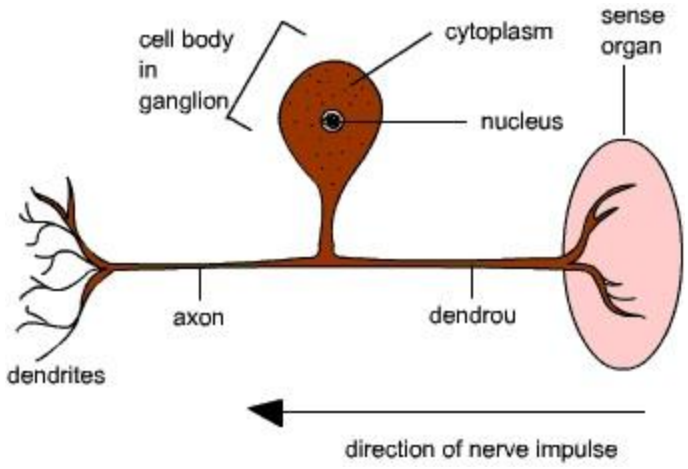
1. **SENSORY (AFFERENT) NEURONS**

They transmit impulses from sense organs towards the central nervous system (brain and spinal cord).

Each sensory neuron has an axon and Dendron. The Dendron has its origin in a sense organ. When there are changes in the environment the sense organ is stimulated at the tip of the Dendron.

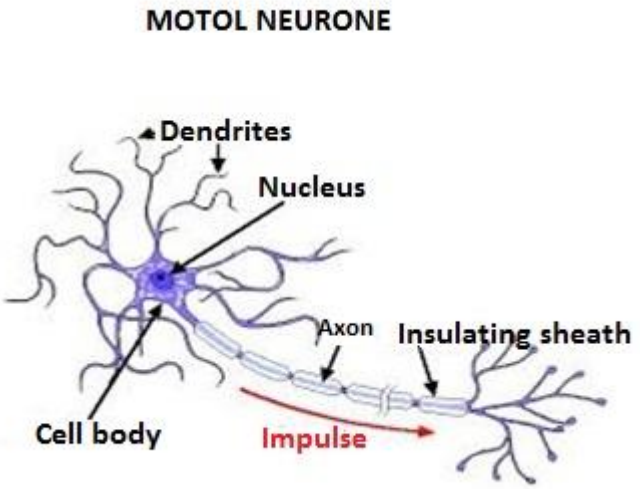
The nerve impulses are transmitted along the Dendron to the cell body and from there via the axon to the finely branches ends of the nerve cells in the brain or spinal cord.

N.B There will be no sensation until the nerve impulses have been interpreted



1. **EFFERENT (MOTOR) NEURONS**

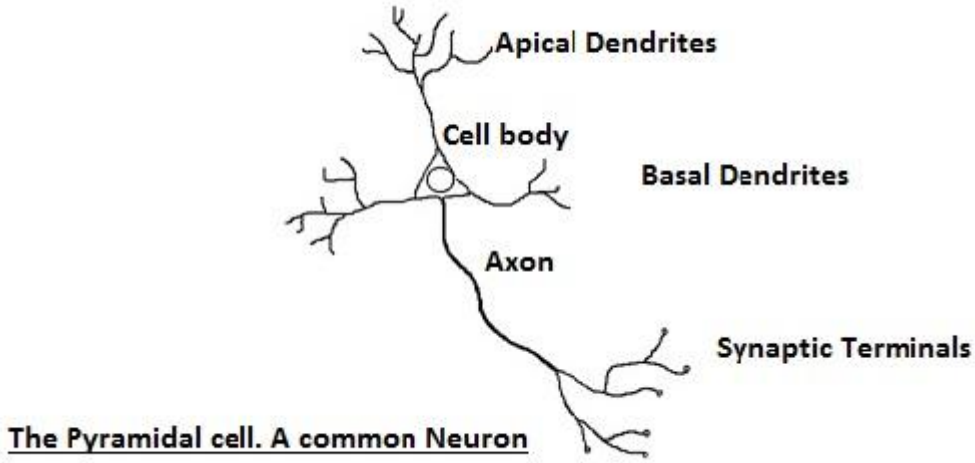
They transmit impulse from central nervous system to effectors organs.



3. RELAY NEURONS

Form intermediate links between afferent and efferent neuron. They are found in the brain and spinal cord. The terminal part of the Dendron of relay neurons receives impulses from the terminal part of the axon of a sensory neuron.

Impulses from the axon of a relay neuron are passed to the dendron of a motor neuron



CENTRAL NERVOUS SYSTEM

The central nervous systems (C.N.S) consist of the brain and spinal cord.

The CNS analyses the impulses received. It also determines what actions are to be taken in response to stimulus.

The central nervous system has two main components. Which are:

1. Brain
2. Spinal cold

1. THE BRAIN

Situated in the skull and it is covered by system of membrane called MENINGES. Between the inner most membrane and the middle membrane is a space filled with a fluid called cerebrospinal fluid.

This fluid cushions the brain against shock. Brain is very sensitive to insufficient supply of oxygen and glucose which causes rapid damage.

The brain is divided into 3 regions fore brain, mid brain and hind brain.

a) FORE BRAIN

This is the anterior portion of the brain. It is composed the Olfactory lobes and Cerebrum. The outer portion is grey hence called grey matter, like inner part is whitish hence called white matter.

The cerebrum interlinks impulses and coordinates response. Nerve impulses from the eye, ears and tongues are interpreted in the cerebrum.

Also cerebrum is responsible for speech, reasoning, memory, decision making, behavior and imagination.

Also controls activities are under the control of such as running, walking, eating, and playing. Since such activities are under the control of the will of the animal, they said to be voluntary or consciously done. In human the cerebrum is extremely active, compared with other animals. That is why we can reason and recall past experience.

The olfactory lobes receive impulses of smell via olfactory nerves from the organ that sense smell (nose).

b). MID BRAIN

Mid brain is smaller compared to other regions. This part of the brain is called the OPTIC LOBES. It lies between the fore brain and the hind brain. It is composed of thalamus and hypothalamus together with pituitary gland.

- Its function is to relay information between the fore brain and hind brain.

- Also to relay information between fore brain and the eyes. It is in this region that optic nerve linking the brain and eyes originates.

c)HIND BRAIN

Hind brain is composed of the cerebellum and medulla Oblongata

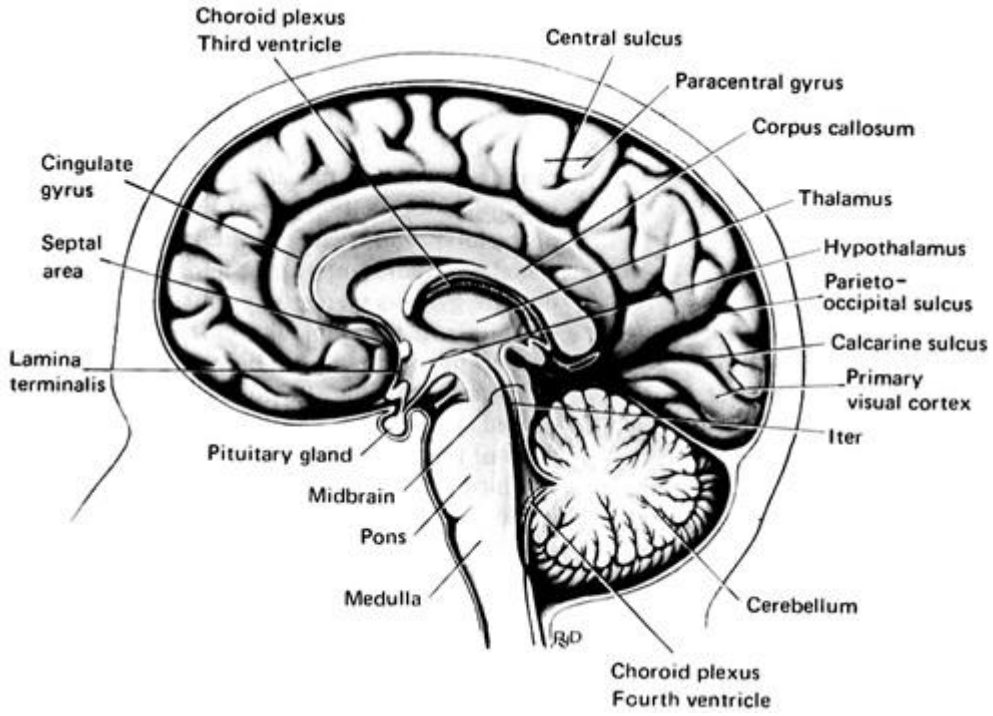
- The cerebellum regulates and coordinates body movements which are concerned with equilibrium

- Receive impulses from skeletal muscles, tendons and the inner ear, then relayed to fore brain

- In the fore brain the impulses are analyzed and the animal is made aware of its posture.
- Also cerebellum relays impulses from the inner ear to the appropriate muscles. These muscles act in such a way that the body position is changed to maintain balance.
- **The medulla Oblongata:** Is the most posterior part of the brain which merges with the spinal cord
- It controls all unconscious activities of the body e.g. Breathing, heartbeat, digestion, dilation and contraction of blood vessels, secretion of juices from glands and temperature regulation
- Oblongata is essential to life of animal because it controls breathing and heart beat. If the medulla oblongata is severely damage the animal dies immediately. The parts of the nervous system that control these unconscious activities are collectively called the Autonomic N.S.

  NB: Meningitis is a disease results from the infection of the meninges by certain types of bacteria or viruses.

- Meningitis are caused by bacteria can be treated with antibiotics but very difficult to treat with antibiotics meningitis which is caused by viruses. If the infection reaches the brain the person may die.



Human brain longitudinal section

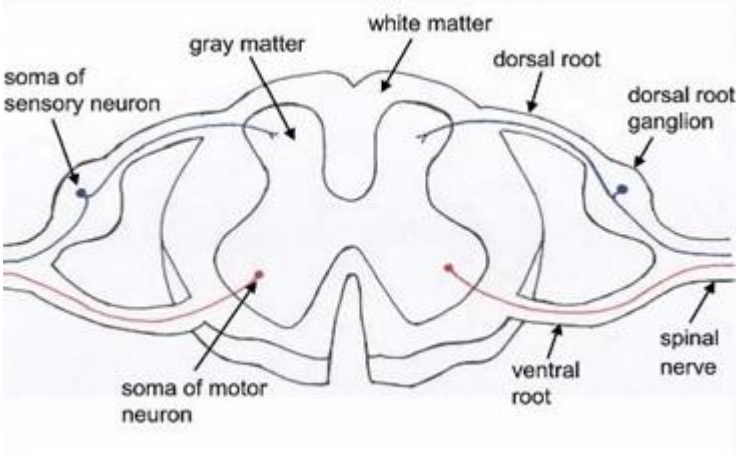
2. THE SPINAL CORD

The spinal cord is the extension of the central nervous system (CNS) from the brain to the tail. The spinal cord is incased in meninges and protected by the vertebral column. The spinal cord is made up of 2 halves fused together called spinal canal, the canal is filled with cerebrospinal fluid.

The spinal cord gives rise to 31 parts of spinal nerves which exist between the bones of the vertebral column and connect to all parts of the body.

- The spinal cord serves as nerve impulse conduction path way. Nerve impulses transmitted by the spinal nerves are relayed to the brain. Then from the brain to the spinal cord, then transmitted to the effector organs
- Spinal cord act as a *coordinating centre*. It controls actions called *involuntary actions*, these are actions which are fast and automatic. They cannot be controlled by the will power and need not to be learnt.
- Such responses are called *reflex actions* e.g. sneezing, coughing.

STRUCTURE OF SPINAL CORD



GREY MATTER

- Is central part of spinal cold
- It consists the central canal filled with cerebrospinal fluid
- It consists of relay neurons which connect information between the afferent and efferent.
- The cell body is found inside the grey matter

WHITE MATTER

Is the outer part of the spinal cord, consist of axon of sensory and motor neurons

VENTRAL ROOT

This is a part of the spinal which carries motor nerve fibres

DORSAL ROOT

This is a part of the spinal which carries sensory nerve fibres

Function of the spinal cord

- Conducts sensory nerve impulses from the receptors of the sense organs to the brain.
- Conduct motor nerve impulses from the brain to the effectors.
- Enables animals to attain an upright position through the maintenance of muscles tone.

Protection of nervous system

The nervous system is very delicate and vital to the well being of the animals, it is therefore highly protected from damage

- The brain is protected from mechanical damage by the bones which make up cranium /skull.
- The meninges are tough membrane that protect the brain from shock.
- The cerebrospinal fluid provides a floating environment.
- The fluid also helps to protect the brain from blows on the skull and from abrupt head movement.
- The spinal cord is protected by the vertebrae from mechanical damage.
- The nerves are sheathed by membrane.

PERIPHERAL NERVOUS SYSTEM

The peripheral nervous system is made up of sensory and motor nerves. These nerves run to and from the central nervous system and the rest of the body.

REFLEX ACTION

A reflex action is a sudden, automatic and uncontrolled response of parts of the body or the whole body to external stimuli. E.g. - when a hot object is accidentally touched, the hand is quickly withdrawn.

Their eyelids close quickly when a small object comes very close.

All these activities are responses which help to protect the individual. Actions occur as a result of impulses that travel along the neurons which are arranged in a path called *reflex arc* (the neural path way linking a receptor and effectors)

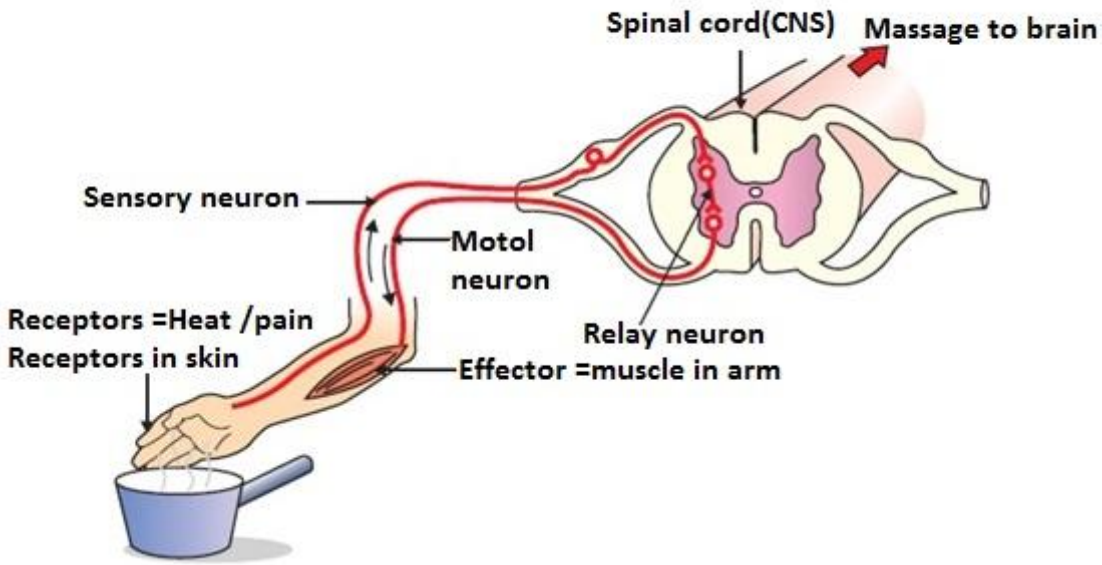
These responses are fast and automatic. – They cannot be controlled and are not learnt.

The sensory neuron transmit impulses from a receptor, enters the spinal cord via the dorsal root of a nerve. Impulses travel from the receptor to the spinal cord or brain.

The relay neuron lies in the spinal cord receives impulses from the sensory neuron and passes them to the motor neuron via a relay neuron.

The motor neuron then sends the impulses to an effector via the ventral root so that a very quick response is produced. As a spinal reflex action takes place, impulses are sent to the brain. The

brain takes note of what has happened, records it and the individual then become aware of what has happened



CONDITIONED REFLEX ACTION

Conditioned reflex action refers to the reflex actions which results from experience or learning. That is the reflex action was not there before.

Example of coordinated reflex action: is a dog produces a lot of saliva at the sight of food. The production of saliva is a reflex action in response to the sight of food.

An experiment was carried out on dogs in which a bell was rung every time food was supplied to the dog. After the experiment was repeated several times, it was noticed that when a bell was rung even without supplying the food, the dog salivated.

Usually the sound of bell does not causes a dog to salivate the dog had learned to associate the sound of the bell with the presence of food. Thus the second of the bell with induced the secretion of saliva in the same way as did the sight of food.

Through conditioned reflex actions, it is possible to change an animal's behavior, in this way help animal to learn new ways of behaving.

Also produce responses which are favorable.

SENSE ORGANS

A sense organ is a mass of specialized sensory receptor cells compacted together. Sensory receptor cells detect stimuli from the environment. Each type of receptor is responsible for registering a particular kind of stimulus.

Receptors will not respond to stimuli other than those for which they are specialized E.g. A sense organ sensitive to touch will not detect the stimuli of heat or cell which is sensitive to chemical, will not detect pressure.

The sense organs or sense cells are connected to the brain or the spinal cord by nerve fibres. When the sense organs receive an appropriate stimulus it sets off an electric impulse which travels along the nerve fibre to the brain or spinal cord.

When the impulse reaches one of these centers it may produce automatic or reflexaction.

The sense organs of one kind and in a definite are connected with the one particular region of the brain. It is the region of the brain to which the impulse comes that gives rise to the knowledge about nature of the stimulus, and where it was received. Each part of the body has its own sensory area in the brain. E.g. nerve fibres from one's thumb run to one area in the brain or from one's big toe run to another area.

SENSORY ADAPTATION

When the sensory nerve in the receptor is stimulated for the fact first time, transmission of nerve impulses is very fast, continued stimulation soon leads to a slowing down of impulse transmission and finally it cease all together.

The sensory adaptation is useful for the comfortable life of an organism

E.g. when a person is cut or bruised, they feel sharp pains to begin with. These pains have not healed yet.

SENSORY RECEPTORS

Human beings have different types of sensory receptors which are located in different parts of the body. They are found in the skin, eyes, ears, blood vessels, muscles, tendon, nostril and tongue.

I. EAR

There are three types of sensory receptors in human ear

- That concerned with hearing.

- Equilibrium of the body (balance)
- With acceleration (structure concerned with detection).

The mammalian ear is divided into three organs.

1. The outer ear.
2. The middle ear.
3. The inner ear.

1) OUTER EAR

The pinna, ear canal and the eardrum form the outer ear.

a. The pinna is the outermost part of the ear and is made up of cartilage. The function of the pinna is to trap sound wave and direct them into the ear canal.

b. Ear canal is the tube through which sound waves travel. The walls of the ear tube secrete wax and hairs which traps dust. This tube directs sound waves into the eardrum.

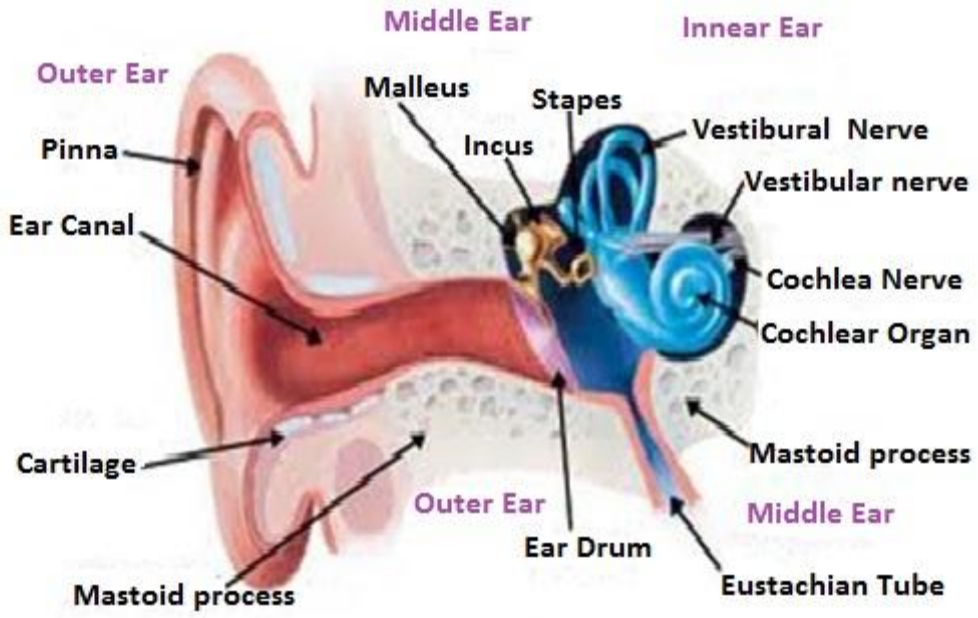
c. Eardrum (tympanum): Is a thin double membrane that forms the boundary between the outer ear and middle ear. The eardrum vibrates when hit by sound waves.

