INTERMEDIATE STAGE BIOLOGY

BOOK TWO

FOR CLASS XII

For

Sindh Textbook Board, Jamshoro.

CONTENTS

Chapter 1

HOMEOSTASIS

OSMOREGULATION:

It is the control of the gain and loss of water and dissolved solute.

EXCRETION:

The removal of excess and unwanted products from cells are called as excretion.

THERMOREGULATION:

The maintenance of the internal temperature within range that allows cell to function efficiently is called as thermoregulation.

FEED BACK SYSTEM:

There are number of physiological process functioning in the body to maintain the homeostasis. It requires the check and balance.
The check and balance system is called as feedback system.
Usually hormones control this feed back system but it is ultimately controlled by nervous system.
When any change in the internal environment takes place it is detected by the receptors and immediately reported to control center that is brain which decided about the appropriate responses and sends its instructions to the effectors. That plays very important role and brings the substance back to normal.
The feed back may be negative or positive.

NEGATIVE FEED BACK:

The opposite effect produced in the relation to any changes in the body fluids is called as negative feed back. For example when a person takes the sugar the level of glucose will rise in blood. It will triggers the mechanism, that will decreases the level of glucose back to the normal level.

POSITIVE FEED BACK:

Similar affects produced which leads to the enhancement of change. For example once child birth process begins then each succeeding event will make it more likely that the process will continue until the completion.

OSMOREGULATION:

The metabolic reaction on which life depends require a precise balance of water and dissolved salt. Among the salts whose concentration must be reguylated and amino acids, proteins and dissolved ions such as sodium potassium, calcium, and bicarbonate. Each cell must adapt to definite quantity of the water in relation to salts in it to perform its function. Homeostatic mechanism maintain the concentration by osmoregulatuion.

BALANCE OF WATER AND SALTS:

Osmosis occur when two solutions of different concentrations are separated by cell membrane.

There is net movement of water from hypotonic solution to hypertonic solution until the solute concentration are equal on both sides of the cell.
When the concentration of water is greater outside the cell the water moves from outside to inside the cell and the cell become turgid. The cell swells and may burst. But if there is loss of water from cells the cell shrinks and dries. To avoid this condition the cell osmoregulatte themselves to keep water and salt balance.

OSMOREGULATION IN PLANTS:

Efficient functioning of plant cell and the whole plant depend on maintaining the water content at the steady state. According to the availability of the water the plants are divided into four groups.

1. Hydrophates
2. Mesophates
3. Xerophates
4. Halophates

HYDROPHATES:

Hydrophates are those plants which are found in the fresh water. The plants may be partly or totally submerged in water They do not have any difficulty in obtaining water. To remove excessive water, they have following adaptations.

ADAPTIONS:

- Their leaves are large so surface area is large for removal of excessive water by transpiration.
- They have large numbers of stomata at upper surface of leaves,.
- The stomata always remain open.
- Root is absent if present root hairs are absent.

MESOPHATES:

The type of plants that are found in the moderate supply of water majority of angiosperms are mesophates. These are the land plants and can easily maintain their water balance.
When there is sufficient supply of water, the stomata are kept open but when there is restricted supply the stomata are closed.
To prevent excessive loss, the stems and leaves are covered with cuticle.
Shape of leaves is variable which also helps in regulating the water. Leaf fall also help in regulating the water.

XEROPHATES:

These are the plants which are found in the dry placesuch as deserts, steep hills.
Under such conditions, the water potential is very low. They have the following adaptions to prevent the water loss.

Root is deep vertical to absorb more water from soil and it also spread horizontally.
Leaves in most cases are absent or shed during dry season. In such cases the stem become green and performs the function of photosynthesis.
Leaves become small or modified into spines to reduced the rate of transpiration.
The leaves are covered with cuticle or by hairs.
Number of stomata are reduced and are sunken type.

In rainy season stem root and leaves store water in their parenchymatous cells such parts are called succulent.