2) MIDDLE EAR.

This is an air filled cavity which is behind the eardrum. The middle ear consist of three tiny bones namely Malleus (hammer), Incus (anvil), stapes (stirrup). These *ear ossicles* amplify the vibrations and transmit them towards the inner ear. The cavity is connected to the mouth by a tube called *Eustachian tube*.

Usually the tube is closed but when the pressure in the middle ear increases, the tube opens until the air pressure in the middle ear is equal to that in the throat and therefore to the atmosphere.

- Eustachian tube equalizes the air pressure between inside and outside of the eardrum.
- If this tube is blocked by mucus as in the case of cold the hearing is impaired.
- Opposite to the eardrum, there are two opening, one of them is oval shaped and hence is called the oval window (fenestra ovalis). The other is round is called round window (fenestra rotunda)



3) INNER EAR

The inner ear consist of cavity filled with a fluid called perilymph, two sac- like structure called the sacculus and utriculus, three semi – circular canals and a coiled tube called cochlea.

The sacculus, utriculus, semi – circular canal and the cochlea are filled with a liquid called endolymph.

The cochlea detects sound vibration (hearing) and semi – circular canals, sacculus and utriculus, control balance and posture

MECHANISM OF HEARING

- The pinna collects sound waves and directs them to the eardrum through the ear canal.
- When sound waves hit the eardrum it vibrates. The vibrations are transmitted to the ossicles and amplified. The vibration of the stape causes the membrane at the oval window to vibrate. The vibrations of the oval window are transmitted to the perilymph on the sensory nerve fibres. The impulses are transmitted to the brain for interpretation.

SENSE OF ACCELERETION

The semi- circular canals are concerned with the detection of motion. The ampullae of the semi – circular canals contain sensory cells, attached to sensory nerve endings. The sensory cells have hair which is enclosed in a core of jelly substance called “cupulla”.

Whenever the body or the heart moves the semi – circular canals lags in its motion and apparently moves in the opposite direction.

The moving fluids cause the cupulla to tilt thus pressing the hair of the sensory cells. The pressing of the sensory hair creates nerve impulses in the sensory nerve endings. The nerve impulses are transmitted to the brain. The brain then interprets direction and speed of motion of the body or head

SENSE OF EQUILIBRIUM

The utriculus and sacculus are concerned with sense of balance and posture. The inner surface of these structures contains sensory cells. The sensory hair cell, which has protruding hairs embedded in a jelly – like substance containing tiny particles of chalk called “otoliths”.

When the head is titled on one side the otoliths move in the opposite direction pulling or pressing the sensory hairs they initiate nerve impulses which transmitted to the brain. Then the brain directs the angle which tends to return the body to its normal.

HEARING DEFECTS

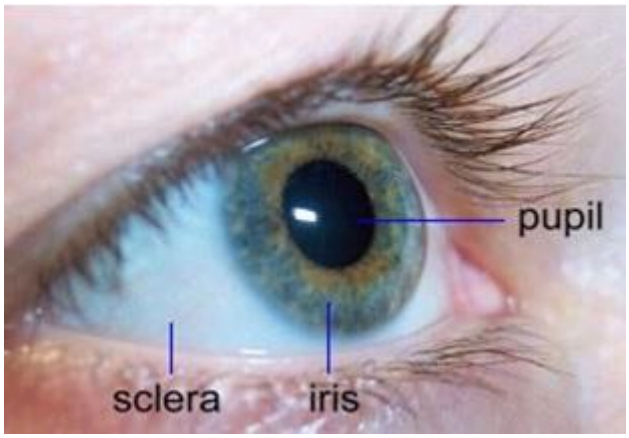
Loss of hearing and deafness can be caused by

1. BLOCKAGE OF THE EAR CANAL: Production of too much wax may harden and block the external auditory canal.
2. RAPTURE OF THE EARDRUM: The eardrum may be perforated or burst due to load, noise, physical blow and infection.
3. FUSSION OF THE EAR OSSICLES: Due to abnormal growth of connective tissues in the middle ears which fuses the ear ossicles and prevents them from vibrating.
4. NERVE DESTRUCTION: This is caused by either the damage of the auditory nerve due to nervous disease
5. INFECTION OF THE MIDDLE EAR: When the eardrum is infected it becomes thick and rigid such that it cannot vibrate even when struck by sound wave.

II. SENSE OF VISION (EYE)

Receptors which are concerned with the sense of vision are located in the eyes.

(Front view of mammalian eye)



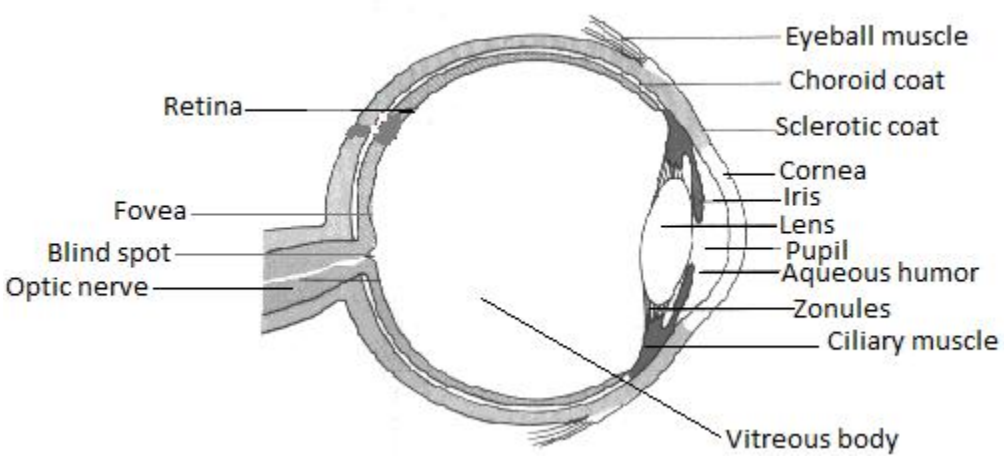
From the front view, the eye has three well marked regions

Pupil – These is a small dark central portion which is surrounding by the region called Iris.

Sclerotic layer – Is the layer which surrounds the iris. This is the largest part of the eyeball.

Cornea: is a transparent region in front of the eyeball passes over the iris and pupil.

Cross-section of the mammalian eye



Function and adaptation of the parts of the eye.

The eyeball has a cavity which is divided into two portions:

I. VITREOUS HUMOUR

A large posterior portion filled with jelly like fluid called vitreous humour which is found between the lens and retina. The vitreous humour maintains the shape of the eyeball. The fluid also reflects light and since it's transparent, allows light to pass through.

II. AQUEOUS HUMOUR

This is a watery filled in a small anterior portion found between the cornea and lens. Aqueous humor is transparent allows light to pass through. Also reflects light and maintain the shape of the eyeball.

The two chambers are separated by lens.

LENS is held in position by fibres called SUSPENSORY LIGAMENTS. Lens is transparent to allow light to pass through.

1. RETINA is the innermost layer of the eyeball. It is elastic and contains a lot of blood vessels. It contains PHOTORECEPTORS called CONES and ROD.

2. CONES are sensitive to light of high intensity (bright light) and colour.

3. RODS are sensitive and functions in dim light.

4. FOVEA is a region where the cones are packed together. The fovea is directly opposite of the lens, is a most sensitive part of the retina.

5. CILIARY BODY

Contain ciliary muscles that contract to contol the shape of the lens.

6. IRIS

Is a ring of contractile muscles (circular and radial); they control the amount of light entering the eye.

7. PUPIL

Is a hole an opening in the iris, which allow light to enter the eye.

8. SCLERA

This is the outermost layer of the eye. This layer protects, support and maintains the shape of the eyeball. The sclera continues and become a transparent layer at the front of the eye from cornea.

9. CORNEA, It is a transparent front of the eyeball covered by a thin membrane known as conjunctiva, it is convex to reflect light also allow light to pass through.

10. CONJUCTIVA: It is a transparent membrane; it covers and protects the cornea

11. CHOROID LAYER

This is a layer next to the sclerotic layer. Choroid layer extends to the front of the eye to form the Ciliary body and Iris. The pigment of the choroid absorbs stray rays of light to prevent reflection of light within the eye.

12. BLIND SPOT

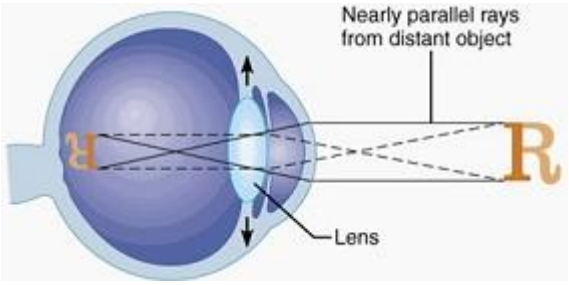
This is the area in retina through which optic nerve leaves the eyeball. The blind spot has neither rod nor cones. So images from object falling on the blind spot cannot be perceived by the brain

IMAGE FORMATION

Vision depends upon image formation. The formation of an image is dependent upon cone of the proper of light. That is when light passes through from one medium to another its velocity changes. If light goes from air into a denser medium the rays bent. This bending of light is called Refraction.

The formation of image depends on the law of refraction. Light rays from the object enter the eye through the cornea. Then they pass through the aqueous humour, pupil, lens, vitreous humour and finally reach the retina where the image is recorded as real upside down and smaller than the objects.

When light rays fall on the retina, they stimulate the photo receptor and impulses are sent to the brain through the optic nerve. The cerebrum then interprets the impulses, making the object visible. The interpretation also means that a person will be able to see the object in its right orientation and correct size



ACCOMODATION OF THE EYE

Accommodation is the ability of the eye to focus, both near and distant objects or ability of the eye to produce clear images of objects at different by altering the focal length of the eye lens. This is brought about by action of the ciliary muscles, and elastic of the lens.

When the eye is focusing on a distant object the Ciliary body muscle relaxes, while the suspensory ligaments become tighter and pull on the lens. The lens gets thinner and gives you clear image of the object.

When the eye is focusing on a near object the tension of the suspensory ligament is relaxed or decreased and the lens becomes thick and more convex. This allows light rays to be focused into the retina.

THE COMMON EYE DEFECTS

Defects of the mammalian eye are structure deviations of the eye which alter the focusing mechanism of the eye.

There are two common eye defects

1. HYPERMETROPIA (long sight)
2. MYOPIA (short sight)

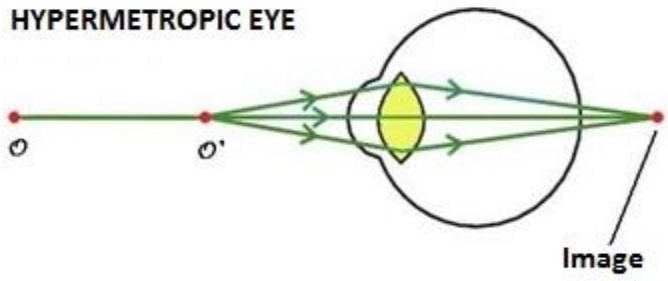
1. HYPERMETROPIA (long sight)

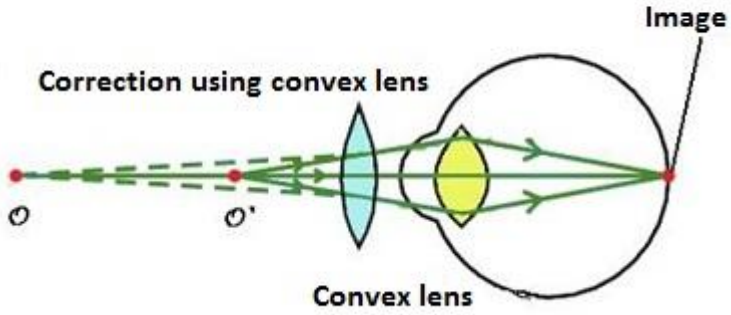
This condition is due to compression of the eyeball, resulting in the shorting of the normal distance between the lens and the retina.

In this condition, light rays from distance object are focused on retina, where light rays from near objects fall behind the retina.

This means;

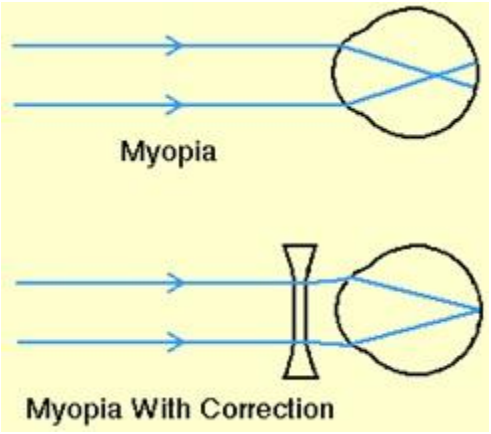
- A person cannot see near objects clearly
- Images of near objects fall behind the retina
- Caused by the eyeball being too short or the lens being too thin, so that it does not converge the light rays enough.
- These defects are corrected by using spectacles with convex lens.
- Convex lens converge the light rays before they reach the eye.





2. MYOPIA

A short sighted person focus distance objects properly. This individual can only focus near objects clearly. This is because the light rays of distance object converge at a point infront of the retina.



This may be due to eyeball being too large. This may be corrected by a biconcave lens. This help to diverge the light rays from distance objects so that they can be focused on the retina.

COLOUR VISION

There are three kinds of cone in a human retina, all three respond to more than one colour, but each particular cone is sensitive either to blue, green or yellow. Yellow light stimulates the green and yellow cone but red light affected the yellow sensitive of redness.

When all three types of cones are equally stimulated, we get the sensation white light.

3. A STIGMATION

This is a condition in which the cornea or lens is uneven such that is not focused properly on the retina. The defect can be corrected by using spectacles with special cylindrical lenses.

4. PRESBIOPIA

This condition, the lens cannot change its shape. It is brought about by loss in elasticity of lens and ciliary muscle due to old age can be corrected by the use of convex lenses

5. CATARACT

The lens gradually becomes cloudy so that light cannot pass through easily and the person cannot see properly. It may become gradually worse. The lens may have to be removed by operation and can be replaced by a plastic lens inside the eye.

6. GLAUCOMA

This defect is common in old people, glaucoma is caused by pressure in the eye.

7. COLOUR BLINDNESS

This is the genetic disorder in which a certain colour cannot be distinguished by man. A common type is red green blindness, individual is not in position to determine/distinguish between red and green colour.

8. TRACHOMA

These are a viral disease which affects the lighting of the eyelids. If not treated, trachoma can cause blindness.

III. SKIN

There are different types of sensory receptors in the skin.

1) Touch receptors

Are sensitive to light touch; they enable a person to distinguish between different textures, e.g. rough and smoothness, hard and soft, liquid and solid substances. Touch receptors are scattered all over the body surface but not evenly distributed. They are more concentrated in such areas as fingertips, others attached to the base of hairs.

2) Pain receptors

These are evenly distributed throughout the skin. They are also found in muscle, tendons, ligament and walls of the digestive system but not in the brain.

3) Heat receptors

Are sensitive to temperature.

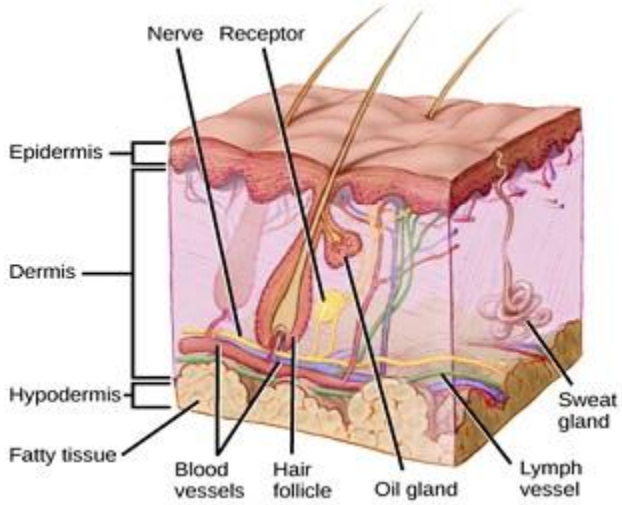
4) Cold receptors

Are also sensitive to temperature.

5) Proprioceptive and visceral senses.

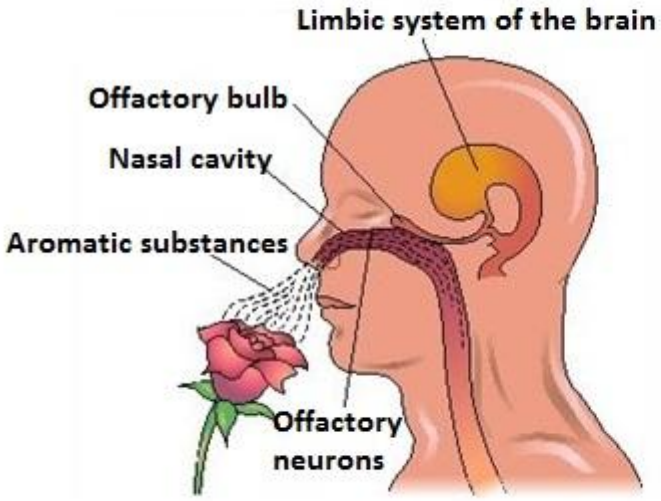
These receptors receive information about the condition of the body itself. Proprioceptive receptors are found in the muscles and tendons. Stretch provides the brain with information about the degree of tension in muscles and angle at which each joint is bent. Such information makes the brain aware of the movement of parts of the body.

TRANSVERSE SECTION OF A MAMMALIAN SKIN

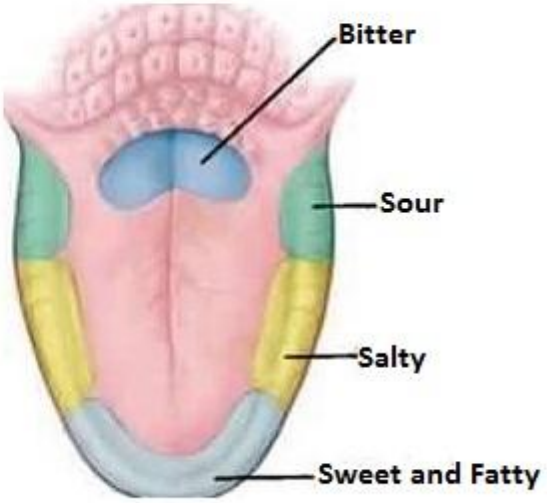


SENSORY RECEPTORS OF THE TONGUE AND NOSTRILS

The sensory receptors of the tongue and nostrils are sensitive to solution of certain chemical substances. The sensory receptors of the taste are located on the upper surface of the tongue and the lesson extends on the surface of the pharynx. The receptors for smell are located in the upper parts of the nasal passages.



Smell receptor in nose



Taste receptor in tongue

There are four (4) basic taste sensations

1. Sweet is detected at the tip of the tongue
2. Sour is detected at the side of the tongue
3. Bitter is detected at the back of the tongue
4. Salt is detected all over the tongue

The combined cavity of state buds and smell reception gives the sensation of flavor. Sensation of taste is important in that it helps animal to distinguish between suitable substances from unsuitable one for ingestion.

It also stimulates the salivary glands to secrete saliva continuing digestive enzymes

The receptors of state and smell are similar in it functions. Actually much of what is called "taste" is in fact a function of a sense of smell.

QUESTION

Why hot food often has more taste than cold food?

- This is because they vaporize more, the vapour passes from the mouth up into the nasal passages where it stimulates smell receptors.

Why we cannot taste foods small when suffering from cold?

- This is because the nasal passages are inflamed and coated with mucus. The smell receptors are essentially non- functional.

In each case of taste and smell, chemical and smell must go in solution in the film of liquid coating the membrane of the receptors cell if they can be detected.

The major functional differences between the two (2) kinds of receptors is that smell receptors are more specialized for detecting vapour coming to the organism from distant source. Taste receptors are specialized for detection of chemical present in the mouth itself. Furthermore, smell receptors are much more sensitive than taste receptors.

DRUGS AND DRUG ABUSE

DRUG

This is any substance natural or synthetic, which has a physiological action on a living body.

It can be used for the treatment of disease on the alleviation of pain.

PSYCHOACTIVE DRUGS

Psychoactive drugs are the drugs that affect the central nervous system. Psychoactive drugs produce a false sense of well being and relieve someone from tension, anxiety, stress and pain.

Types of psychoactive drugs

1. Stimulus e.g. cocaine, heroin and nicotine
2. Sedatives / depressant e.g. alcohol, diazepam and mandrax
3. Pain killer / volatile solvent e.g. glue, kerosene, toluene and petroleum
4. Hallucinogens
5. Narcotics

Forms of drug taking

1. Intravenous; this is injecting a chemical substance into brood through vein.
2. Inhalation; some people prefer to inhale volatile solvents such as petrol, glue or paint.
3. Oral; some other drugs are taken in through the mouth.
4. Smoking; some drugs like marijuana (bhang or ganja) are smoked.
5. Sniffing; some drug like cocaine are sniffed through the nose.

DRUG ABUSE

This is when drugs are used for non – medical reasons with no regain to their side effects.

The drugs when used regularly, they can cause a state of dependence called ADDICTION. A drug addiction is to depend up on drug so that life becomes unbearable without it. Depend up if there is a sudden cut –off the drug, a person suffers withdrawal system

1. **CAFFEINE**

This is bitter substance found in, tea, soft drink, chocolate, kola nuts and certain medicine. It has the same effects on the nervous system accelerate the heart rate and increase the amount of sugar in blood. These have negative effect on the well being of the human body.

2. **NICOTINE**

Is found in tobacco it has the same effects on the nervous system as that of "Caffeine" smoking linked with cancer of lungs, mouth throat, larynx, gullet bladder and pancreas. Also thinning and weakening of long tissue, smoking delay the healing of stomach ulcers, reduce sense of smell and taste.

3. **COCAINE**

Is found in the leaves of nuts and of the coca plants, have the same effect as nicotine.

4. **ETHLY ALCOHOL**

Is found in alcohol and beer, it enforce with the transmission of nerve impulses at synapse little alcohol have a stimulation effects large among distorts vision and interfere with hearing

The person becomes insensitive to touch, experience difficult is speaking. Ethyl alcohols slow reflexes and interfere with concentration and distance judgment. This is why people are advised not to drink when driving.

1. **OPIUM,MARPHINE,HEROIN AND METHADONE**

   These are found in capsules of the poppy plant. These drugs rise to feeling of person and power. They interfere with nerve impulse transmission resulting in a positive affecting the well being of the body. If inhaled in appreciable amounts with either chlorofluocarbon or benzene induces unconsciousness,similar to that produced by alcoholic intoxications.

2. **VALIUM**

   Interfere with impulses transmission other tasted to valium interfere with the function of the medulla

3. **MARIJUANA & HARSHISH**

   They produced from a plant called Indian hemp. These drugs disturb the sense of judgment so that a person becomes careless and foolish.

EFFECT OF THE USE OF DRUGS ON HEALTH AND SOCIAL

Social hazard

- Users may lose their jobs as result of repeated failure to up for work.
- Users often turn to crime to find their habit.
- Loss of esteem by the user as he or she may be rejected by first family
- Loss of work hours as may users take time off to recover from side effects of their habits
- Relationship may break up as a result of the increasing impotence of user's habits.

HEALTH HAZARD

1. Smoking may lead to lung cancer or heart disease.
2. Alcohol causes brain damage, liver cancer.
3. Some drugs affects the reproductive system by slowing down the rate of sperm production.

CAUSES OF DRUG ABUSE

- Social pressure, fear of being rejected in a social group.
- Taking drugs might ease anxiety or unpleasant feeding.
- Escapism: some are taking drugs because they think it is the only way to have a pleasant time socially.

PREVENTION

- Avoid taking any form of drugs without description from doctor
- If one realizes that is addicted should seek help from health officials
- To avoid boredom and idleness one needs to get engaged in activities such as games, and sports during leisure time
- To form counseling club in the community to advice people especially youth on how to keep off from drugs.
- Cultivation of drugs producing plants can also be prevented
- Drug dealing can also be controlled or eliminated by communities
- Drug abusers can obtain help in drug rehabilitation centers.

HORMONAL COORDINATION IN HUMANS

Hormonal coordination involves organs which secrete chemicals substance. This system is known as endocrine system which is composed glands and secretes chemical substance known as hormones.

These glands have no ducts, their secretions enter directly into the blood stream or body fluid by diffusion. The hormones are then transported through these media to the target tissues or organs, where they initiate response.

Therefore hormonal coordination refers to the regulation of body functions through release of hormones.

Hormones are vital in the body because they coordinate the body functions, some hormones act directly on effectors organs such as muscles; some regulates metabolic activities while others activate other endocrine glands.

Still others regulate normal growth and development of the young animals, and keep the adult animal in a health state.

Hormones are produced in some quantities and in most cases their effects is slow.

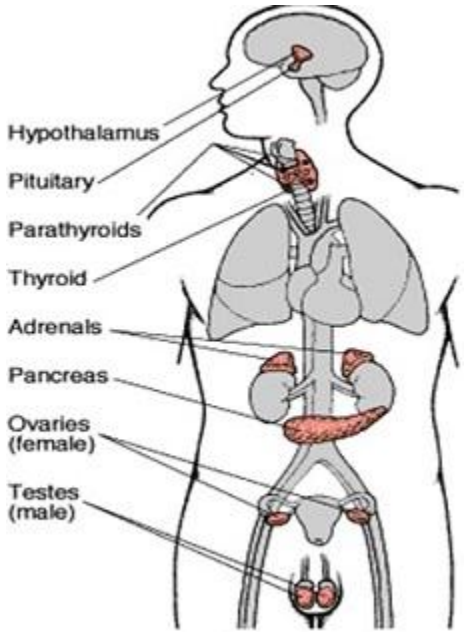
The endocrine system and the nervous system are similar in two (2) ways:

i) They are both set into action by a stimulus to produce a response

ii) They both involve chemical transmission.

The difference between nervous and hormonal

Nervous	Hormonal
Electrical impulse passing through, blood stream	Chemical passing through, blood stream
Rapid	Slow
The response is immediate	The response is usually slow
Duration of response is short	Long lasting
Response is located at a certain point	Response usually wide spread e.g. adrenalin



Position of endocrine gland in human body

The endocrine system consists of the following glands: pituitary, parathyroid, thyroid, pancreas, adrenal gland, ovaries and testes.

1. PITUITARY GLAND

This is found at the base of the fore brain. It controls the functioning of the body directly by producing its own growth hormone. It is also known as the master gland because controls the other ductless glands e.g. it controls the production of Thyroxin hormone in thyroid gland.

Pituitary gland produce thyroid stimulating hormone (THS) which stimulates the thyroid to release off more thyroxin.

Pituitary gland secret at least nine hormones which include the following;

1. **Growth hormones (somatotrospin**)

This influence protein metabolism and growth of bones, normal secretion of the hormones produce normal growth.

- Over secretion of the hormones resulting in abnormal large size of the body, the condition is called GIGANTISM
- Under secretion result in dwarfism which may be resulting of *delayed growth* or *permanently retarded growth*.

1. Pituitary produce **follicle stimulating hormone (FSH)** stimulates development of Graffias follicle in ovary.
2. **Testis are stimulating hormone** cause sperm production in males.
3. **Anti – diuretic hormones (ADH)** increase the absorption of water from kidneys.
4. **Luteinizing hormone** brings about ovulation
5. **Prolactin hormone** stimulates milk production in lactating mammals
6. **Oxytocin** brings about contraction of the uterus at birth, cause expulsion of milk from mammary gland. Hypo secretion birth is delayed while hyper secretion results in premature birth.

2. THYROID GLAND

It is found on the neck, it produces thyroxin, it regulates the rate of metabolism, it stimulates growth, development in young animal and control birth to old age

Under secretion causes *cretinism* (stunted growth) and severe mental retardation in child

-Over secretion in adult causes exopothalmic goiter reaction and premature ageing. The condition is called MYXOEDEMA.

Excess in adult causes under weight, restlessness and mental instability.

Goitre is characterized by enlargement of the thyroid gland. The cells in the thyroid gland enlarge in an attempt to contract as much Iodine as possible from the blood.

3. PARATHYROID

This is found within the thyroid gland. It produces parathormone in response to a lack of calcium in the blood resulting increased absorption.

4. ADRENAL GLAND

These are found above the kidney. They produce adrenalin hormone which prepares the body for action in an emergence by rising blood pressure increasing heart and breathing rates, increasing

blood sugar levels and increasing supply of blood to the muscles. These actions prepare the individual to run away or to fight the enemy.

Adrenaline is thus referred to as a hormone of flight, or fight.

Aldosterone regulates blood sugar and deposition of glycogen in to the liver. They also concerned with the re absorption of sodium and chloride ions as well as osmotic pressure.

5. PANCREASE (Islets of langerhans)

Produce **insulin** which lowers the level of glucose in the blood stream by causing the liver to store more glycogen.

Too little insulin causes **diabetes Mellitus** (excess glucose in blood stream) which is diagnosed by the presence of sugar in the converting glycogen to glucose again (metabolism excess glucose info facts/glycogen).

6. TESTES

Male reproductive organ produce testosterone hormone which is responsible for sperm production and development of male secondary sexual characteristic.

7. OESTROGEN

Is a hormone produced by the ovary in female, **oestrogen** controls the development of female secondary characteristics, promotes development reproductive organs. Also prepares the uterus to receive a ripe fertilized ovum.

- **Progesterone** is also produced by ovary. It is concerned with maintenance of pregnancy. It encourages the development of the uterus lining after ovulation. It inhibits ovulation and prevents the uterus from contracting during pregnancy.
- Relaxin is also produced by ovaries begins as the time of birth approaches. This hormone causes the ligaments between the pelvic bones to loosen providing a more flexible passage for the baby during birth

COORDINATION -2

Plants respond to a variety of stimuli in their environment. Unlike animals, plants cannot move from one place to another. However, they can move by forces of wind or water. Movement in plants in response to a stimulus is continuous and very slow. Movement of plants can be grouped into two:

- Growth movements
- Turgor movement

1. **Growth Movement**

These are the movements that take place in the meristematic regions due to unequal permanent growth. Growth movements can be classified into two categories namely:

- Autonomic movements
- Paratonic movements.

(a) *Autonomic Movements*

These are self-controlled movements for instance growth in the meristematic regions i.e. tips of stems and roots.

(b) Paratonic Movements

These are the plant movements induced by external stimuli. These stimuli include:

- Light
- Moisture
- Gravity
- Chemicals
- Touch

Paratonic movements include tropic and nastic movements

Tropic Responses

These are growth movements that are caused by a wide range of stimuli. In this case the plant grows either towards or away from the stimulus. If the response is towards the stimulus it is referred to as positive. If the response is away from the stimulus it is referred to as negative. Tropic movements are mediated through plant hormones. Tropisms are growth movements by plant organs in response to a unilateral stimulus, in which the direction of the movement is related to the direction of the stimulus.

Plant Hormones

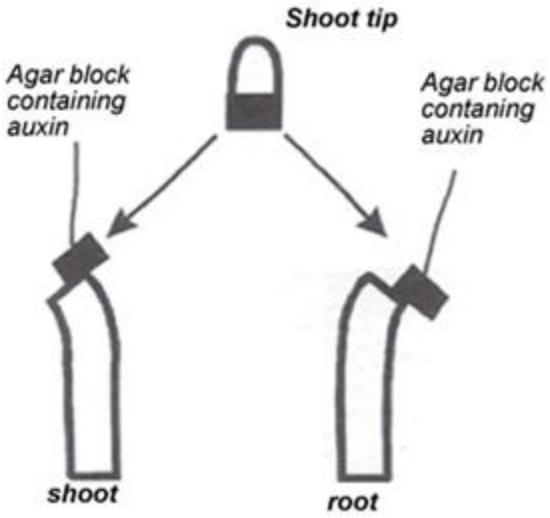
The first plant hormones were discovered by a Dutch botanist Fritz Went in the year 1928. Fritz Went called these hormones auxin or more accurately, indoleacetic acid (IAA). This hormone has an extremely powerful effect on growth. Like the animal hormones, plant

hormones act in very low concentrations. A solution of 0.001 milligram in a litre of water applied to the side of a shoot is enough to cause bending.

A part from auxins, plant hormones also include gibberellins and cytokinins. Auxins are synthesized from amino acid tryptophan in meristematic tissues such as the shoot tips, buds, young leaves and germinating seeds. Auxins increase cellwall elasticity by losing the bond between the cellulose fibres. Auxins promote cell division, cell elongation and cell differentiation.

Effects of Auxins Concentration on Growth

Experiments have revealed that higher concentrations of auxins stimulate growth in shoots while lower concentrations stimulate growth in roots. Amount of auxins which stimulate shoot growth, normally inhibit root growth



Experiments demonstrating that a hormone regulates growth in shoots and roots

Tropisms

A tropism is a movement by a plant organ in response to a unilateral stimulus, in which the direction of the movement is related to the direction of the stimulus. Tropisms are named according to the nature of the stimulus.

Types of Tropisms

(i) Geotropism

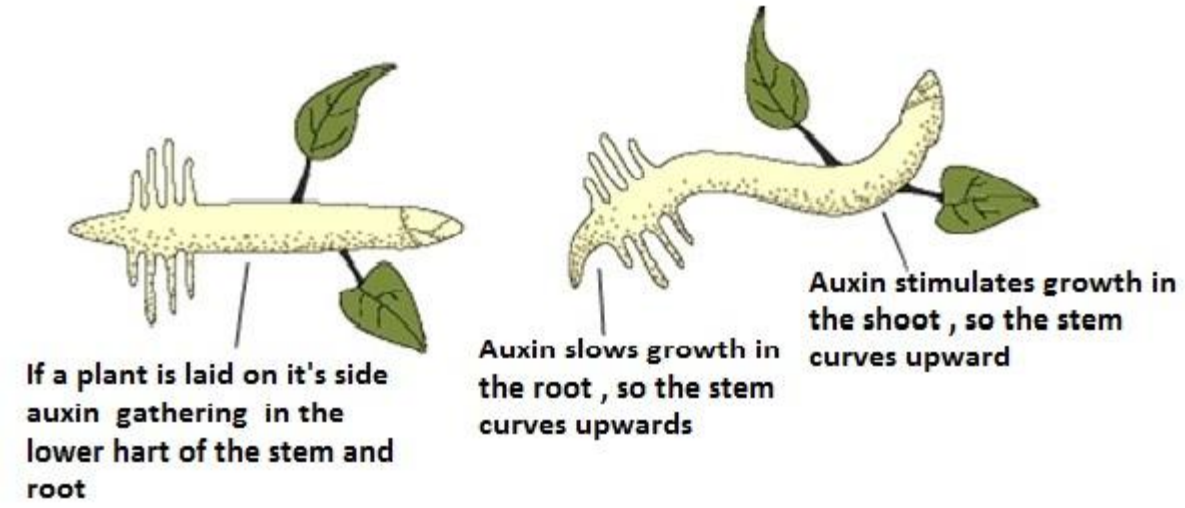
Geotropism is also known as gravitropism. This is the growth movement of plant parts in response to the direction of the force of gravity. The roots grow towards the direction of

the force of gravity which means are positively geotropic (gravitropic). The shoot grows away from the force of gravity which means are negatively geotropic (gravitropic).

If a seedling is placed horizontally, the plumule will eventually grow vertically upwards while the radicle will grow vertically downwards. The above observation can be explained as follows:

- When the seedling is placed in a horizontal position, more auxin settles on the lower side of the root and shoots due to the pull of gravity.
- Shoots respond to a higher concentration of auxin than roots. In this case the lower side of shoot grows faster than the upper side, resulting in a growth curvature that makes the shoot grow vertically.

- Root growth is inhibited by high concentrations of auxins. Thus, the lower side of the root grows at a slower rate than the upper side where there is less auxin concentration. Consequently, this results in a growth curvature that makes the root grow vertically downwards

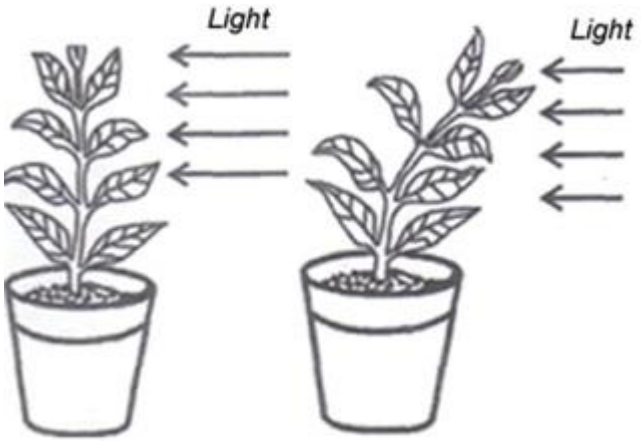


The effect of gravity on the growth of roots and root

(ii) Phototropism

This is the growth movement of plant organs in response to a unilateral source of light. In an experiment it was revealed that auxins are directly involved in phototropism. If a shoot is exposed to light from one direction only, the shoot bends towards the source of light. Light causes an unequal distribution of the hormone (auxin). Light causes auxins to migrate to the darker side. In this case the auxins are more concentrated on the darker side than on the side where the light is coming from. The cells on the dark side grow faster and elongate than the ones

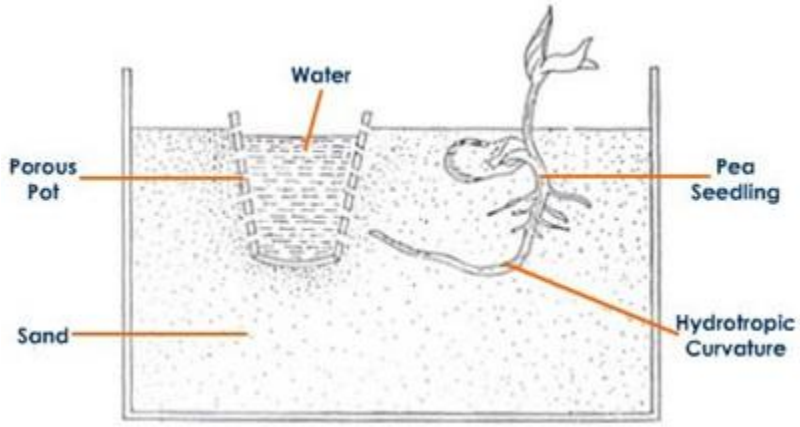
on the side where the light is coming from. As a result, the shoot bends towards light. Shoots are positively phototropism because they grow toward the light. Some roots grow away from light, which means they are negatively phototropic. However many roots are not sensitive to light.



Effects of light on shoots

(iii) Hydrotropism

That is growth movement of plant organs in response to unilateral source of water or moisture. In hydrotropism the root grows toward the source of water means the root are positively hydrotropic. On the other hand the shoot either grow away from the source of water meaning are negatively hydrotropic or show no response meaning are neutral.

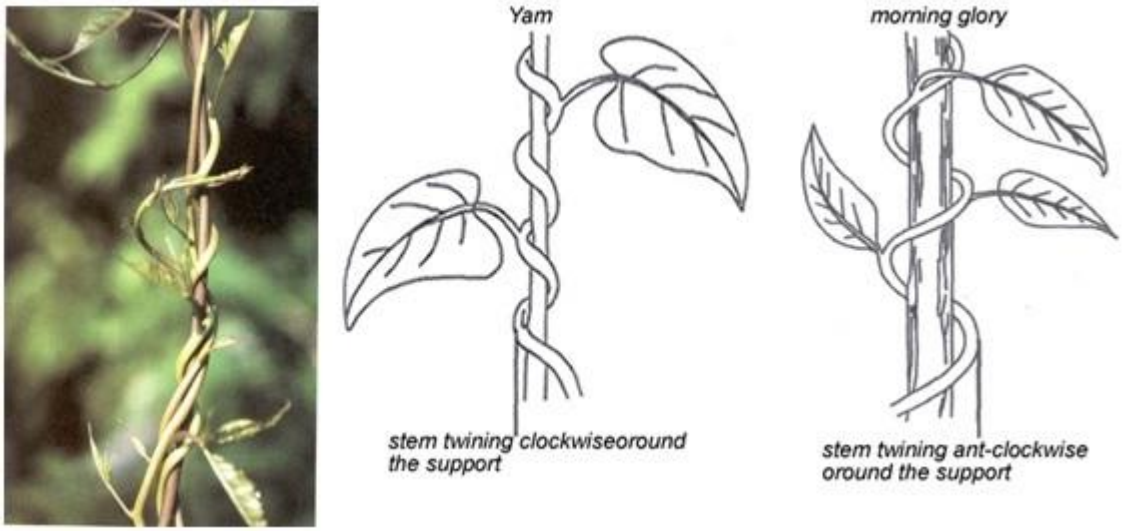


Root is positively hydrotropic

(iv)Thigmotropism

The term thigmo comes from a Greek word thigma meaning touch. Thigmotropism is also referred to as haptotropism. In plants such as possiflora and gloriosa with tendrils which curl around and cling to stems, auxins also play a major role. When climbing stems or tendrils come into contact with a hard object, the contact causes them to curve and coil round the hard object.