HALOPHATES:

The plants growing in salt marshes close to sea are called halophates. They have to absorb water, which has high salt concentration

Such plants actively absorb salt by their root and as the salt concentration in their root cell become high, they absorb water by osmosis.
Excess of salt absorbed by root, stored in the cells is executed out from salts glands in leaves.
The salt thus secreted by some species help them to trap water vapours from air, which is being absorbed in liquid form by leave surface.

EXCRETION:

Survival in any environment requires an accurate balance between excretion and animal's need of water and salts. The excretory system plays a central role in homeostasis by forming and excreting urine while regulating the amount of salt and water in body fluid.

EXCRETION IN ANIMALS:

Animals are very active group of organisms and need energy for life activities. They get energy from the break down of food. As a result many waste products are produced. They are harmful if remain in the body for long time. Therefore, excretion is necessary to keep the animal alive.

EXCRETION IN PLANTS:

Among plants oxygen, water, carbon dioxide and some mineral crystal could be looked as a waste.

OXYGEN:

It is a by product of photosynthesis and is eliminated through stomata.

CARBON DIOXIDE:

It is by product of respiration which is eliminated through stomata.

WATER:

Extra amount of water is excreted by transpiration or in some land plants it is excluded in liquids form from hydathodes found at the margin and tips of the leaves which is called as guttation.

CRYSTAL FORMATION:

The plants produce some organic and inorganic salt which are stored in the leaves the leaves die and fall off and thus plants gets rid off these salts.
Falling of yellow leaves in the autumn season is a mean to get rid off such poisonous substances.

OSMOREGUALTION IN FRESH WATER ANIMALS:

The Fresh water animals have higher salt concentration in their body fluid than in surrounding water.
If they lose much salt or take in too much water they die. Therefore they expel water and retain salts. Fresh water fish are covered by scales and mucous secretion which preventing water entry into the body.
They absorb salt by their gills and take in salt rich food. They remove extra water by producing large amount of dilute urine. Fresh water Amoeba and paramecium pump out extra water by contractile vacuoles.

OSMOREGULATION IN MARINE ANIMALS:

As we know that, Marine animal live in salty water, so their body fluid contain less salt concentration. Marine animals have different adpatations for osmoregulation.

BONY FISHES:

These type of fishes constantly loses water through their surface by osmosis. These fished drink water continuously. They retain water and expel salt through their gills. They also save water by excreting small amount of concentrated urine.

CARTILAGINOUS FISH:

These types of fishes maintain lower internal salt concentration than that of seawater. Shark and rays store high concentration of urea in their body. It make the body fluid slightly saltier than seawater. They also have trimethylamine oxide for protection again toxic urea. They do not face the problem of water loss. They contain special glands in their rectum called rectal glands. These glands help to remove excess amount of salts. Salmon fish have remarkable osmoregulatory adaptation. Salmon fish can mirgate between fresh and marine water.

Inocean: they drink more water and excrete extra salts from their gills.
In freshwater: They stop drinking water and gills absorb salts from fresh water.
Invertabrates: Marine invertebrates and hagfishes are osmoconformers.
They do not have osmoregulatory mechanism.

ADAPTATION IN PLANTS TO LOW AND HIGH TEMPERATURE:

The temperature plays a very crucial role in the plant life. Most of the physiological process in the plants require an optimum temperature. Extremely high and low temperature causes some morephological and anatomical adaption in plants such as

LOW TEMPERATURE:

In plant low temperature effect;
(i) Enzyme activities i.e. become inactive.
(ii) Permeability of cell membrane or it become crystalline.
(iii) Effect Cell transport.

HIGH TEMPERATURE:

High temperature damages the cell by denaturing its enzyme. Plant has the following adaptation for high temperature.

1. Transpiration
2. Heat shock protein
3. Leaf modification
4. Heat gain

Chapter 2

SUPPORT AND MOVEMENT

IRRITABILITY:

The ability of an living organism to produce response against any stimula are called Irritability it is also called Sensitivity.