This is caused by the migration of the auxins from the point of plant contact and the hard object. In this case the part in contact with the hard object has a lower auxin concentration than the outer part. Higher auxin concentration promotes faster growth in shoots. Therefore, greater auxin concentration in the outer part causes faster growth than the part in contact with the object, hence the shoot continues to round the object.



Thigmotropism

(v) Chemotropism

This is the growth movement of plant organs in response to a unilateral source of chemicals. For instance, pollen tubes grow through the style towards the ovary and finally towards the ovules.

(vi) Thermotropism

This is the growth movement of plant organs in response to a unilateral source of heat as shown by movement of sunflower orienting itself towards the sun. However, there is an overlap between thermotropism and phototropism and sometimes a combination of both tropisms.

(vii) Rheotropism

This is the growth movement of plant organs in response to a unilateral source of air currents.

Importance of Tropisms

1. Phototropism: exposes the leaves of the plant to trap maximum sunlight for photosynthesis.
2. Haptotropism: enables plants with weak stems to obtain mechanical support.
3. Geotropism: enables the roots of the plant to grow deep in the ground to provide anchorage.
4. Chemotropism: enables the growth of the pollen tube in flowering plants to facilitate fertilization.
5. Hydrotropism: enables roots of the plant to obtain water.

Nastic Responses

These are non-directional movements of plant organs in response to diffuse stimuli, such as folding of leaves in warm weather, opening and closing of flowers in response to intensity of light and the closing of leaves when touched. Such movements occur as a result of changes in turgor pressure in certain cells.

Types of Nastic Responses

(a) Nyctinasty

This is a plant movement in response to temperature changes. This is a thermostatic movement; therefore nyctinasty is referred to as thermonasty.

*(*b) Photonasty

This is a plant movement in response to a change in light intensity. Some flowers in certain plants open in presence of light and close in its absence.

(c) Seismonasty

This is plant movement in response to shock or vibration.

(d) Hydronasty

This is plant movement in response to changes in atmospheric humidity

(e) Haptonasty

This is plant movement in response to contact. The sensitive plant *Mimosa pudica*response to touch by folding up its leaves.

(f) Chemonasty

This is a plant movement in response to chemical stimuli.

Tactic Movement

This is the movement of whole organism in response to an external stimulus. If the movement toward stimulus the tactic is positive, when the movement is away from the stimulus, the tactic is negative. Tactic movement is known as **taxis.**

Types of Tactic Movement

1. **Phototaxis** – locomotary response to light
2. **Chemotaxis** – locomotary response to chemical
3. **Aerotaxis** – locomotion response to variation in oxygen concentration
4. **Rheotaxis** – locomotary in response to direction of water current
5. **Magnetotaxis** – locomotary in response to magnetic field.
6. **Osmotaxis -** locomotary response to variations in osmotic pressure.
7. **Thermotaxis -** locomotary response to temperature changes.

Other Effects of Auxins

(a) **Apical Dominance**

This refers to the inhibition of lateral bud development by the terminal bud. If the terminal bud is removed, lateral buds develop into side branches. This is because when the apical bud is cut and removed, the apical dominance is reduced. However, if the apical bud is cut and then a substance containing auxin is applied to the cut end, lateral buds do not sprout or develop. This experiment clearly indicates that apical dominance is brought by auxins. The principle of apical dominancy is applied in pruning. Removal of the terminal bud encourages the sprouting of side branches causing the plant to grow sideways instead of upwards.

(b) **Development of Adventitious Roots**

Adventitious roots are the roots that develop from a stem cutting. Plant cuttings which do not develop roots readily may be dipped in rooting auxins e.g. Indole Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA).

(c) **Storage**

NAA is used to increase the period of dormancy in tubers and bulbs so that they can be stored for a longer period of time.

(d) **Parthenocarpy**

This is the formation of fruits without fertilization. Parthenocarpy can be inducedby treating unpollinated flowers with auxin. This phenomenon is applied in the development of seedless fruit varieties.

(e) **Falling of Leaves and Fruits**

Falling of leaves and fruits is brought about by a reduction in the concentration of auxins. Premature falling of fruits occurs due to the failure of the plant to produce adequate amount of auxins. This situation can be reversed by application of auxins.

(f) **Weed Killer**

In higher concentrations, auxins interfere with normal plant growth and can cause death. In this case auxins are used as herbicides or selective weed killers. For instance 2,4-dechlorophenoxyacetic acid (2,4-C) can be used as a weed killer (herbicide) killing broad-leaved plants.

Other Plant Hormones

(a) **Gibberellins**

These are a mixture of chemical compounds which have an effect on plant growth. A common example of gibberellins is **Gibberillic acid**. Gibberillic acid causes stem elongation in plants. It stimulates rapid growth in dwarf varieties of certain plants by increasing the length of the internodes. Also used in breaking seed dormancy and inducing parthenocarpy.

(b) **Ethylene**

Speeds up ripening of fruits such as citrus

(c)**Abscisic Acid (ABA)**

Regulates fruit drop at the end of the season.

(d) **Cytokinins**

These are active growth substances which promote growth in plants in the presence of auxins. Cytokinins promote cell division by inducing growth of roots, leaves, callus tissue and repair or wounds in plants.

Phytochromes

These are pale blue-green compounds consisting of a pigment, which absorbs light energy. Phytochrome exists in two interconvertible forms. One absorbs red light at a wavelength of 665mm while the other one absorbs far red light at a wavelength of 725mm. These two forms of phytochrome are designated as Pr and Pfr respectively. When Pr absorbs red light it is rapidly converted into Pfr and when Pfr absorbs far-red light it is rapidly converted into Pr.

The two phytocromes, that is Pr and Pf have the following effects:

1. Elongation of the stem is stimulated by far-red light but inhibited by the red light,
2. Leaf expansion is stimulated by the red light but inhibited by far-red.

3. Lateral roots growth is stimulated by far-red and inhibited by the red light.
4. Seed germination is stimulated by the red light but inhibited by the far-red light.

Photoperiodism

This is a flowering response in plants relative to lengths of day and night. When a plant is exposed to light, phytochrome absorbs light energy and P725 accumulates. P725 initiates the formation of a flowering hormone known as florigen, which is transported to the stem apices to promote flowering.

With reference to photoperiodism, plants can be classified into three groups:

- Short day plants
- Long day plants
- Day neutral plats

Short-day

These are the plants that require short-length illumination but shorter night periods to flower. Examples include chrysanthemum andpoinsettias.

Long-day Plants

These are the plants that require longer day-length illumination but shorter night periods in order to flower. Examples include wheat and lettuce.

Day - neutral plant

These are the plants that flower irrespective of day - length or right periods. Examples of day-neutral plants include cotton andtomatoes.

EXCRETION

This is a process of getting rid of waste products from the body of living organism formed during metabolic process. Metabolic process includes all chemical reactions taking place inside living system. Example; respiration

During the process of respiration, carbon dioxide is one of the products. Therefore carbon dioxide is known as excretory product and the organs that get rid of them are called excretory organs.

Example

Excretory product	Where it is made	Excretory organs
Carbon dioxide	Cell respiration	Lungs in mammals, Leaves(darkness)in plants
Oxygen	Green plant cells during photosynthesis	Plant leaves (light)
Nitrogen waste e.g. urea	Deamination of excess amino acid in the liver	Kidney excreted excretes urea in solution as urine
Bile pigment	Breakdown of hemoglobin by liver cell	Excreted from liver, store in gall bladder as bile.emptied into duodenum.

IMPORTANCE OF EXCRETION

1. It is important that all unwanted products be removed from the body of a living organism, because if they are allowed to remain in the body, they would soon become harmful and poisonous to the living.

2. Also sometimes materials that are taken into the body from outside maybe in excess of what is required. If so they will have to be removed as waste. E.g. proteins

3. In some cases excretory product undergo detoxification in order to make them less toxic to the organism before they are moved from the body

EXCRETION IN UNICELLAR ORGANISM

Unicellular or single celled organism such as amoeba and paramecium get rid of their waste product simply by diffusion through the surface of their bodies

-These waste substances diffuse from cytoplasm where they are at high concentration to outside of the body where concentration is low. Another method of excretion is by use of contractile vacuole

EXCRETION IN HIGH ANIMAL

Excretion in higher animal is carried out by elaborate system made up of specialized tissue and organ. This is because their bodies are complex and have greatest number of cell such that simple diffusion will not suffice.

FORMS OF WASTE PRODUCT IN ANIMAL ARE;

1. NITROGENOUS WASTE PRODUCT.

Excess amino acid/ protein cannot be stored in the body instead they are broken down to form ammonia .Nitrogenous waste product can be removed in 3 forms.

a. AMMONIA

Ammonia is high poisonous and dissolve in water it is removed in soluble form. It can be rapidly and safely removed if diluted in a sufficient volume of water. eg fish

b. UREA

Ammonia with carbon dioxide to form less toxic form of waste product .Urea is formed in the liver and insoluble in water. Urea is formed in the liver and insoluble in water. Urea is excreted by aquatic mammal and terrestrial animal E.g. man

c. ACIDIC UREA/URIC ACID.

Ammonia is also excreted as uric acid; uric acid is unstable and non toxic. This is excreted by animals living in shortage of much water E.g. insects, birds and reptile's uric acid is shortage and excreted in form of crystals.

2. CARBONDIOXIDE

Carbondioxide is produced during respiration. It is excreted through gaseous exchange.

3. EXCESS WATER.

Excess metabolic water form chemical breakdown of glucose lost either as water vapour sweat or urine.

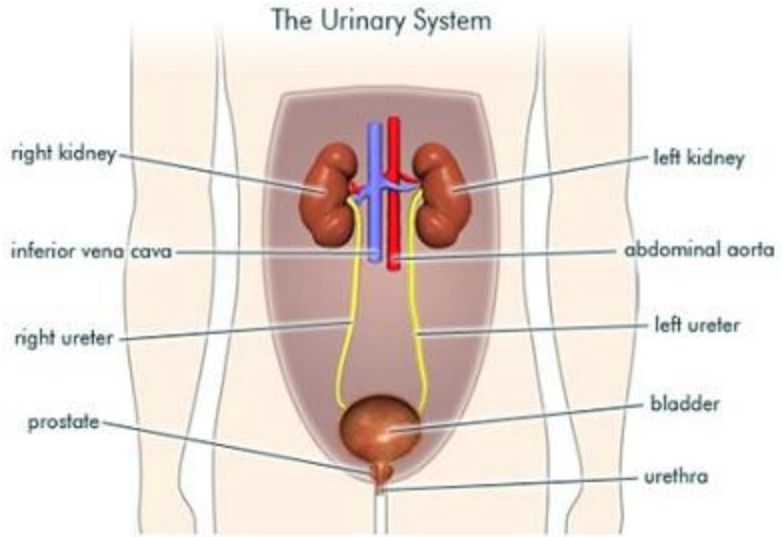
THE KIDNEY.

These are dark red bean shaped organ located at the back of abdominal cavity. There are two kidneys in human body the right kidney and the left kidney. Above each kidney are adrenal glands which secrete hormones which stimulate reabsorption of sodium ions. There are two blood vessels connected to the kidney one of them is RENAL ARTERY, supplies blood to the kidney. The other is the RENAL VEIN, takes blood away from the kidney.

A tube called URETER runs from each kidney to the **bladder**. Urine passes through ureter from the kidney to store in the bladder. From there, it is released periodically through a tube called URETHRA.

When the bladder is nearly full the stretching stimulates sensory nerve ending in its wall so that nerve impulse are relayed to the brain and argue to urinate develop. The **sphincter**

musclelocated at the base of the bladder relaxes and the urine is released via urethra. This tube is contained within the penis in mammals

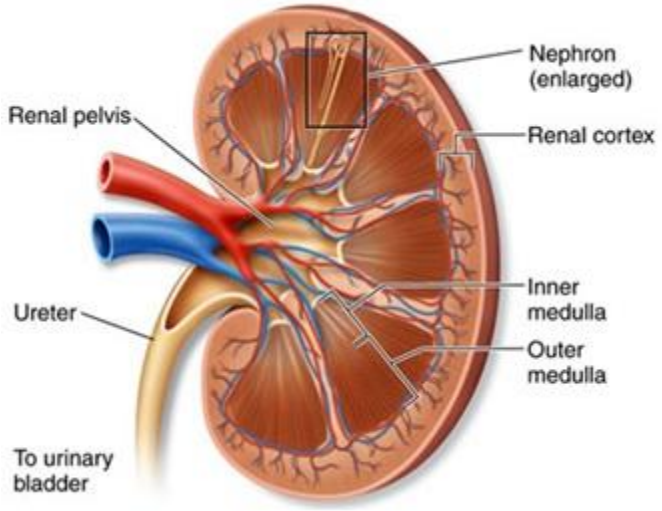


COMPOSITES OF KIDNEY

The kidney is composed of three regions namely

1. CORTEX
2. MEDULLA
3. PELVIS

INTERNAL STRUCTURE OF MAMMALIAN KIDNEY



i) **CORTEX**

Is the outer zone which is dark in colour contains a dense network of blood capillaries that form the glomerali of the nephrone, which are the functional unit of the kidney.

ii) **MEDULLA**

This part lies between the cortex and the pelvis. The surface of the medulla facing the pelvis is folded to form projection called PYRAMIDS

iii) **PELVIS**

Pelvis narrow to form ureter. Pelvis is a collecting space leading to the ureter which takes the urine to the bladder.

THE NEPHRONE

Nephrone is a function unit of the kidney. The nephrone performs both function of OSMOREGULATION and EXCRETION (Osmoregulation – maintains constant osmotic pressure of body fluids)

Each nephrone consist of a long tubule closed at one end and open at the other

The Nephrone is divided into four parts

1. Bowman's capsule
2. Proximal convoluted tubule
3. Loop of henle
4. Distal convoluted tubule.

i). **BOWMAN'S CAPSULE**

This is a round – cup shaped part of the closed end of the tubule and encloses the glomerulus, which is a network of blood capillaries the glomerulus formed from the afferent blood vessels, a branch from the renal artery.

ii)**. PROXIMAL CONVOLUTED TUBULE**

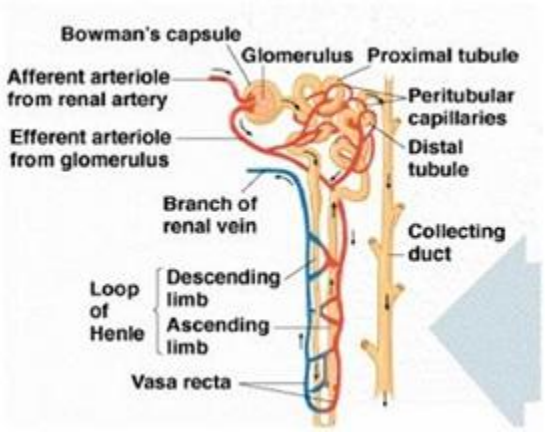
Is the coiled part of the tubule next to the Bowman's capsule. It lies in the cortex.

iii). **LOOP OF HENLE**

The portion of the tubule which extends from the approximation convoluted tubule and dips into the medulla, from the medulla it bends back into the cortex to form a u – shaped loop.

iv). **DISTAL CONVOLUTED TUBULE**

This is coiled part next to the open end of the tubule which joins with a collecting duct (ureter). The whole length of the nephrone is surrounded by network of capillaries.



MECHANISMS OF EXCRETION

Excretion takes place in three types

(i) Filtration

(ii) Reabsorption

(iii) Removal

i) **FILTRATION**

Kidney receives blood at high pressure through renal artery (branch of Aorta)

- The blood is rich in nitrogenous waste such as urea, dissolved food substance, plasma, protein, mineral ions, hormones and oxygen.

- The afferent vessels entering the glomerulus are wider than the efferent vessels leaving the glomerulus. The narrowness of the efferent vessels produces resistance to blood flow and thus creates pressure in the glomerulus.
- Due to high pressure in the glomerulus, the liquid of the blood dissolve substance of small molecular sizes are forced out of the glomerular in the Bowman's capsule (urea, glucose, salt and amino acid).
- Large sized molecule such as proteins and blood cells are not filtered because the walls of the capillaries of glomerulus and Bowman's capsule have very **small pores**.

-Hence the blood which remains is rich in plasma and has very little water.

- This process is known as **ultrafilitration** and the filtrate formed is called **glomerular filtrate**

ii). **REABSORPTION**

- As the glomerular filtrate moves along tubules, useful substance to the blood are selected and reabsorbed back into the blood.

- Most of the reabsorption occurs in the proximal convoluted Tubule through the process of *Active transport*.

- For efficient reabsorption of substance, the proximal convoluted tubule is adopted in several ways;

a) The cell the tubule has mitochondria which provide necessary energy in form of ATP.

b) The cell has microvillus to increase surface area reabsorption

c) Tubule is long and coiled to provide large surface area for reabsorption

d) Well supplied with blood capillaries.

e) The tube is coiled to slow down the speed of the flow of the filtrate.

COMPLICATION AND DISORDERS OF EXCRETORY SYSTEM

URINARY SYSTEM

Certain disorders of the body can be diagnosed by examining the contents and measuring the quantity of urine

1. For example, if the urine contains glucose then this indicates the disease DIABETS MELLITUS

- Diabetes Mellitus occurs because the pancreas does not produce enough of the hormone (insulin) which controls blood sugar level.

- It can be treated with injections of insulin

2. Another type of diabetes is DIABETES INSPIDUS, which results from large quantity of dilute urine being produce

-This happens because the sufferer cannot produce enough Anti – Diuretic hormone (ADH), which is responsible for regulation of the amount of water in the blood.

- Diabetes inspidus can be treated by Nasal sprays which contains ADH.

NEPHRITIS

Nephritis is the general term for any infection or inflammation of the kidney.

- In one type the glomeruli fail to function normally and allow protein to filter through into the tubules.
- It is diagnosed by the presence of protein in the urine

Causes of Nephritis

1. Could be allergic reaction
2. It may be blood vessels disorders or high blood pressure
3. Damage of the kidney.

Treatment

- It is dependent on the cause

KIDNEY STONES

Small stones can sometimes be formed in the pelvic region of the kidney.

- These stones may be made of

1) Uric acid

2) Calcium oxalate or (mixture of calcium)

3) Magnesium

4) Ammonium phosphate

- They form as a result of obstruction of urine flow on excess of certain chemicals in the blood stream

- There are often no symptoms of kidney stones unless stones move from their original position

- If a stone moves into the ureter, it causes severe of pain (Renal pain) which can be felt in the lower back to the grain, accompanied by vomiting sweating.

- There may also be blood in the urine.

Treatment

1. Can be treated by x- rays some small stones may put down the ureter and out through the bladder with the need for treatment.
2. Larger stones may have to be removed surgically actively they can be shattered into fragments by treatment.
3. The small fragments are passed out harmless in the urine.

NB: An untreated kidney stone may obstruct urine and lead to Nephritis

CYSTITIS

Cystitis is an inflammation at the bladder caused by infection.

Symptoms

1. Symptoms are frequent painful urination and blood urine.

   Middle symptoms maybe

2. Slight increase in the frequency of urination accompanies by a burning sensation.
3. If the infection spreads to the kidney, it may cause fever, blood in urine and backache.