MOVEMENT:

Living organism shown the responses towards stimuli are called Movement.

SUPPORT IN PLANT:

Plants require proper strength and support it is necessary to maintain their shape, increase in size and keep them straight and strong. The support maintains balance. In plant body support is provided by two ways.

* Turgidity in soft parts of plants

* Mechanical tissues

SUPPORT THROUGH TURGOR PRESSURE:

The living cell of epidemics, cortex and pith take in water by osmosis. Thus an Internal hydrostatic pressure called "Turgor Pressure", which keeps them rigid and resistant to bending. If they loose turgidity stem wilts. The turgor pressure is extremely important to maintain the turgidity in plants.

SUPPORT THROUGH SUPPORTING TISSUE:

In plants there are certain tissue called Mechanical tissues. These tissue provide strength to the plant body.

1. Parenchyma

2. Collenchyma

3. Sclerenchyma

1. PARENCHYMA:

STRUCTURE:

* Parenchyma is a simple tissue. It is composed of thin walled spherical, oval or elongated cells.

* They are with or without Intercellular spaces.

* They are living cell.

LOCATION:

They are found in cortex, pith and epidemics, mesophyll region of leaves.

FUNCTIONS:

Their function is synthesis of food and storage of food. They may serve as a supporting tissue in soft plant due to internal turgor pressure.

2. COLLENCHYMA:

STRUCTURE:

* Collencym is a simple permanent tissue. It is composed of rounded, oval or polygonal cells.

* They are living cells with protoplasm.

* Intra cellular spaces are absent and these cells thickened at the corners due to deposition of cellulose and protopectin.

LOCATION:

These tissues are found in the dicot stem below the epidermis.

FUNCTIONS:

Collenchyma cell provide support to young herbaceous part of the plant. It elongate with the grow stem and leaves.

3. SCLERENCHYMA:

STRUCTURE:

* Sclerenchyma is a simple permanent tissue. It is composed of long, narrow thick walled cell.

* They have no intracellular spaces.

* They are dead cell without protoplasm.

* A thick materials is deposit along the wall of cell called pectin and lignin.

LOCATION:

Sclerenchyma tissues are found in xylem which are vascular tissue.

FUNCTIONS:

They provide strength and Mechanical support to the plant parts.

TYPES OF SCLERENCHYMA:

There are two type of sclerenchyma

1. Fibers

2. Sclerides

1. FIBERS:

The sclerenchyma elongated cell with tapered ends. They are tough and strong but flexible Fibers.

2. SCLERIDES:

The variable often irregular in shape sclerenchyma are called sclereids. Simple unbranched sclerids are generally called stone cell.

SECONDARY GROWTH:

An increase in plant girth due to the activity of cambium ring is called secondary growth.

SECONDARY TISSUE:

Tissues which are formed by the activity of cambium ring are called secondary tissue.

SIGNIFICANCE OF SECONDARY TISSUE:

CAMBIUM RING:

The ring of activity dividing cells responsible for lateral growth in plant are called cambium ring.

Secondary growth occurs due to cell division in cambium ring. There are two type

I. VASCULAR CAMBIUM RING:

The cambium present between xylem and phloem is called Vascular Cambium Ring. The cell within the vascular bundles are called fusiform initials.

Vascular cambium gives rise to two new tissues.

* Secondary Xylem (Toward the inside)

* Secondary Phloem (Toward the outside)

GROWTH RINGS:

The secondary Xylem causes most of the increase in stem thickness. Over the year a woody stem get thicker and thicker as it vascular cambium produce layer upon payer of secondary Xylem. These layers are visible as rings.

SAP WOOD AND HEART WOOD:

The outer region of secondary wood is of lighter color and take part in the conduction of water from root to leaf are called Sap Wood.

The inner region of secondary wood is dark brown in color and do not take part in the conduction of water are called Heart Wood.

In most plant heart wood accumulate a variety of chemical such as resins, oil, gum and tannins. Which provide a resistant to decay and insect attack.

II. CORK CAMBIUM RING:

The cambium ring present in cortex region and increase the diameter of stem are called cork cambium ring.

Cork cambium cell divide and form new cells on both side.

* Cork / Phellem ------> Outerside

* Secondary Cortex ------> Inner Side

CORK / PHELLUM:

Cork is formed on the outer side by the cork cambium. Which is an insulating layer prevent transpiration. Cork cell are dead and thick wall.

SECONDARY CORTEX:

It is formed on the inner side by cork cambium. It is consist of few layers of parenchymatous cells. They contain chloroplast.

BARK:

Epidemics, lenticels and cork collectively called bark which is the outer part of stem.

CALLUS:

Another important function of the cambium is to form callus or wood tissue on over the wound. The tissue are rapidly formed below the damage surface of stem and root.

MOVEMENT IN PLANT:
DEFINITION:

Any action taken by living organs to reduce its irritability produce by stimuli are called Movement.

TYPE OF MOVEMENT:

There are two type of movement in plant.

1. Autonomic Movement

2. Paratonic Movement

1. AUTONOMIC MOVEMENT:

Movement which occurs due to internal stimuli factor inherent inside the plant body itself are called Autonomic or spontaneous movement.

TYPES OF AUTONOMIC MOVEMENT:

There are three type of autonomic movement.

i. Locomotory Movement

ii. Growth Curvature Movement

iii. Turgor Movement

I. LOCOMOTORY MOVEMENT:

Movement of whole plant body or an organ or material within plant cell from one place to another due to internal stimuli is called movement of locomotion.

EXAMPLE:

* The streaming movement of cytoplasm (Cyclosis).

* Movement of chromosome during cell division.

II. GROWTH CURVATURE MOVEMENT:

Change in the form and shape of plants or plant organs due to the differences in the ratio of growth of different parts are called growth and curvature movement.

TYPES OF GROWTH CURVATURE:

There are two type of growth movement.

* Nutation

* Nastic

NUTATION:

The growth tip of young stem moves in zigzag manner due to alternate changes in growth on opposite side of the apex. This type of growth is called nutation.

EXAMPLE:

Movement of climber around any rope as found in railway crupper.

NASTIC:

When the process of growth occurs in different manner in the parts of a plant and slow in other part it is called Nastic Movement.

There are two type of Nastic movement

* Epinastic

* Hyponastic

EPINASTIC:

When faster growth occurs on the upper side of the organ is known as epinastic.

HYPONASTIC:

When faster growth occurs on the lower side of the organ is known as hyponastic.

III. TURGO MOVEMENT:

Movement occur due to change in the turgidity and size of cells as a result of loose or gain of water called Turgo Movement.

EXAMPLE:

* Movement of leaves of touch me not.

2. PARATONIC MOVEMENT:

The movement occurs due to external stimuli are called paratonic or Induce Movement.

TYPE OF PARATONIC MOVEMENT:

There are two type of paratonic movement.

i. Nastic Movement

ii. Tropic Movement

I. NASTIC MOVEMENT:

The non directional movement of parts of plant in response to external stimuli are called Nastic Movement.

Usually this movement occur in leaves or petals of flower.

TYPE OF NASTIC MOVEMENT:

There are two of nastic

i. Photonastic

ii. Haptonastic

I. PHOTONASTIC:

The nastic movement occurs due to light are called photonastic.

EXAMPLE:

The flower open and close due to light intensity.

II. HAPTONASTIC:

The nastic movement occurs due to the touch of any living organism are called Haptonastic.

II. TROPIC MOVEMENT:

Tropic ------> Tropos mean "to turn"

The movement in response of growth of whole organ toward and away from stimuli are called tropic movement. It is also known as directional movement.

TYPE OF TROPIC MOVEMENT:

The main type of tropic movement are as follow

* Phototropism

* Geotropis m

* Chemotropism

* Hydrotropism

* Thigmotropism

PHOTOTROPISM:

Photo ------> Light Tropos ------> turn

The movement of part of plant in response to stimulus of light are called phototropism.