Causes

1. It may be caused by bacterial infection of the bladder usually from the urethra.

KIDNEY FAILURE

Kidney failure is a condition where one or both kidney cease to function.

- If it happens to both kidneys it is fatal it not treated
- It can happen suddenly as a result of high blood pressure
- It is possible to live with one kidney only, but the only treatment for failure of both kidneys is DIALYSIS or a KIDNEY TRANSPLANT.
- **In dialysis**, the patient's blood supply is linked to a kidney machine. The machine performs the functions of normal kidney by filtering the blood and removing and excess salts and water.
- The patient's spends several hours in a week linked to the machine.
- **A kidney transplant** involves surgically inserting a health kidney from a donor to replace a diseased kidney.
- The kidney has to be compatible to avoid problems with rejections.
- Sometimes a health person will donate a kidney to save the life of a close relative suffering from kidney failure.

EXCRETION ON PLANTS

- Plants manufacture all their organic needs according to demand.
- They only make as much protein as they need at any one time, for example
- Therefore they do not excrete urea from excess amino acids because they do not usually have any.
- They do however respire and photosynthesis and as a result products.
- However, they waste products of one process may be the raw material for the other e.g. carbon dioxide and waste produced by respiration are recycled during daylight hours is usually high enough to produce oxygen faster than its use by respiration.
- Therefore the oxygen is not used up by respiration and the excess is excreted.
- Some plants produce tannins and other organic acids from nitrogen and carbohydrate metabolism.
- These are passed into leaves. Where they build up and are lost from the plant when the leaves fall off.
- Bitter substances such as tannins and other organic acid have a protective role in deterring leaf acting animals, from feeding on the plants.
- Trees produce various gums, resins and latexes which can be collected from the tree and have a wide range industrial uses.
- Products such as turpentine, paints, varnishes, soap cosmetics, food, surgical items, gold balls, bubble gum and rubber are manufactured from these plants products.

Mechanism through which plant remove their waste product

1. Diffusion
2. Abscission
3. Degradation

REGULATION (HOMEOSTASIS)

- REGULATION - This is the maintenance of a relatively constant body internal environment. Internal environment include temperature, concentration of salt, glucose, water and also hydrogen ions (PH) which are always changing.
- Such changes affect the rate of chemical processes of the body e.g. enzymes work best within certain temperature ranges. Outside this optimum temperature range, enzymes become inactive or may be destroyed.
- Therefore if enzymes are destroyed, metabolic process may stop. Changes in water, salt and hydrogen ion concentration will also affect the rate of metabolic reaction.
- For efficient functioning of the body, rate of chemical reaction must be kept at their optimum levels, hence the need to maintain the internal environment in a state of equilibrium
- Equilibrium may be achieved by

1. nervous
2. hormonal control

The maintenance of a constant internal environment is called **Homeostasis.**

Types of regulation

1) Temperature regulation (Thermoregulation)

2) Osmoregulation

3) Blood sugar regulation.

1. **Temperature regulation in animals**

This is the maintenance of a relatively constant body temperature. A constant body temperature favour efficient enzymes activities.

Enzymes work best at a narrow range of temperature known as optimum temperature

The temperature above a given optimum temperature is less favored by enzymes and may denature enzymes or destroy cell.

Temperature below the optimum inactivates the enzymes slowing down or stopping enzymes catalyzed reaction. It is very important that body temperature to be kept constant.

External temperature affecting the body is detected by thermal receptors in the skin. The thermal receptors relay information to temperature regulation center in the brain (hypothalamus)

Animals can be divided into two groups based on body response to environmental temperature fluctuations. These groups are;

1. Poikilothermic regulation
2. Endothermic regulation

1**. ECTOTHERMS (poikilotherms)**

This is type of temperature regulation in which organism temperature fluctuates with those of the environment e.g. all invertebrates and some of vertebrates as fish, amphibians and reptiles. Also organism known as cold blooded

2**. HOMOETHERMS (endotherms)**

Refers to animal where body temperature remains constant irrespective of environment changes.

Irrespective of whether an animal is endotherms or homotherms, changes in its body temperature will affect metabolic process. Rise in temperature beyond a certain limit will lead to decrease in the rate of metabolism.

A decrease in temperature below the optimum will result in a decrease in the rate of metabolic reactions enzymes become inactive hence metabolic reactions for survival, homeotherms and ectotherms must rest respect to changes in temperature.

TEMPERATURE REGULATION IN HOMEOTHERMS

Homeotherms have structures to detect temperature changes and mechanism to restore the temperature changes to the normal level.

- This is detected by sensory cell. Temperature changes stimulate the sensory cells which initiate impulses at the sensory nerve endings. Then send it to brains thermoregulatory centre.
- They interpreted the changes and set off a series of body reactions which may either lead to **production of heat**, **reduction of heat and less or elimination of excess heat**
- When the temperature of the surrounding environment is lower than the body temperature, the animal loses heat to its surrounding by Radiation. Hence when the temperature of the surrounding is low the temperature of the animal begins to fall.
- In order that the temperature of the animal to be raised to normal, the body responds by one or more of the;

1. **Increased rate of respiration** - which results in the production of heat in the body. The heat energy heats up the body resulting in a raised body temperature.

2. **Shivering** – this is due to contraction of skeletal muscles. This produces heat which is transferred to the body.

3. **Vasoconstriction** – this is the narrow of blood vessels at the skin's surface. It reduces blood flow in the skin in this way heat lost by radiation is reduced.

4. **Contraction of hair erector muscles**. This causes hair to rise; air is trapped between the hair, forming an insulating layer between the skin and the surrounding. Hair is poor conductor of heat hence provides insulation

- Also structural adaptations that regulate the amount of heat gained or heat loss include possessions of fur in mammals and thick layer of skin for animals living in cold areas. Features in birds that provide insulation

- **When the body temperature rises,** the temperature of the blood also rises (this may be due to increased vigorous muscular activity, rise in the temperature of the surround) the blood flows to the brain and stimulate the thermoregulatory centre. This triggers the following:

1. Vasodilatation – this is widening of blood vessels supplying the skin, it allows a large volume of blood to reach the skin. Since the blood in the skin is closed to external environment, the body's heat is lost to the environment – cooling effects.

2. Sweating – water fluid produced by sweat glands and brought to the skin by sweat ducts, evaporation of sweat from the skin draws heat from the body which has cooling effects.

- In humid atmosphere, sweat may not evaporate fast enough to cool the body under such condition the temperature of the body may raise over to 41^0C, resulting to coma and convulsion – heat stroke. If a victim is not taken to cool place it may result in death.

- Sweat contains salts, sweating also results in loss of large amounts of sodium. This way causes – muscle cramps, vomiting, nausea, fainting.

- This makes the hairs be flat on the body surface increasing heat loss by conduction and radiation

TEMPERATURE REGULATION IN ECTOTHERMS

Ectotherms in contrast to homeotherms do not have mechanism to regulate their body temperature.

- When the environmental temperature falls their bodies loose heat to the environment. This results in a fall in body temperature. Under this condition also the rate of metabolism decreases and the animal becomes sluggish.
- They overcome the problems either by moving away from cold to warms areas or by **HIBERNATING** (**dormant state**).
- When the environmental temperature rises the body gains heat from the surroundings, eventually the rate of metabolism increase and the animal becomes active.

- Prolonged exposure to higher temperature leads to death. To avoid being over heated, they move to cooler areas or by **AESTIVATE (dormant**)

OTHER MEANS OF LOSING HEAT FROM THE BODY

- Evaporating water from respiratory system and buccal cavity e.g. dogs achieve it through quick shallow breathing called **painting**, also saliva to evaporate from the tongue.

ADAPTATIONS TO COLD AND HOT

Animals living cold areas

- Animal living cold areas have thick layer of fat under the skin, thick layer of fur throughout their lives while other develop a thick layer during winter. (These acts as insulators against heat loss.)
- These animals have small ears and short noses (reduce heat loss)

Under extreme low temperature, animals whose regulatory mechanisms fail to combatheat loss hide in nests or burrows. During this period they cease to move. Their metabolic processes are reduced in a minimum. This is called HIBERNATION. During this period, animals depend on the food store in their bodies in the form of flat.

Animals that have no suitable insulators such as fur or fats cannot hibernate, to avoid extreme temperature by migrating to warmer places.

ANIMALS LIVING IN HOT AREAS

Homeotherms living in hot dry area have short sparse fur, little fat under the skin.

Large ears and long noses to increase surface area, volume ratio and maximize heat loss.

Also if exposed to prolonged hot temperature, then go into state of rest – AESTIVATION (their body metabolism slows down and they become very inactive).

OSMOREGULATION IN MAMMAL

This is the regulation of concentration of water and mineral salt in an organism. For proper functioning of the body, the amount of water and mineral salt are required at a certain amount. Water and mineral salt serve various physical functions in the animal body.

An excess or deficiency of water and mineral salts in the cell may interfere with osmotic pressure metabolic process of the cells.

Therefore, for the cell to carry out the physiological process efficiently, the level of water and mineral salts must be maintained within certain limits.

The regulations of concentrations of water and mineral salts in the body are referred to as **Osmoregulation**.

Movement of water into and out of the cell is closed related to the salt concentration. If the concentration of salts in blood and tissue fluid is higher than that of the body cells, then the water will move out of the cells by osmosis and they will shrink.

If the concentration of salts in blood and tissue fluid lower than that of the body cell, water will move into cells by osmosis. Continuous absorption of water makes an animal cell sub abnormally and possibly burst.

The balancing of the amount of water in the blood by selective re absorption occurs in the distal convoluted tubule and collecting duct of the kidney.

The process is controlled by hormones. The secretion of these hormones is depending on the osmotic pressure of the blood.

Osmotic pressure depends on the amount of water and salt present in it.

A rise in the osmotic pressure of blood is brought about by an increase in salt. (NaCl) concentration also brought about by reduction in its water content.

When a rise in the osmotic pressure of the blood is due to a decrease in the amount of water, blood reaching the brain causes the brain to register the water shortage. Thus stimulate the pituitary gland to produce ANTIDIURETIC HORMONE (ADH)

When the hormones reaches the kidney, ADH makes the distal convoluted tubule and the collecting duct more permeable to water so more water is reabsorbed back into the blood stream.

Water reabsorption will continue until the Osmotic pressure of the blood is brought back to normal. When this happens, secretion of the hormone falls and less water is reabsorption.

When there is a fall in the osmotic pressure of blood as a result of low concentration of sodium chloride (NaCl) concentration, another hormone called ALDOSTERONE is secreted from adrenal glands.

This hormone stimulates the tubules to reabsorb salt (NaCl) back into the blood.

This sodium chloride is returned into the blood circulation through the **RENAL VEIN.**

Re absorption will continue until the osmotic pressure of the blood is brought to its normal level, then the secretion of the hormone stops so no more reabsorption of sodium chloride.

1. **BLOOD SUGAR REGULATION IN MAMMALS**

One of the most important metabolites in the blood is glucose, so its level must be controlled.

Glucose is the end product of carbohydrates digestion. Glucose is the main respiratory raw material and must be supplied continuously to cells.

The brain cells are especially dependent on glucose and unable to use other metabolites as an energy source. Lack of glucose resulting in fainting

Human blood glucose concentration is between 80 – 110gm per $100c^3$ of blood, in order to provide an adequate source of energy and to maintain the required osmotic pressure of the blood. Deviation from this amount will result in an imbalance of energy supply and osmotic pressure of the blood.

If the concentration of glucose in the blood *rises above* normal, the osmotic pressure of blood will also arise resulting in cells losing more water to the blood than they gain from it.

Deficiency of glucose lowers the osmotic pressure of blood resulting in the net movement of water from blood into the tissue. Also the body will not be getting enough energy which may result in convulsions and eventually coma. Thus there is a need to maintain glucose at required level.

The level of glucose in the blood is maintained by two pancreatic hormones, insulin and glucagon. These hormones are secreted by specialized group of pancreatic cells called Islets of langerhans.

The increase in blood sugar concentration stimulates the secretion of insulin, which is carried to the liver and muscles, where it promotes the conversion of the excess glucose into glycogen and stored in the liver. Also glucose is converted into fats by the liver, and stored under the skin, around the heart, along blood vessels and intestines and around the kidney.

Hence if the concentration glucose in blood falls and the secretion of insulin is also lowered

If the level of glucose in the blood fall below the normal, glucagon is secreted which stimulate the conversion of glycogen to glucose which released into blood. Thus the blood glucose concentration is raised to bring it back up to normal.

1. **DIABETES MELLITUS**

This disease is due to accumulation of glucose in the blood.

Since the glucose is not removed from the blood as a result of conversion to glycogen the concentration remains high.

Re absorption of water in the kidney tubules is reducing as a consequence. Large volume of more dilute urine is produced and the individual may suffer severe dehydration.

Because little glycogen is stored in the body, body fat and proteins are used as a respiratory substrates the individual rapidly loses weight.

This disease can be treated by injections of insulin.

REPRODUCTION -1

This is the process by which organism produce new individual of the same species.

This is one of the important features of living things. Reproduction results in the increase in numbers of organisms and the perpetuation of life on earth

Importance of Reproduction

1. It ensures the continuity of individual species. This is because newly born individual replace the dead ones.
2. Reproductions increase the number of populations of living organism on earth.

Types of reproduction

Basically there are two ways in which living things reproduce.

1) Sexual reproduction

2) Asexual reproduction

I. ASEXUAL REPRODUCTION

It is the reproduction of off springs from single organism without the use of sex cells (gametes).

It means that there is no fusion of gametes. Single celled organism like amoeba and bacteria use asexual reproduction as the only means of reproduction

There is different forms/methods of asexual reproduction depending on the type of organisms. Asexual reproduction may be of different forms such as

1) Binary

2) Fragmentation

3) Multiple fission(sporulation)

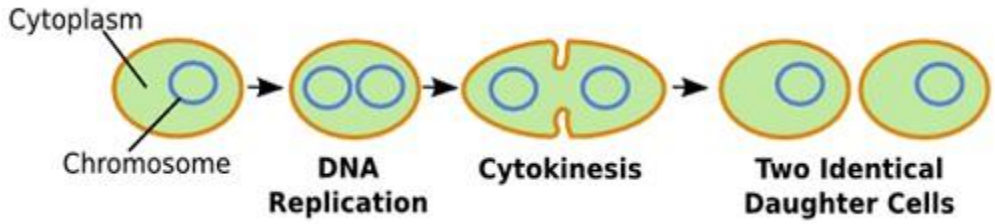
4) Budding

5) Suckers

6) Artificial/ Vegetative propagation

1) BINARY FUSSION (SPLITTING)

Is the process whereby organism divided into two (2) equally parts and each part then grows to attain the original size of the parent cell and becomes a separate and independent organism. Organism such as amoeba, paramecium euglena and trypanosome practice binary fission

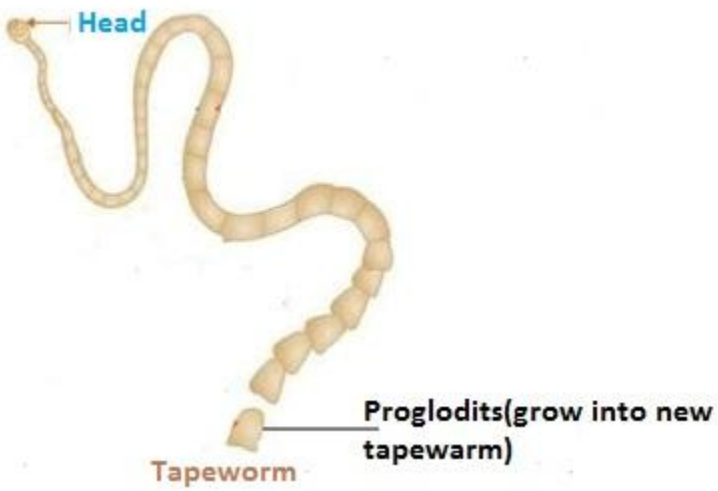


Binary fission

2) FRAGMENTATION

Is the reproduction where by an organism breaks physically into two or more parts with identical feature with parent.

Each of the parts grows to be a complete organism. Examples of organism that practice fragmentation are flatworms etc



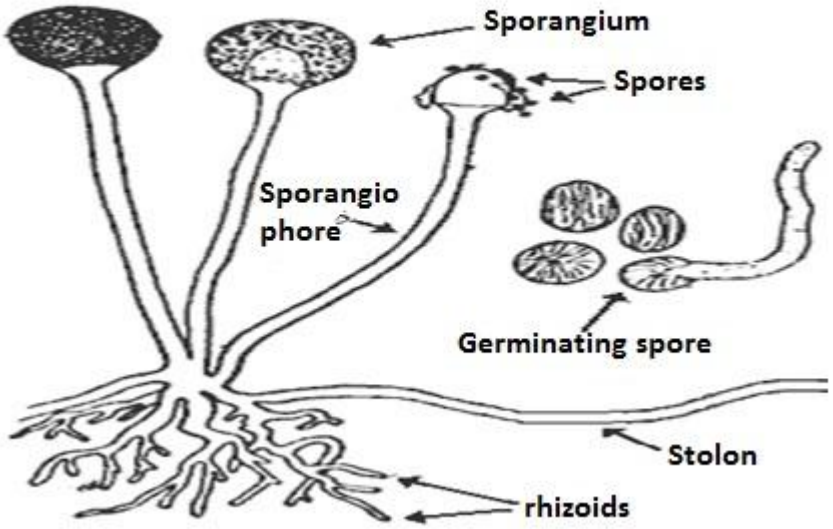
3) MULTIPLE FISSION (SPORULATION)

This is the type of reproduction where by organism produce organism by reproductive cells called spores

Spores are small unicellular structures which contain reproductive cell. The spores develop from a single cell from a structure know sporangium. When the sporangium is fully developed, they burst to release the spores to the ground. When land on a suitable environment germinate into new organisms.

Examples of organisms that reproduce by sporulation include fungi, mosses, ferns and *amoeba*. In amoeba multiple fission only occur when environmental condition do not favor binary fission such as drought.

Spores are produced in specialized structures known as sporangia, but in ferns are called sorus and in moses are sometimes known as capsules.



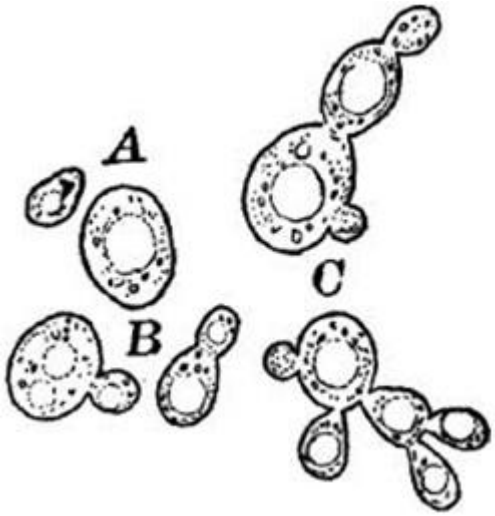
Spore formation

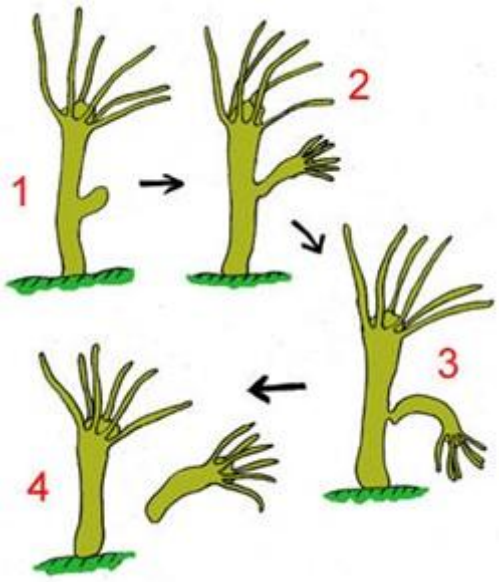
4) BUDDING

Is a type of reproduction where by a new organism arises asexually as an outgrowth on the older organism.

The bud finally separates from the parent's body and grows to attain the size of the parent
Example are yeast and hydra.

Yeast





Hydra

5) SUCKERS

These are lateral branches with terminal buds which grow from the base of an underground stem. These branches are called suckers examples banana.

6) ARTIFICIAL/ VEGETATIVE PROPAGATION

This is a form of a sexual reproduction found in plants in which a bud grows and develops plants. In these type a detached plant, root, stem or leaves grows and develops into an independent plant.