EXAMPLE:

* Positive phototropism in stem

* Negative phototropism in root

GEOTROPISM:

Geo ------> earth Tropos ------ turn

The movement of part of plant in response to force of gravity are called Geotropism.

EXAMPLE:

Root display positive Geotropism and shoots negative geotropism.

CHEMOTROPISM:

Chemo ------> Chemical Tropos ------> turn

The movement in response to some chemicals is called Chemotropism.

EXAMPLE:

The hyphase of fungi show chemotropism.

HYDROTROPISM:

Hydro ------> Water Tropism ------> turn

The movement of plant parts in response to stimulus of water is called hydrotropism.

EXAMPLE:

The growth of root toward water is due to positive hydrotropism and shoots negative hydrotropism.

THIGMOTROPISM:

Thigmos ------> touch Tropos ------> turn

The movement of plant parts in response to stimulus of touch are called Thigmotropism.

EXAMPLE:

The movement in climber

SKELETON:
DEFINITION:

The tough hard and rigid framework of the body which gives particular shape and support to animal body are called Skeleton.

HUMAN SKELETON:

Endoskeleton present inside the human body. It consist of 206 bones. In man endoskeleton divide into two parts.

1. Axial Skeleton

2. Appendicular

1. AXIAL SKELETON:

The skeleton composed of skull, sternum, ribs and vertebral column are called Axial Skeleton.

i. SKULL:

The skull is made up of cranium and facial bones.

CRANIUM:

The part of the skull consist of eight bones and form a box like structure which protect the brain are called Cranium.

FACIAL BONES:

The other bones of skull form face are called facial bones. There are 14 facial bones such as check bones, upper jaws and lower jaws single bone called dentary.

ii. RIBS CAGE:

Ribs are semicircular bones attached on their dorsal side with the vertebrae and on their ventral side with sternum.

Rib Cage is composed of 12 pairs of ribs. The lower two pairs of ribs are called floating ribs because they do not attached with the sternum.

FUNCTION:

The rib cage enclosed the chest cavity and protects heart and lungs.

iii. STERNUM:

The narrow rod shaped bones present in ventral wall of thorax are called sternum. It is also known as breast bone.

iv. VERTEBRAL COLUMN:

A hollow spine in which spinal cord protected extend from skull to pelvis are called V column.

BONES OF VERTEBRAL COLUMN:

The vertebral column consists of 33 bones called vertebrate but due to fusion 26 bones are formed.

2. APPENDICULAR:

The skeleton system consist of pectoral girdle and hind limbs and easy to move are called Appendicular skeleton.

Pectoral Girdle and Fore Limb

PECTORAL GIRDLE:

The girdle present in shoulder region and attach the arm to the trunk are called Pectoral Girdle.

PARTS OF PECTORAL GIRDLE:

Pectoral girdle consist of two parts.

1. Scapula ------> board part

2. Clavicle ------> Collar bone which connects scapula with sternum.

For Limb consist of

* Humerus (1)

* Radius (1)

* Ulna (1)

* Carpals (8)

* Meta Carpals (5)

* Phalanges (14)

ARRANGEMENT OF BONES IN FORE LIMB:

ARM:

Humerus forms ball and socker joint with scapular while at distal end humerus forms hinge joint with radius and ulna.

WRIST:

The radius and ulna at their distal end from multistage with eight wrist bones called Carpals.

HAND:

Five metacarpals from the frame work of palm of the hand.

DIGITS:

Five rows of the phalonges in fingers are attached to the meta carpals. They support the finger.

Pelvic Girdle and Hind Limb

PELVIC GIRDLE:

The girdle present in lower region (hip region) and attached the hind limbs (legs) to the vertebral column are called Pelvic gridle.

STRUCTURE OF PELVIC GIRDLE:

Each pelvic girdle consist of large bone called Innominate. It is formed by the fusion of three bones called Illium, Ischium and Pubis.

HIND LIMBS:

The hind limbs consist of

* Femur (1)

* Tibia (1)

* Fibula (1) + Patella (1)

* Tarsals (8)

* Meta tarsals (5)

* Phalanges (14)

ARRANGEMENT OF BONES IN FORE LIMB:

THIGH:

Femur is the largest bones of the body which forms a ball and socket joint with the Pelvic girdle.

KNEE AND CALF:

At the distal end the femur from knee joint with the proximal end of two parallel bones called tibia and fibula.

ANKLE:

The distal end of the tibia and fibula form a joint with eight tarsals, which are also attached with five meta tarsal bones of foot.

DIGITS:

Five rows of the fourteen phalonges of the toes are attached with meta tarsals**.**

TYPES OF SKELETON:

There are three main types of skeleton in animals.

1. Hydrostatic Skeleton

2. Exoskeleton

3. Endo Skeleton

1. HYDROSTATIC SKELETON:

A fluid filled gastro vascular cavity or coelom act like a skeleton are called hydrostatic skeleton.

FUNCTIONS:

Hydrostatic skeleton provides support and resistance to the contraction of muscle so motility results.

EXAMPLE:

Hydrostatic skeleton found in annelids and other soft bodies invertebrate.
Mechanism of Working
The fluid filled body cavity of in these animals is surrounding by layer of two types of muscles.

Circular Muscles

Longitudinal Muscles

When circular muscles contract and pressure comes on body fluid by this process the body become elongated and hard.

When the longitudinal muscles contract the body becomes short and thick due to the lengthen and shorten body move easily in the soil.

2. EXOSKELETON:

The hard non living external covering that is secreted by the outer epidermal layer of animals are called exoskeleton.
OR
The skeleton present outside the body are called Exoskeleton.

COMPOSITION OF EXOSKELETON:

exoskeleton are made up of different materials.

1. SILICA:

The exoskeleton of single celled diatoms made up of silica.

2. CALCIUM CARBONATE:

The exoskeleton of mollusks made up of lime (Caco3)

3. CUTICLE:

The exoskeleton of arthropods made up of hard, non living substance called chitin. It is the complex of protein and carbohydrates. This exoskeleton is dividing by soft flexible joints.

FUNCTIONS:

It provides a surface to which internal muscle can be attached.

It provides the protection and support to the body.

It is not help in locomotion but in arthropod. It helps in movement due to joint.

DISADVANTAGES OF EXOSKELETON:

1. Due to exoskeleton the size of arthropods is short.

2. Growth is also limited because the exoskeleton is non living and non growing.

3. Moulting or ecdysis: When the size of animal increase the exoskeleton become short and it is separated from the body. It is replaced by a new skeleton this process are called moulting.

3. ENDOSKELETON:

The skeleton present inside the body and made up of rigid living connecting tissue bones and cartilages are called endoskeleton.

FUNCTIONS OF SKELETON:

1. SUPPORT AND SHAPE:

It provides supporting frame work of the body, it gives the body a particular shape.

2. PROTECTION:

Bones protect critical internal organs, such as brain spinal cord, heart, lungs and reproductive organs.

3. MOVEMENT:

Skeletal muscles attached to the bones help move the body.

4. MINERAL HOMEOSTASIS:

Bones serve as depository for calcium, phosphorus, sodium and potassium. Bones can release or take up minerals through negative feed back mechanisms to maintain the homeostasis.

5. BLOOD CELL PRODUCTION:

Red and white blood cells are produced in bone narrow.

BONES AND CARTILAGES:

In vertebrate animals the endoskeleton contains two types of connective tissues.

1. Bones

2. Cartilage

1. BONES:

Bones is the most rigid form of connective tissue.

STRUCTURE OF BONES:

Cell of bones are called Osteocytes. They secrete a gel like matrix around them. It contains a network of collagen fibres but unlike cartilages it is hardened by the deposition of Osteoblasts and crystals of calcium phosphate. This process called Ossification or Calcification, takes place in the presence of vitamin D.