Forms of Artificial Propagation

(i) Propagation by cuttings

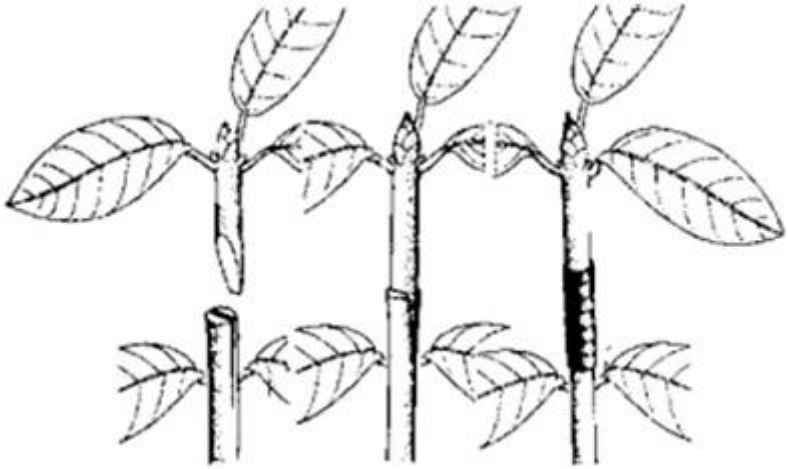
When a portion of a stem or root is cut off and put in a moist soil it produces roots and sprouts and new independent plant produced.

- Plants propagated by stem cutting include – sugar cane, sweet potato, and cassava.
- Plants propagated by root cutting include – lemon and sweet potatoes

(ii) Propagation by grafting

It involves the attachment of a part of a plant to early rooted plant. This type of propagation can be carried out between plant of the same species (or related species), e.g. orange and lemon

For grafting to be successful the xylem and phloem of both plants must be in direct contract, to ensure the easy movement of materials between two plants.



Grafting

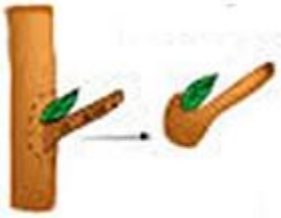
(iii) Propagation by layering

A branch of a plant is bent down until it touches the ground and covered with soil.

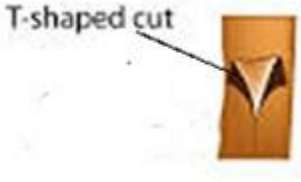
After sometime the portion of the branch under the soil grows roots. If the branch is cut off from the main plant it develops into independent plants example: sweet potato

(iv) Propagation by budding

It is similar to propagation by grafting. Here buds are used instead of stems.



(a) Bud is removed



(b) T- cut is made in stock

Bud is fixed in T-cut

ADVANTAGES OF A SEXUAL REPRODUCTION

1. It results into an organism with the same genetic component as their parents
2. They produce (organism) many off springs which mature fast than sexually organisms. This is beneficial to farmers who need fast growing plants.
3. Asexual reproduction does not waste time.

DISADVANTAGES OF ASEXUAL REPRODUCTION

1. Organisms are at a great risk to perish or get destructed when environmental conditions are not favorable.
2. Parents may pass undesirable characteristic to the offspring's since organisms produced are identical to the parents genetically.
3. Competition for resources such as food and shelter many occur due to large number of organisms being produced.

II. SEXUAL REPRODUCTION

Sexual reproduction involves the fusion of two sex cells called gametes. The two gametes differ in form and function, and each is produced from a different organ.

In animals, gametes – production organs are Gonads (ovaries and testes). In flowering plants structures for producing gametes are called Anthers and ovaries.

When male and female reproductive structures are born on different individuals it is referred to unisexual. When made and female reproductive structures are produced by the same individual, it is said to be bisexual/ hermaphrodite.

Characteristic of Sexual Reproduction

1. It always involves a female and male parent
2. The parents must form gametes by meiosis. In bryophytes and filicinophytes formation of gamete does not involve meiosis.
3. A new individual is formed only after a male gamete has fused with a female gamete.

   NB

   The organism is capable of sexual reproduction only when it is sexual mature. This is because in young organisms the reproductive organs are not fully developed or they may be absent.

ADVANTAGES OF SEXUAL REPRODUCTION

- It results in perpetuation of life.
- Harmful gene of the parent will not necessarily to be handled to the offspring gene.

DISADVANTAGES OF SEXUAL REPRODUCTION

- Sexual reproduction may produce individual with undesired qualities. E.g. disease like hemophilia, sickle cell and anaemia.
- Time and energy are consumed as it needs two organisms.
- In cases when certain organism isolated from another it becomes difficult for sexual reproduction to take place.

MEIOSIS AND REPRODUCTION

(CELL DIVISION)

Cell division is the splitting of a cell into two or more parts where each rises into a new cell.

It involves three stages:

- division of the nucleus
- the cytoplasm division
- Cell separation

Chromosomes: are threads like structure found in the nucleus which contain hereditary material (DNA).

Types of cell division

1) Meiosis

2) Mitosis

1**. MEIOSIS**

Meiosis is a type of cell division which occurs in reproductive organs, to produce sex cells (gametes).

Meiosis reduces the number of chromosomes from the diploid state (pairs of chromosomes) to the haploid state (single chromosomes). It is also called reduction division.

Everybody cell of a multicellular organism contains the same number of chromosome 46 and it stays constant, generation after generation.

A human develops from a zygote which is the result of fusion of a male and female gamete. If the gamete has 46 chromosomes the resulting zygote would have 92 chromosomes.

To avoid doubling chromosomes, a special type of division takes place to halve the chromosomes number during gamete formation, which is meiosis.

Meiosis involves a number of processes. There are two meiotic divisions

1) First meiotic division

2) Second meiotic division

I. FIRST MEIOTIC DIVISION

This division involves the following stages

(1) Prophase I

(2) Metaphase I

(3) Anaphase I

(4) Telophase I

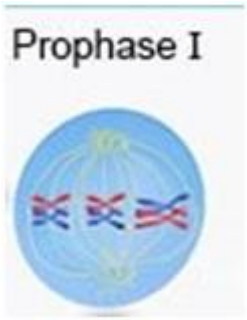
1. INTERPHASE (RESTING STAGE)

Cell grows and carries out normal life function. The cell is prepared for division.

1. Prophase I

It is the longest phase of meiosis. During prophase I, DNA is exchanged between homologous chromosomes in a process called homologous recombination. This often results in chromosomal

crossover. The new combinations of DNA created during crossover are a significant source of genetic variation, and may result in beneficial new combinations of alleles. The paired and replicated chromosomes are called bivalents or tetrads, which have two chromosomes and four chromatids, with one chromosome coming from each parent. The process of pairing the homologous chromosomes is called synapsis. At this stage, non-sister chromatids may cross-over at points called chiasmata (plural; singular chiasma) which result in exchange of chromatids parts.



2. **METAPHASE I**

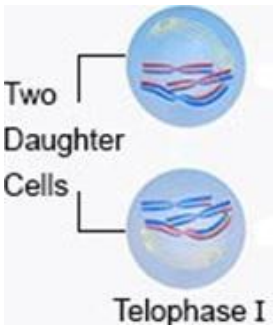
- The bivalent of homologous chromosome move to the equator of the spindle.
- The homologous chromosome becomes arranged with the centromeres of the homologous pair pointing toward opposite poles.

3. Anaphase I

Kinetochores (bipolar spindles) microtubules shorten, severing the recombination nodules and pulling homologous chromosomes apart. Since each chromosome has only one functional unit of a pair of kinetochores, whole chromosomes are pulled toward opposing poles, forming two haploid sets. Each chromosome still contains a pair of sister chromatids. During this time disjunction occurs, which is one of the processes leading to genetic diversity as each chromosome can end up in either of the daughter cells. Nonkinetochore microtubules lengthen, pushing the centrioles farther apart. The cell elongates in preparation for division down the center.

4. Telophase I

The first meiotic division effectively ends when the chromosomes arrive at the poles. Each daughter cell now has half the number of chromosomes but each chromosome consists of a pair of chromatids. The microtubules that make up the spindle network disappear, and a new nuclear membrane surrounds each haploid set. The chromosomes uncoil back into chromatin. Cytokinesis, the pinching of the cell membrane in animal cells or the formation of the cell wall in plant cells, occurs, completing the creation of two daughter cells. Sister chromatids remain attached during telophase I.



II. SECOND MEIOTIC DIVISION

Meiosis II is the second part of the meiotic process, also known as Reduction division. Mechanically, the process is similar to mitosis, though its genetic results are fundamentally different. The end result is production of four haploid cells (23 chromosomes, N in humans) from the two haploid cells (23 chromosomes, each of the chromosomes consisting of two sister chromatids) produced in meiosis I. The four main steps of Meiosis II are: Prophase II, Metaphase II, Anaphase II, and Telophase II.

1. **Prophase II**

We see the disappearance of the nucleoli and the nuclear envelope again as well as the shortening and thickening of the chromatids. Centrioles move to the Polar Regions and arrange spindle fibers for the second meiotic division.

2. **Metaphase II**

The centromeres contain two kinetochores that attach to spindle fibers from the centrosomes (centrioles) at each pole. The new equatorial metaphase plate is rotated by 90 degrees when compared to meiosis I, perpendicular to the previous plate.

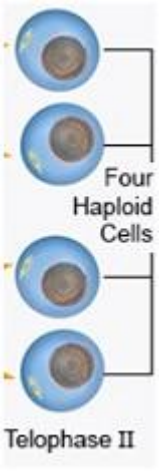
3. **Anaphase II**

Where the centromeres are cleaved, allowing microtubules attached to the kinetochores to pull the sister chromatids apart. The sister chromatids by convention are now called sister chromosomes as they move toward opposing poles.

4. **Telophase II**

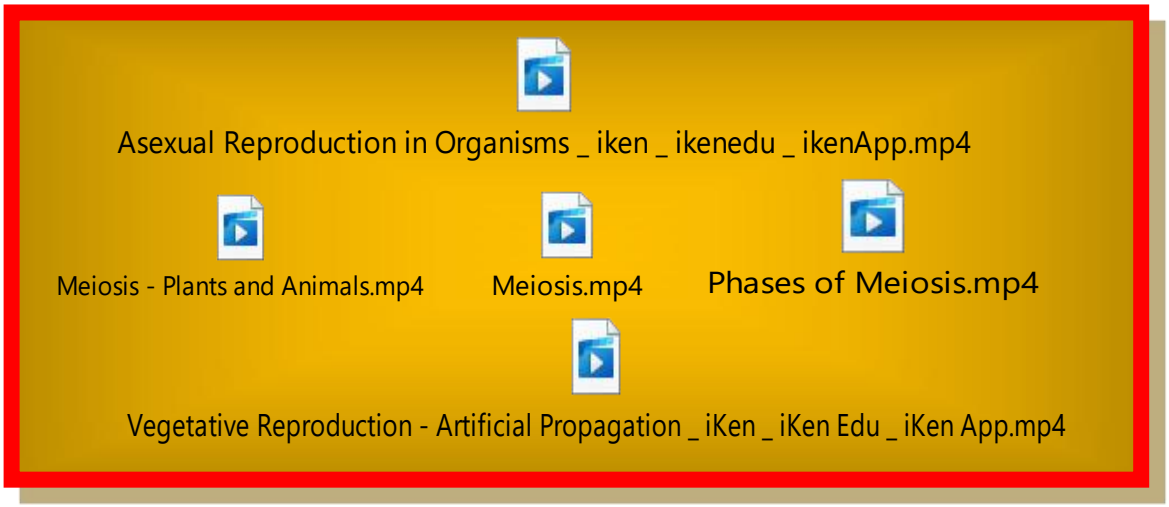
This is similar to telophase I, and is marked by uncoiling and lengthening of the chromosomes and the disappearance of the spindle. Nuclear envelopes reform and cleavage or cell wall formation eventually produces a total of four daughter cells, each with a haploid set of chromosomes.

Meiosis is now complete and ends up with four new daughter cells.



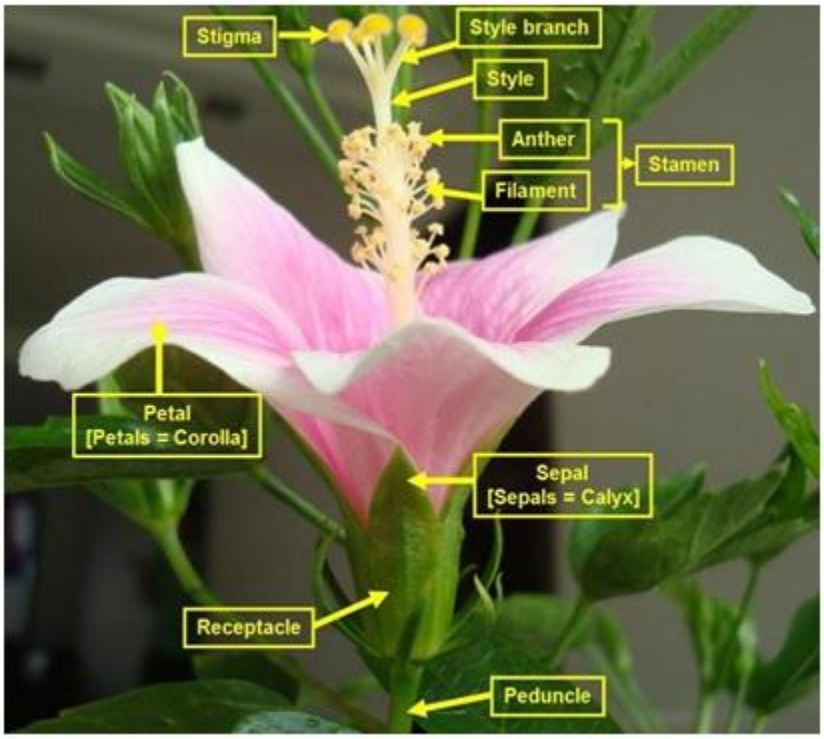
IMPORTANCE OF MEIOSIS

1. It ensures a constant number of chromosomes in all the species by reducing the doubling number chromosomes which would result into different species.
2. It involves the possibility of exchange of pieces of genetic information/ materials between the paternal and maternal chromosomes leading to new combination of characteristic in the gamete.
3. It provides variation when the membrane of each pair of chromosomes is separated from each other independently.



REPRODUCTION IN FLOWERING PLANTS

Flowering plants or angiosperms reproduce sexually, Flowering plants have specialized structures called the **flowers**, which is used for the reproduction process.



A flower comprises of different parts

1. **PEDUNCLE**

   It is a flower stalk attached to the plant. It is where flower develops. If it is branched so as to bear many flowers each branch is called ***radical***.

2. **RECETACLE**

It is the top of the flower stalk/ peduncle to which other parts are attached.

3. **CALYX/ SEPAL**

It is the outermost ring of floral leaves. Are usually great and protect the inner floral structure when the flower is not open.

Some species of plants have flowers with rings of sepals. The outermost ring is called the epicalyx

4. **COROLLA**

This is a ring of petals on a flower. In some plants the petals are brightly coloured. They may fuse to form corolla tube. Corolla and calyx together constitute the **perianth**.

5. **STAMEN**

This is the male reproductive organs. It consists of filament on top with a head of filament called anther

The anther contains pollen grains inside. In the hibiscus flower there are many stamens and filaments which join to form a stamina tube, which is connected to the receptacle.

6. **CARPEL**

This is the female reproductive organ, it consists of three parts called ovary, style and stigma – Ovary contains eggs/ stigma.

- Style is a tube connected to the ovary.

- Stigma is a knob like structure at the top of style. It receives pollen grains during pollination. It is usually have five branches.

Types of Flowers

Bisexual flower is a flower which has both female and male organs – examples are hibiscus flower, sunflower, tomato and flamboyant.

Unisexual flower is a flower which has either female or male organs. Examples are maize and some pawpaw flowers

NOTE

- If both male and female flowers are found on the same plants. It is said to be **Monoecious** (maize)

- When the male and female flowers are born on separate plants it is called **dioecious** (pawpaw).

POLLINATION

Pollination is the transfer of pollen grains from the anther to the stigma. It follows that the male's gametes must move from an anther to the carpel (female gametes).

When the Anthers are ripe they split open and are expose ready to be transferred to carpel. For a successful fusion of gametes, the pollen grains must land on the stigma.

Types of pollination

I. SELF POLLINATION

This is the transfer of pollen grains from the anther to stigma of the same flower. It may also occur if the different flowers are of the same plants. Examples are garden peas and dandelion.

II. CROSS POLLINATION

This is the transfer of pollen grains from the anther from a flower of one plant to a stigma of another flower and plant. It involves plants of the same species. E.g. are maize and sorghum.

AGENTS OF POLLINATION

Pollen grains produced from an anther are carried to the stigma by different agents. Such agents are

– Wind,

- Water,

- Insects,

- Bats and

- Birds.

Flower according to mode of pollination are divided into two groups which are;

1. Wind pollinated flower
2. Insect pollinated flower

1. **WIND POLLINATED FLOWERS**

Flowers may use wind as a pollination agent. When the grains are exposed out and their grains are light, air current easily blows them from anthers.

As pollen floats in the air – it is easily trapped by feathery sticky stigma of other flowers. (Example; maize and grasses).

Characteristic of wind pollinated flowers

1. Are not brightly coloured (are dull coloured)
2. Pollen grains are small and light
3. The flower structure is simple
4. They have no scent
5. They do not have nectar
6. Stigma is large and feathery hanging outside to trap pollen

2. INSECT/BIRD POLLINATED FLOWERS

Insects may be the pollination agent. When insects and birds visit the flower to feed, the pollen grains stick to their body. As they move from flower to flower some pollen (stuck pollens) are transferred and deposited or sticky on stigma of a different flower.

Characteristics of insect pollinated flowers

1. The flower is brightly coloured
2. They produce a sweet fluid (nectar) which is food to most of birds
3. The pollen grains are large and sticky covered with spiky hairs which enables pollen to stuck to the bodies of insect

FERTILIZATION IN FLOWERING PLANTS

Fertilization is the fusion of male and female gamete. It is followed after pollination one sperm nuclei of pollen grains combines with an egg cell to form a **zygote**.

- Fertilization by plants takes place in the **embryo sac**.

Types of fertilization

1) Self fertilization

2) Cross fertilization

I. SELF FERTILIZATION

It is when gametes of the same plants are involved

II. CROSS – FERTILIZATION

It is when gametes involves are of different plants of the same species.

The fertilized ovule develops into a seed, protected by the ovary wall which develops into the fruit wall. In some plant the receptacle becomes part of the fruit such as pineapple

DISPERSAL OF FRUIT AND SEEDS

Dispersal of fruits and seed is of paramount importance because it reduces congestion of plant in a certain habitat. Seed and fruits are dispersed and scattered to other places. Dispersal of fruit and seed reduce overcrowding and competition for light, nutrient and space. Competition between the offspring and parent plant may lower the survival rate to an extent that the plant may become extinct

Since a plant is not motile, the dispersal of fruits and seed is carried by physical agent and explosive mechanism. Depending on the agent of dispersal, fruits and seeds have different adaptive features.

Methods of seeds and Fruits Dispersal

1. Wind Dispersal

Seed and fruit dispersed by wind have the following adaptive feature:

(a) Are small and light

(b) Have wing – like structure

(c) Have feather – like projection

One or combinations of the above adaptive feature enable the seeds and fruit to be carried by wind. Example include: Nandi flame, jacaranda, cotton seeds etc.

2. Water Dispersal

Seeds and fruits dispersed by water have the following adaption:

(a) Have fibrous mesocarp.

(b) Air pockets.

(b) Have water proof coats Example coconut.

3. Animal Dispersal

Fruits and seeds dispersed have the following adaption:

(a) Are sticky

(b) Have hooks

(c) Are succulent and palatable

4. Self Dispersal

This is the sudden splitting open (dehiscence) of the dry pod. The seed are hurled away from the parent plant.

REPRODUCTION IN MAMMALS

Sexual reproduction occurs in almost all mammals by fusion of male and female gametes. The gametes produced by a male animal are **sperms** while those produced by female animals are **ova**.

Mammals and other animals reproduce sexually, involving the *fusion of gametes.* In most animals, both fertilization and the development occur internally and such animals are called **viviparous.**

Most fish shed gametes directly into water where fertilization occurs externally. In amphibians the tendency of returning to water for fertilization (mating) is observed

Reptiles and birds lay eggs, which hatch and develop into an adult reptile or bird after a number of processes.