2. CARTILAGE:

Cartilage is the softer and flexible form of connective tissue.

STRUCTURE OF CARTILAGE:

The living cells of cartilage are called chondrocytes. These cells secrete flexible, elastic, non-living matrix. It consists of protein and polysaccharides. The main protein in the matrix is collagen whose fibers run in all directions and surrounds the chondrocytes. No blood vessels penetrate into this cartilage.

FUNCTION:

It covers ends of the bone at the joint and also supports the flexible portion of nose, external ears and larynx.

JOINT:

The point at which two or more bones connect each other are called Joint. The help in motality of skeleton.

TYPES OF JOINT ON THE BASIS OF MOVEMENT:

Joints are classified on the basis of the amount of movement allowed by them, into three categories.

i. Immovable Joints

ii. Slightly Moveable Joints

iii. Freely Moveable

i. IMMOVABLE JOINTS:

The joints fit together tightly like the pieces to a puzzle. These joints are called immoveable joints or fixed joints because they don't allow the joining bones to move.

EXAMPLE:

Example of fixed joint are the joints of skull in the term of case to protect the brain.

ii. PARTIALLY MOVEABLE JOINTS:

The joints which allow a little government is called partially moveable joints or slightly moveable joints.

EXAMPLE:

Example of partially moveable joint is the attachment of ribs with vertebrate. These joints permit out ribs to moves ups and down while we breath.

iii. FREELY MOVEABLE JOINTS:

The joints which allow the movement in several directions is called freely moveable joints.

TYPES OF FREELY MOVEABLE JOINT:

Freely moveable joint that are present in human skeleton system are

i. Ball and Socket Joint

ii. Hing Joint

iii. Pivot Joint

iv. Sliding Joint

v. Gliding Joint

i. BALL AND SOCKET JOINT:

The joint which allow the movement in all directions even in a circle is called ball and socket joint.
In this joint ball like head of the long bone of leg and upper are fit into a cup like socket of girdle.

EXAMPLE:

joint of hiPs and shoulder

ii. HING JOINT:

The joints that allow the movement in two directions such as show the back and forth movement is called hing joint.

EXAMPLE:

Joint of fingers, elbow and knee.

iii. PIVOT JOINT:

The joints which allow a twisting movement as well as side way movement is called pivot joint.

EXAMPLE:

Joints of elbow and skull connected to the spine are the examples of pivot joint.

iv. SLIDING JOINT:

The joints which allow the bones to slides over one another and show the movement in many directions are called sliding joint.

EXAMPLE:

Joints of wrist and ankle.

v. GLIDING JOINTS:

The joints in which bones moves easily over one another in a back and forth manner is called gliding joints.

EXAMPLE:

Joints of vertebral column that makes the back bone flexible are the example of gliding joint.

STRUCTURE OF HING AND BALL AND SOCKET JOINT:

At moveable joints the joining bones are held in place by strong straps of connective tissues called Ligaments. Ligaments connect the bones to each other and don't allow the bones to slip and dislocate at a joint. As ligaments stretch they allow the joints to move.
Highly moveable joints also need lubrication and cushioning to prevent the adjoining bones crushing with each other. This is the function of Synovial Cavities prevent around fluid the reduces the friction and keeps the joint moving freely.
In addition cartilage pads at the end of bones act as shock absorber and present bones from grinding together.

DEFORMITIES SKELETON:

Human skeleton support and upright body. Sometimes in skeleton certain disorders are developed which weak a skeleton system are termed as Deformities of skeleton.

CAUSES OF DEFORMITIES:

The causes of deformities are

1. Genetic Disorder

2. Hormonal Disorder

3. Nutritional or Malnutrition

4. Physical Trauma

1. GENETIC DISORDER:
i. CLEFT PALATE:

It is a genetic disorder in which cleft present in the palate which interferes with sucking. It can lead to inhalation of food into the lungs causing aspiration pneumonia.

ii. MICROCEPHALY:

It is genetic disorder in which the skull becomes small sized.

iii. ARITHRITIS:

Arthritis is the inflammatory or degenerative disease that damage the joints. Osteo arthritis is the most chronic arthritis which is a degenerative joint disease also caused by genetic defect.