Mammals like other animals have specialized structure called reproductive organs (gonads). Which are responsible for production of gametes.

GAMETE FORMATION

Gametes are haploid cells which fuse to form a zygote in the sexual reproduction.

Both male and female humans produce gametes. The process of production of gamete is known as Gametogenesis

There are two types of gametogenesis

1) Spermatogenesis

2) Oogenesis

1. **SPERMATOGENESIS**

This is the production of sperms in mammals. It occurs in the testes. The production of sperms starts when males reach puberty

2. **OOGENESIS**

This is the production of eggs in the ovary. Production of ova is not continuous throughout one's lifetime. The production of egg cells (primary ova) occurs during the foetus development. But only 400 – 500 (primary ova) develop to maturity during the active reproductive age of the female.

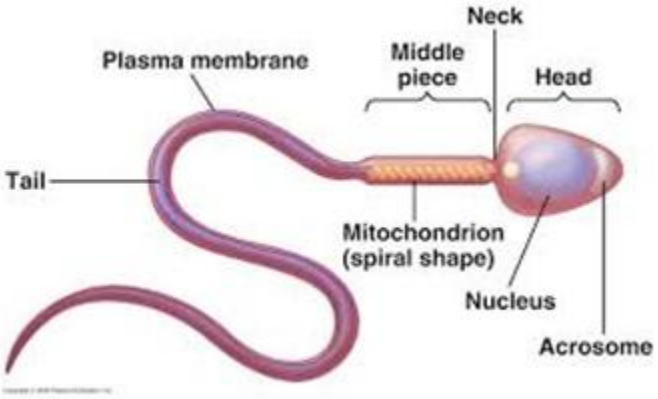
STRUCTURE OF SPERM AND OVA

1. SPERM CELL: Is an extremely small cell. It has three district regions

   -Head,

   -Middle piece and

   -Tail



The head

The head is flat and oval in shape. It contains nucleus which are contains hereditary materials (DNA).

The middle piece

Has many mitochondria which are concerned with energy production.

The tail

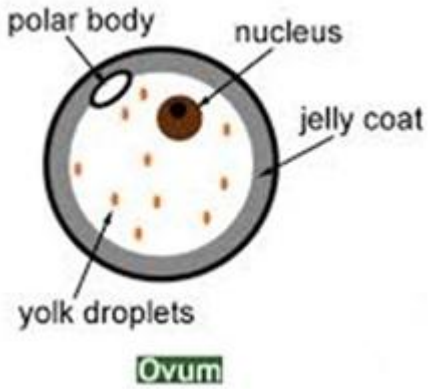
The tail is like flagella in structure for propulsion.

Adaptation of sperm to its function

1. It has structure like tail which helps to move the sperm
2. The presence of mitochondria enables the sperm to produce energy needed during the action.
3. It has an **acrosome** enzyme which help penetrate the egg cell at fertilization
4. They are produced in big number for survival

2. OVA CELL

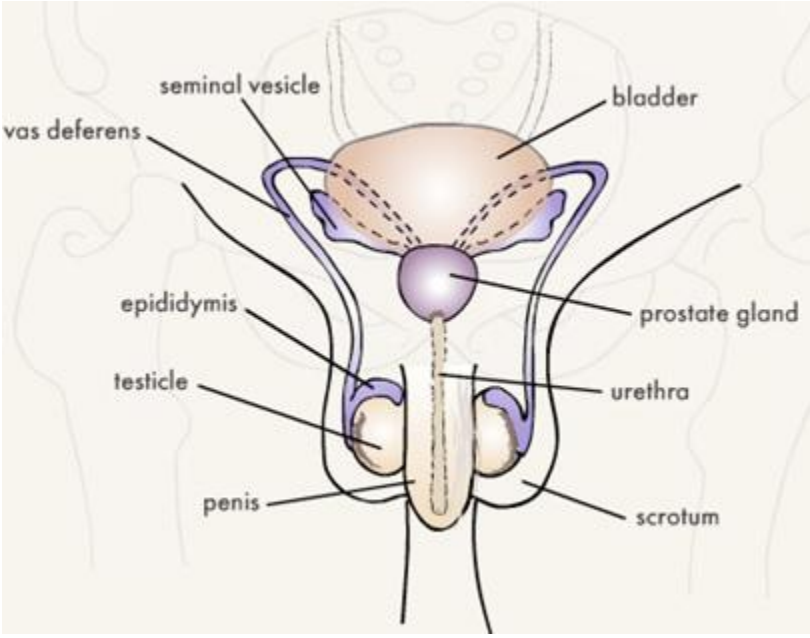
It is oval in shape; the egg cell contains a nucleus which contains the hereditary material (genetic). It also contains cytoplasm and granules.



REPRODUCTIVE SYSTEM IN MAMMALS

1. **IN MAN/MALE REPRODUCTIVE SYTEM**

The male reproductive system is composed of the following parts in diagram below



PENIS

The penis is the copulatory organ which is used to introduce sperms into the vagina.

TESTES

Testes are two oval shaped structures lying behind and below the penis. They are covered in a sac called **scrotum.**

Testes they produce:

- sperm cell
- Men sex hormone (testosterone)

- That hormone is responsible for secondary sexual characteristic

- Testes are suspended outside for a good environment for the production, of sperms which needs lower temperature.

Testes are attached to a coiled structure "**epididymis**" which is temporal storage organ for sperms

SEMINAL VESICLES

Seminal vesicles stores sperms until nourishment takes place. They are located just below the urinary bladder.

PROSTATE GLANDS

This gland together with seminal vesicles secretes a fluid which mixes with sperm as nourishment and protection to the sperm.

The sperm together with fluid are called **Semen**

VAS EFFERENTIA

These are ducts which collect sperms from inside the testes and transfer them to epididymis.

SPERM DUCT

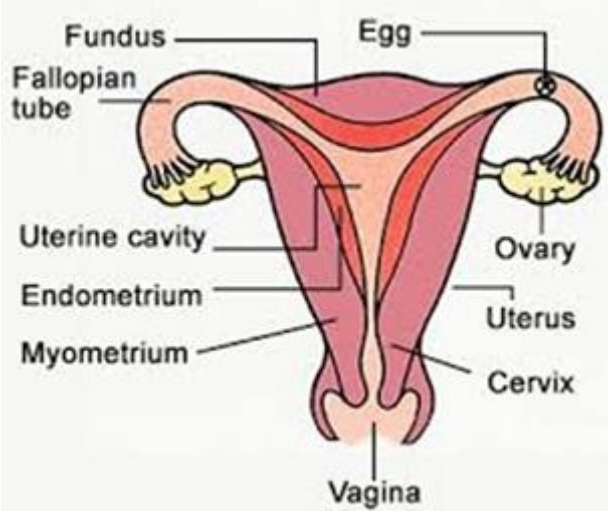
This is a straight tube which carries sperms to the urethra.

PENIS.

Is copulatory organ which carry sperm from sperm duct to the vagina during copulation. Also take part in excretion process.

FEMALE REPRODUCTIVE SYSTEM

The female reproductive organs are located inside the body, within the pelvis region.



OVARIES

These are oval shaped structures near each kidney

Ovaries produce - ova
-oestrogen
- progesterone

THE OVIDUCT (FALLOPIAN TUBE)

This is the tube with a funnel shaped opening extending from the ovary to the uterus. The oviduct carries eggs from the ovaries to the uterus. It is where fertilization takes place.

THE UTERUS (WOMB)

This is the muscular thick walled organ within which the zygote implants and develops. As an embryo develops, an organ called **placenta** is formed. It brings uterine tissues into close contact with the tissue of the developing embryo

Placenta also passes nutrients and oxygen from the maternal blood to the embryo, and waste products of metabolism are passed from the embryo's blood to the maternal blood.

Progesterone maintains pregnancy by preventing the production of ova and contractions of uterine walls.

VAGINA

This is the muscular passage from the vulva to the uterus. It is in this region that sperms are deposited during sexual intercourse. The vagina is both a birth canal and a copulatory organ.

CERVIX

This is the narrow opening to the uterus from the vagina. It is made of muscular ring. It is the entrance from the vagina to the uterus

VULVA

These are external genitals of the female reproductive system.

The urethra opens to outside through these structures.

OVULATION AND MENSTRUATION

Ovulation

This is the process of releasing an egg from the ovary. The egg reaches maturity approximately once every 28 days. This releasing of eggs alternates between two ovaries

The developing ovum is surrounded by a group of cell called follicle. The mature egg is then released from the ovary. Ovulation is controlled by leutenizing hormones.

Before and after the process of ovulation an ovary continues to secrete oestrogen and progesterone, which cause thickening of uterus, making it suitable to receive a fertilized ovum. This occurs when the egg passes from the oviduct to the uterus. If the ovum isn't fertilized the uterus lining cells gradually disintegrates, discharging blood and tissue debris from the uterus through the vagina.

MENSTRUATION

This is the discharge of mucus, epithelial cells and blood through a vagina and the discharge is called menstrual flow.

A period between one menstruation and the next is called menstrual cycle. Menstruation cycle usually occurs on average every 28 day and menstruation last for 3 – 7 days.

After ovulation the follicle enlarges and a yellow pigment accumulates in them to form a corpus luteum. When the follicle corpus luteum is developing, the walls of uterus prepare itself for receiving an ovum. The inner layer become thickened and surrounded with many blood vessels and glands.

If fertilization does not occur, the unfertilized egg never be implanted and the thickening lining of uterus disintegrates well as the corpus luteum, then are discharged through the vagina as the blood. After menstruation the uterus begin to prepare itself for the next ovulation.

COPULATION

Copulation is the process of inserting the erect penis into the vagina. When a man is sexually stimulated the penis is filled with blood and becomes erect. The erect penis is inserted into vagina and moved back and forth, stimulating sense organs in the penis and ejaculation occurs.

Ejaculation is the release or discharge of semen. Once the sperm is deposited in the vagina they start swimming towards the oviduct.

The climax of sexual excitement in human is known as **orgasm**, it is accompanied by a feeling of extreme pleasure.

FERTILIZATION AND IMPLANTATION

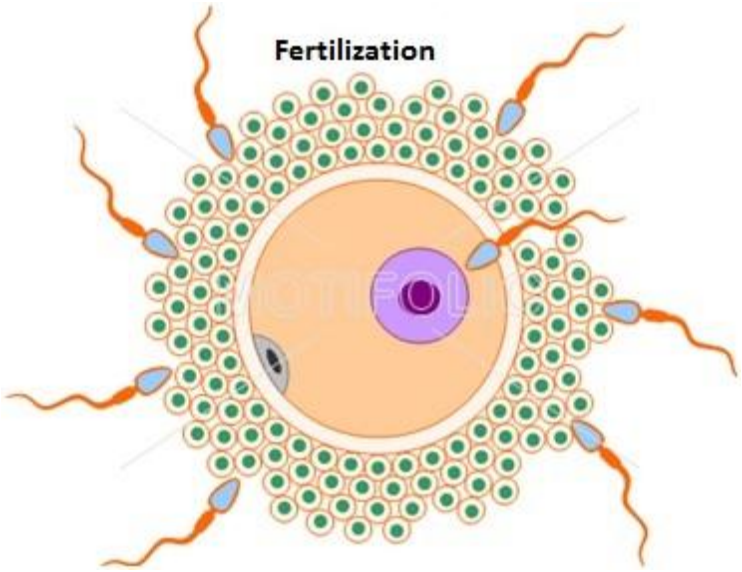
Fertilization is the process whereby sperm nuclei and ovum nucleic fuse to form a diploid cell called **zygote**. If ejaculation occurs when an ovum is in the oviduct, fertilization is likely to occur.

Sperm takes less than an hour to reach the uterus. At least half the number of sperm dies due to acidic condition of the vagina, and uterus is not their final destination. They have to move to reach the oviduct in order for fertilization to occur; only a few sperms reach the oviduct and can survive for about 72 hours.

The time when fertilization is likely to occur is called the fertile period of a woman. Counting from the first day of menstruation, ovulation is likely to take place on the 14^{th} day, but it can also be on the 13^{th} or 15^{th} day.

Thus the probable time for pregnancy to occur is when the copulation takes place between the 11^{th} day and the 17^{th} day.

Only one sperm enters an ovum and other are prevented from entering due to formation of a tough membrane round the ovum.



Soon after zygote has been formed it starts to divide so that a ball of cells is produced. Here the zygote is called **embryo**

While zygote is dividing it travels along the oviduct towards the uterus. It takes 3 to 5 days for zygote to reach the uterus. When the embryo reaches the uterus it attaches itself to the **uterine wall**. This process is called **implantation.** Within 4 or 5 days the embryo becomes firmly attached to uterus.

When implantation is complete, the embryo forms two membranes

– **Chorion (outer)** and

- **Amnion (inner)**

The amnion is filled with a liquid called **amniotic fluid** where the embryo is suspended in

1. Act as shock absorber.

2. Protecting the embryo from mechanical damage.

The chorion is a thin membrane but it has a thick portion that forms finger like projection called **villi**. Villi together with thick portion of chorion form the **placenta**

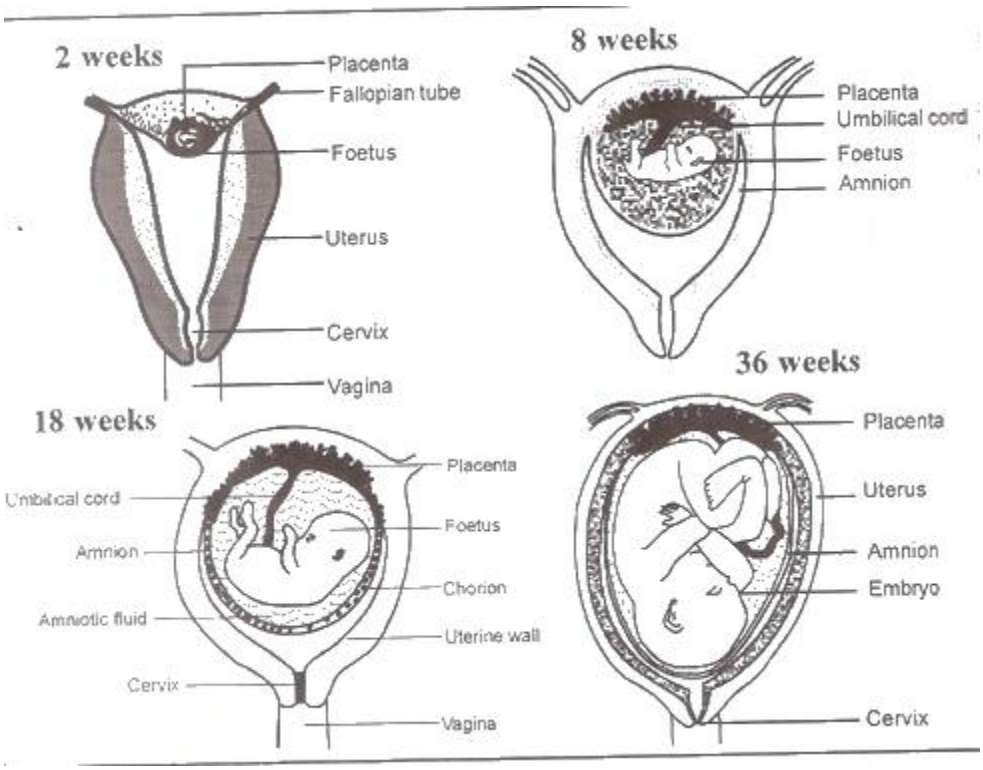
The developing embryo is connected to the placenta by cord called **umbilical cord.** It carries two arteries and vein of embryo's circulatory system.

Function of placenta

• Nutrients and oxygen from maternal circulatory system diffuse to the embryo through placental membrane.

• Also waste product of metabolism from embryo diffuses in the opposite direction.

At about three week the embryo will have formed the body. Characteristic of human, on wards the embryo is referring as **foetus.**



The foetus remains in the uterus for 9 month's (280 days). After that time it is expelled by birth. From the time the ovum is implanted in the uterus up to the time of birth the female is said to be **pregnant**; **gestation** or the **incubation period**.

BIRTH

This is the process by which the baby is expelled from the **uterus.** It starts by a sudden fall in level of oestrogen and progesterone which results in periodic contractions of muscular wall of the uterus, which cause labour pains.

As the contractions get strong, they force the foetus into lower part of the uterus at the same time causing the cervix to **dilate**

As this continues (contractions) the osmotic sac ruptures and the amniotic fluid escapes through the vagina.

When contractions become more frequent and more powerful, the foetus is forced through cervix and vagina usually head first, and is **delivered**

The umbilical cord is still attached to the baby, but is always cut and tied. The final stage of birth involves the removal of placenta through the vagina and is accompanied by some loss of blood because the maternal blood vessels which were supplying to placenta are ruptured.

Immediately after birth the baby must start breathing so as to survive. The concentration of carbon dioxide in the baby's body blood increases when the umbilical cord is cut, lower temperature of the environment stimulate the breathing centre in the medulla oblongata.

FACTORS WHICH MAY HINDER PREGNANCY

Any factor that prevents sperms from reaching ova prevents fertilization. This can happen through natural or artificially.

Factors which can hinder pregnancy in female are

1. Ova are not released in the normal monthly cycle
2. The fallopian tubes may be blocked/ twisted.
3. Uterus may not allow an embryo to implant due to an imbalance of hormones.
4. The woman may make antibodies that destroy the sperm
5. Immature ova

Factors that affect sperm production in male are

1. Very few sperms are produced in one ejaculation
2. A high proportion of sperms produced are abnormal
3. Sperm duct / vas deferens may be blocked
4. Immature sperms.

CAESAREAN DELIVERY

This is the removal of the baby by surgical means through the abdominal and uterine walls.

• This becomes necessary when the baby is so big that it can pass through the mother's cervix.

• It can also be caused by the mothers pelvis being too small to accommodate the normal sized baby.

WAYS WHICH TO OVERCOME HINDRANCE OF PREGNANCY

1. IN –VITRO FERTILIZATION

Women whose oviducts are blocked can overcome by method called in –vitro fertilization.

•Several ova are taken from a woman's ovaries and put into a dish containing sperm from her partner and kept warm for a few hours, the ova are fertilized in a dish.

•One or more embryos are inserted in the woman's uterus where one will implant and develop into a baby

2. FERTILITY DRUGS

Some women are sterile because their ovaries fail to develop ova. This can be because the hormone responsible for the ova production is not there.

Then ovaries are stimulated to produce ova by injecting drug called fertility drug, it contains the hormone responsible for stimulating production of ova.

3. ARTIFICIAL INSEMINATION **(**AI**)**

This is the artificial introduction of semen into the female oviduct by syringe during ovulation for the purpose of fertilization

Semen can be rapidly frozen by using liquid nitrogen and then stored in sperm banks without losing its fertile condition.

Advantages of AI

1. Semen can be transported to far distance even where there are no males.
2. Many females can use semen from one male.
3. Semen can be stored and hence used in future.

Importance of AI

1. It makes possible for couples in which a husband is impossible to have a baby by semen donated by another man.

2. The woman can choose the father of her child because she can select semen from different men.

TECHNOLOGICAL ADVANCED IN REPRODUCTION

1. EMBRYO TRANSPLANTS

Nowadays it is possible to remove a developing embryo from an animal before it has implanted into the wall of the uterus. Such an embryo can be kept for a number of days. When it is placed in the uterus of a different animal it can implant and develop in a normal way.

2. TEST TUBE BABIES

An ovum is sucked from a woman's ovaries. The ovum is placed in a dish containing sperms from her partner and kept warm for a few hours. The ovum is fertilized.

The embryo is then inserted into the woman's uterus where it will implant and develop into a baby.

This method is best for women whose oviducts are blocked thus preventing ova from being fertilized. Such women are therefore unable to have/ bear children.

3. FERTILE DRUGS

These are drugs containing a hormone responsible for stimulating ovaries to produce ova. Some women are sterile because their ovaries fail to develop ova. This happens because the hormone responsible for ova production is not there. Such women are injected with a fertile drug to stimulate ova production.

4. ARTIFICIAL INSEMINATION

Semen is sucked from men and be frozen by using liquid nitrogen and then be stored in sperm banks for several years without losing its fertile condition

Then it can be introduced into the uterus. If it is introduced at the time of ovulation, fertilization can take place

MULTIPLE PREGNANCIES

If a woman has two babies at once, she has twins this is called multiple pregnancies.Sometimes more than one ovum is released into reproductive tract of female. It is possible for more than one ovum to be fertilized and several viable embryos may enter the uterus. They are implanted and develop.

TWINS

• These are babies born at the same time one after other by the same mother.

Types of twins

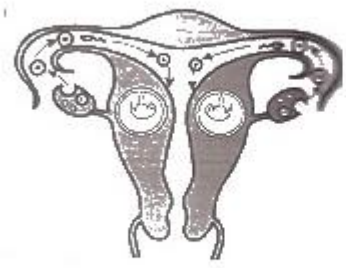
Normally there are two types of twins

1. Fraternal twins (Dizygotic)
2. Identical twins (Monozygotic)

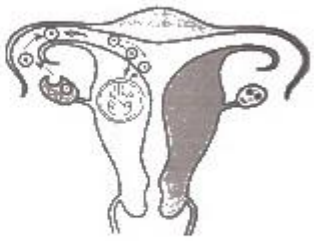
1. **FRATERNAL TWINS**

These are twins that occur as a result of simultaneous release of two ova which both become fertilized and develop.

They may be of the same or different sexes. The twins are genetically different but have diagram of resemblance.



Fraternal twin



Identical twin

2.**IDENTICAL TWINS**

These are twins that occur as a result of one ovum is fertilized and develops into a zygote which then split into two and develops into foetuses. Such twins are genetically identical and so much alike; they are same in every respect.

DISORDERS OF THE REPRODUCTIVE SYSTEM IN FEMALES

1. CANCER

Cancer can affect various parts including cervical and ovarian cancer in women. If diagnosed early, they can be treated with radiotherapy and chemotherapy.

2. OVARIAN CYST

• It is a begin tumor in the ovary. In younger women, a follicle may develop into a cyst,

• Cyst it can be caused by imbalance of hormones produced by pituitary glands

• They don't show any symptoms unless they grow so large to cause visible swelling of abdomen.

• They can be removed surgically.

3. FIBROIDS

• Fibroids are tumors that grow on the uterus. They are made up of muscle fibres.

• They are caused when an area of the muscle fails to shrink with the rest of the womb tissue at the onset of menstruation.

• They can be removed by surgery and complete removal of uterus (hysterectomy).

DISORDERS OF THE REPRODUCTIVE SYSTEM IN MALES

1. **IMPOTENCE**

Impotence is a failure to maintain an erect penis, restricting copulation. The causes are often psychological as depression and anxiety also by diabetes and alcoholism.

• Its treatment depends on the cause.

2. **PREMATURE EJACULATION**

This is when a man can't delay ejaculation enough to satisfy the woman.

3. **PROSTATE PROBLEMS**

• The prostate glands may become enlarged due to infection.

• Infections can be treated by antibiotics.

COMPLICATION OF THE REPRODUCTIVE SYSTEM

1. BREECH BIRTH

This is the situation whereby a baby is born feet and bottom first. In this case the babies fail to turn so as to be born bottom first. Breech birth/ babies are difficult to deliver. This complication requires Caesarean section.

2. MISCARRIAGE

Is a loss of a developing embryo before the 28^{th} week pregnancy.

The causes/ reasons may be

- Development of a deformed embryo.
- Failure of proper implantation of embryo on womb.
- Failure of placenta to develop a sufficient supply.

3. STILL BIRTH

This is giving birth to a dead baby/ foetus.

This may be caused by

- Poisonous chemicals.
- Shock.
- Prolonged period of delivery.

4. ECTOPIC PREGNANCY

This is the pregnancy that results when the zygote fails to move to the uterus after fertilization. The embryo is implanted in the fallopian tube.

It may be caused by infection in the fallopian tube. Such pregnancy rarely lasts for more than two months as the fallopian tube usually bursts.

5. ABORTION

This is the removal of the foetus before it can survive independently. (Before 28 weeks)

Types of Abortion

1) Spontaneous abortion

2) Induced abortion

1. Spontaneous abortion. This is type of abortion which occurs naturally without induction of it.

2. Induced abortion. This is the deliberate ending of pregnancy due to medical reasons. It may be recommended by the doctor if tests show a genetic abnormality in the foetus.

Criminal abortion

This is the killing or destroying the unborn baby as a result of irresponsible behaviors. This is to get rid unwanted pregnancies.

6. PREMATURE BIRTH

•This is the giving birth after six months are over but before the end of nine months.

•The foetus is never fully developed, so it is put in incubator for growth to continue.

SEXUALITY AND SEXUAL BEHAVIOURS

• **Sexuality** is about "maleness" and "femaleness"

• To be aware of one's sexuality is to be aware of how is attractive to the opposite sex.

SEXUAL PRACTICES

ACCEPTABLE SEXUAL (BEHAVIOUR) PRACTICE

1. HETEROSEXUALITY (VAGINAL SEX)

This is the sexual practice between members of opposite sex.

UNACCEPTABLE SEXUAL BEHAVIOUR / DEVIATIONS

2. HOMOSEXUALITY

This is the practice where people are sexually attracted towards membrane of the same sex. They are known as homosexuals

•Male is known as **gays**

•Female is known as **lesbians**

3. BISEXUALITY

This is the practice where people are sexually attracted towards members of the same sex as well as members of the opposite sex.

4. ORAL SEX

This is the practice where the mouth (lips and tongue) is used to stimulate genitals of the partner.

5. ANAL SEX

This is the sexual practice where by the erect penis is penetrated into the anus. It is also known as sodomy.

6. MASTURBATION

This is the sexual practice by the stimulation of one's own genitals.

7.RAPE

This is the forceful sexual intercourse without the consent of the partner. It is a crime and is punishable by law.

8. PROSTITUTION

This is an irresponsible behavior practiced by people who allow other people to use their bodies for sexual intercourse for income.

Causes of irresponsible sexual behavior

1. Poverty
2. Lack of proper counseling and guidance service
3. Peer pressure and influence
4. Marriage breakdown

Consequences of irresponsible sexual behavior

1. Family and marriage breakdown
2. Transmission of sexually transmitted disease
3. Unwanted/ unplanned pregnancy
4. Psychological trauma
5. Death
6. Reproductive distorts such as sterility.

REPRODUCTION -2

FAMILY PLANNING AND CONTRACEPTION

It is very important for a couple to space its family properly. It is very important that a couple gets only a number of children they can afford and care for.

Various methods for birth control have been suggested as follows.

A) NATURAL METHODS

1. CALENDAR/ RHYTHM METHOD

This method involves abstaining from sexual intercourse a few days before and few days after ovulation, as they are referred to as **fertile period days**.

For 28 average menstrual cycles, ovulation can occur on 14^{th} day, also on 13rd and 15^{th} day. To avoid pregnancy, sexual intercourse is avoided on 11^{th} and 17^{th} from menstruation.

Disadvantage of this method is that menstrual cycles are never regular in women. And even those with regular cycles, the time of ovulation can vary considerably.

2. COITUS INTERRUPTS

This method involves the withdrawal of the penis from the vagina just before ejaculation. Its efficiency is about 70%

Disadvantage of this method is that a small amount of semen often comes from the penis before ejaculation.

• Furthermore, a man must concentrate on removing the penis before ejaculation and this deprives both partners the pleasure of sexual intercourse.

B) CHEMICAL METHOD

This is the use of mixture of artificial hormones resembling oestrogen and progesterone, which inhibit the production of follicle stimulating hormone for maturation of follicle.

It is administered in ways of pills (oral contraceptives)

1. **ORAL CONTRACEPTIVES**

These pills have the mixture of artificial hormones of oestrogen and progesterone**.** These hormones stops the development of follicle in the ovary and thus ovulation does not occur.

The disadvantages of pills are that some women experience nausea and weight gain when taking it. Also it may cause blood clot in circulatory system.

2. **INJECTION CONTRACEPTIVE**egDepo-provera injection given about every three (3) months.

- It prevent ovulation.

- Disadvantage
  May produce side - effects eg irregular menstrual breeding.

3. **IMPLANT CONTRACEPTIVE**eg Norplant-Implant placed under the skin releases artificial oestrogen and progesterone so as to prevent ovulation.

- Disadvantage
  Can cause irregular menstrual breeding.

4. **SPERMICIDE,** jelly or foam inserted into vagina only, effective with mechanical barrier. Spermicide kills sperm

- Disadvantage
- Not effective on its own and may occasionally cause irritation.

C) BARRIER METHOD

1. THE CONDOM

This a rubber sheath that is worn over the penis to trap semen. The rubber is fitted over the penis just before. Or A sheath of a thin rabber with two springlyrings,smaller a ring is insisted into the vagina,larger remain outside. Prevent entry of semen.

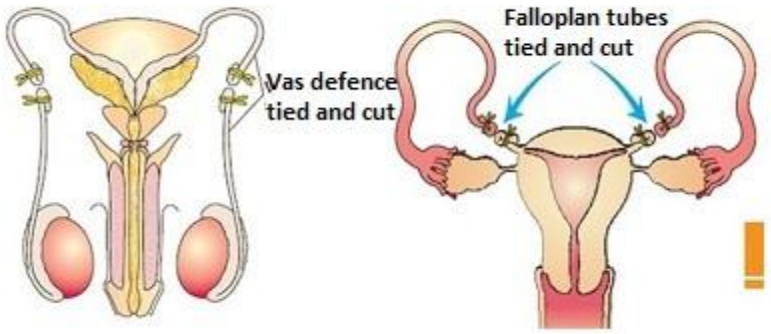
The disadvantage is that the condom may burst and leak.

D) STERILIZATION

This is permanent method of birth control. There are two types of sterilization:

1. MALE STERILIZATION (VASECTOMY)

In this type of sterilization the vas deferens (sperm duct) is cut and tied off. As a result the passage of sperm duct from testes is blocked. Vasectomy does not interfere with sexual activities



2. FEMALE STERILIZATION (TUBAL LIGATION)

This involves cutting and sealing or cutting off both fallopian tubes to prevent transport of eggs to the oviduct.Tubal ligation does not affect the ability of a woman to engage in coitus and experience orgasm.

However it is more complex operation which requires hospitalization. Sterilization is almost 100% although in rare occasions the tubes may join

- Its disadvantage is that it is normally irreversible.

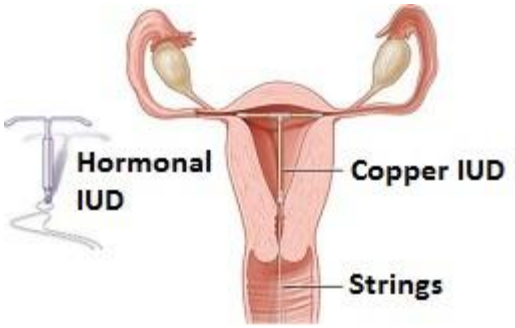
E) INTRA – UTERINE DEVICES

This is devices that are shaped plastic coils and loop. They are inserted in the uterus through the vagina. They prevent normal implantation of a developing embryo.

Disadvantage

1. It could be expelled unnoticed from uterus.

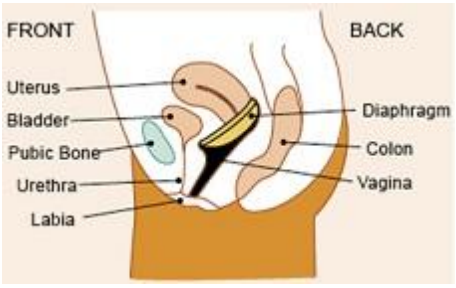
2. It can irritate or punctuate the uterus, so causing bleeding and cramps.



1. DIAPHRAGM

This is a rubber cap which is inserted into the vagina to cover the opening of cervix. It blocks sperm from entering the uterus, and normally together with spermicidal cream that kills sperm

- Disadvantages – it can burst if undersized



- During this time a substance called lochia is discharged from the wound and passes out of the vulva. Therefore until the wound heals, regular bathing is essential to keep the vulva clean.

MARTENAL AND CHILD CARE

1. **Antenatal care (pre-natal care)**

Antenatal or pre natal means before birth. Therefore this is the care given to a pregnant mother before delivery.

Things to be done by a pregnant mother.

- Visit ante-natal clinic for counseling.
- Maintain general body cleanliness all the time.
- Wear loose – fitting dresses and low heeled shoes for comfort.
- Have enough rest.

Eat well balance diet containing protein, carbohydrates, vitamins, roughage and mineral salts especially iron and calcium

Things to be avoided by a Pregnant Mother

- Doing tiring and manual work e.g. lifting heavy loads
- Taking any medicine not prescribed by the doctor.
- Taking drugs such as alcohol cigarettes which could be detrimental to the unborn baby
- Tight clothes and high heeled shoes
- Situation leads to chance of contracting venereal disease such as gonorrhea, syphilis and AIDS which might affect the baby
- Avoid stress situations
- Soon after delivery the mother is called up to carry regular exercises which strengthen the muscle of uterus.It takes 4 to 6 weeks for the wound to heal.

2. **Post natal care**

Post-natal simply means after birth. This is care given or observed by lactating mother. Lactating mother are breast feeding mother. The mother should attend post-natal health clinic for medical examination and immunization of the newborn baby.

CHILD HEALTH CARE

- Immediately after birth the child stats breast feeding. The baby remains under the care of the mother for food and warmth.
- Proper food for a baby is milk from its mother's breasts. If breast feeding is not possible or not adequate then bottle feeding can be a substitute.
- The baby first receives colostrums from the milk. This liquid is rich in vitamins, proteins and antibodies which will help the baby fight early infections before its own immunity develops.

- The children should take to post natal clinic as instructed by doctor for medical checkup.
- The child should given food with proteins.
- Child should be clean all the time.
- The child should immunized against disease such as polio, measles among other

ADVANTAGES OF BREAST FEEDING

1. Breast milk is pure and fresh. Its contents constantly change to exactly meet the needs of the developing baby.

2. Breast milk is quickly and easily digested than bottle milk. This explains why breast – feed babies rarely suffer from constipation.

3. Both colostrums and breast milk contain antibodies which help the baby infections such as diarrhea, bronchitis and nappy rashes.

4. There is evidence to show that chemicals in breast milk and development of the baby's nervous system.

- Gradually the mother milk is replaced by solid food, these are called **weaning**

BIRTH CONTROL AND CHILD SPACING

REASONS

1. A human baby needs the most care for the longest time. The recommended length of time a baby should remain under the care of the mother is at least two years. If during this period, the mother becomes pregnant this can lead to neglected and ill health of the child. This is because the mother may be under/ unable to continue breast feeding the baby and so deprive it of the best food.

2. The process of birth is very demanding on the health of the mother. That is why after giving birth the mother is allowed to rest. Generally women have given birth too many children tended to age faster than women without children.

3. Bringing up of a baby is very expensive nowadays particularly where medical care, education, food and clothing are the responsible of the parents. Where parents have limited resources they cannot afford large families.

4. Birth control provides more time for women to do other work to improve their life and that of the community.

SEXUALY TRANSMITED DISEASES

These are infection, which are transmitted through sexually contact during sexual intercourse. Sexually transmitted disease are also referred to as *venereal disease*

Examples are; Syphilis, genital herpers, Chlamydia, Hepatitis B,
Gonorrhoea , Trichomoniasis, Candidiasis, AIDS, Chanchroid, granuloma

1. Gonorrhoea

   This is bacterial infection. This infection is caused by gonococcus bacteria called *neisseriagonorrhoea*. This bacterium infect the urethra in male and vaginal tract in female

   Symptoms

In male

- Pain or difficult during urination.
- Drop of pus from the penis.
- Sometime there is painful pain swelling of the testicles.
- Rash or sore over the body.
- He may become sterile if untreated.

In female

- Pain in the lower abdomen
- Menstrual problem
- She may become sterile if untreated.
- Urinary problem
- Yellow discharge from vagina

Mode of transmission

- Through sexually intercourse
- Child effected through eye during birth

Treatment and control

Effectively treated by antibiotics; One injection of 2 gram of kanamycin. One injection of 1 g of streptomycin, but only use of streptomycin for gonorrhea that is resistance to penicillin when no other medicine **available**

2. SYPHILIS

This is also another bacterial disease caused by spiral shaped bacteria called *treponema palladium*. Syphilis is much more serious than gonorrhoea

SYMPTOMS

- In male a sore called chancre appear on the gland of the penis. The chancre may look like a pimple, a blister or an open sore.
- Week or month later untreated there may be sore swollen joints.

TRANSMISSION

- Many a time are contracted during sexually intercourse with an infected person.
- Pass from mother infected to a child through placenta. Child effected through this way always become mental retarded and die early

PREVENTION

- Avoid sexually behavior

TREATMENT

- Antibiotics such as benzathine penicillin. If one allergic to penicillin , take tetracycline 500mg 4 times a day for 30 days.

3. GENITAL HERPES.

This is painful skin sores caused by a virus called Herpes simplex

SYMPTOMS

- One or more painful blisters like a drop of water on the skin appear on the sex organ (penis or vagina), anus, buttocks and thigh.
- Blisters bust and form open sore.
- These open sore dry up and become scabs.

TRANSMISSION

- Spread from person to person during sex

- Also appear on mouth as a result of oral sex

TREATMENT

- Currently there is no medicine for herpes. Keep the area clean. Never have sex while the blisters or sore are present. Wash hand more often ad try not to touch the sores. The infection can spread to the eye if a person rubs them after touching the sores.

4. CHANCROID.

This is bacterial disease.

SYMPTOMS

- Soft painful sore on the genital and anus
- Enlarged lymph nodes may develop in the groin.

TREATMENT

- Give co-tremoxazole or erythromycin for 7 days. Take erythromycin after meal to avoid stomach upset

SECONDARY EFFECT OF SEXUALLY TRANSIMITTED DISEASE

1. Infertility/sterility
2. Pelvic inflammatory disease
3. Ectopic pregnancy
4. Sepsis which can lead to death
5. Cervical cancer
6. Premature birth, abortion or stillbirths
7. Blindness of foetus

5. **AIDS**

AIDS stand for; *Acquire Immune Deficiency Syndrome*

CAUSES

AIDS is viral infection caused by a strain of a virus called **HIV**. HIV means *Human Immunodeficiency Virus. HIV* mainly found in body fluids such as blood, semen and vaginal secretion. Also traces of HIV found on saliva, tear and sweat

MODE OF TRANSMISSION

AIDS are transmitted through various ways;

- By having sexually intercourse with an infected person.
- By transfusion of infected blood.
- By birth from an infected mother to her baby at birth.
- By use of unsterilized surgical and skin piercing tools e.g. needles

SYMPTOMS

- Chronic diarrhea for more than a month.
- Eventually loss of weight.
- Constant, persistent severe cough for longer than a month.
- Skin infection.
- Inflammation of the lymph nodes.

EFFECT OF HIV ON HUMAN BODY IMMUNITY

The immune systems defend the body against infection disease. Normally a white blood cell does this

- Phagocytosis (engulf and digest antigen)
- Antibodies

HIV weakens the body immune system by entering into white blood cell (lymphocytes) and a binds itself to chromosome and integrates into the genetic material. The virus now multiplies very fast using genetic materials of WBC. The daughter virus invades WBC destroy and kill them. As more WBC is killed the body becomes less and less fight against disease. Patient with aids are prone to opportunistic infection caused by fungi, bacteria and protozoa.

In nutshell people with AIDS die with disease their body cannot resist. These diseases are referred to as ***opportunistic infection***. Example;

1. Tuberculosis
2. Severe diarrhea
3. Skin cancer
4. Pneumonia

DISEASE ASSOCIATED WITH AIDS

- Brain infection
- Cancerous cases
- Chest infection
- Gut infection

TREATMENT.

At the moment there is no cure AIDS. However several discovers of drugs to treat AIDS have been reported but none has been confirmed as being 100% effective.

PREVENTION AND CONTROL

- The most effective way to prevent spread of AIDS is through health and sexually education. The youth must be enlightened on the risk of acquiring virus through careless lifestyles.
- Through voluntary testing counseling for HIV/AIDS positive people.
- Avoid promiscuous sexually partner, commercial sex worker, prostitute and man visit prostitutes
- Avoid transfusion of blood unless screened for HIV virus
- Avoid using unsterilized surgical and skin piercing instrument.

NB:

High risk group include homosexually and intravenous drug users. Currently scientists in global village are working round the clock to develop a vaccine against HIV virus.