2. HORMONAL DISORDER:

The skeleton deformities of the bones caused by hormonal deficiency.

i. OSTEOPOROSIS:

Osteoporosis mostly occurs in aged women, which is related to decrease the level of estrogen hormone.

SYMPTOMS:

In osteoporosis, the bones become porous, thin and weak and consequently easily breakable.

3. NUTRITIONAL OR MALNUTRITION:

The skeleton deformities occur in the bones due to nutritional deficiency.
Some of the nutritional disorders are

i. OSTEOMALACIA:

Osteomalacia is the softening of bones in which the bones receive in adequate minerals and patient feels pain when weight is put on affected bones. In this disease calcium salts are not deposited and hence bones soften and weaken weight bearing bones of legs and pelvis, bend and deform.

ii. RICKETS:

Rickets in children results in bowed legs and deformed pelvis. It is caused by deficiency of calcium in diet or vitamin D deficiency. It treated by vitamin D fortified milk and exposing sink to sunlight to cure disorder.

4. PHYSICAL TRAUMA:

Certain diseases caused by physical trauma are as follows

i. Disc slip

ii. Spondylosis

iii. Arthritis

iv. Sciatica

i. DISC SLIP:

The backbone of body consists of many vertebrate. Between these vertebrate special cartilage pad are present called Disc.

FUNCTIONS:

the discs act as shock absorber during walking, jumping, running and lesser extend to the bend laterlly.

DISEASE:

if due to physical trauma, the cartilaginous ring of disc ruptures and displaces it is called disc slip.

SYMPTOMS:

Protrution presses spinal nerve and cause sever pain.
Unability to move.

TREATMENT;

As a result of disc slip the person should use hard bed and should take rest for long time.
Pain killer medicine should be used.

ii. SPONDYLOSIS:

Spondylosis is deformity of joints of two vertebrate particularly of neck region when the space between two vertebrate becomes narrow.

SYMPTOMS:

Due to spondylosis the nerves of spinal cord are pressed. It causes pain in neck shoulder and upper parts of arm.

TREATMENT:

In this condition a hard collar is used around neck.
Pain killer are used.

iii. ARTHRITIS:

Arthritis is inflammatory or degeneration disease that damage joints.

CAUSES:

It may be due to
Hereditary
Viral Infection
Injury
Old age

SYMPTOMS:

It results in pain, stiffness, swelling of the joint.
Smooth and flexible cartilage between the bones of a joint is denatured by the deposits of calcium, which makes the cartilages hard.

TREATMENT:

Knee joint and hip joint can be replaced by artificial rubber or plastic joint.
Sometimes it is treated by medicines and physiotherapy.

iv. SCIATICA:

Sciatica is a nerve pain of hind limbs which occur when nerve of sciatic plexus is being pressed.

CAUSES:

It may be due to
Injury

DISC SLIP:

Improper administration of injection in the iliac vein.

SYMPTOMS:

It makes the leg highly painful and virtually immovable.

TREATMENT:

The treatment of sciatica is very slow and prolonged. There is no permanent treatment of this disorder.

MUSCULAR SYSTEM:

Muscle made up to muscular tissue. A muscular tissue is a group of specialized cells contain numerous filament of protein and perform a unique functions to generates a pulling force.
There are more than 600 muscles in a human body and almost half of body weight is due muscles.

TYPES OF MUSCLES:

The vertebrate possess three kinds of muscles

1. Skeleton Muscles

2. Smooth Muscles

3. Cardiac Muscles

1. SKELETON MUSCLES:

The muscles that are attached with the skeleton and associated with the movement of bones are called Skeleton Muscles.

CHARACTERISTICS:

Skeleton muscles are voluntary in function.
They can contract strongly and rapidly but fatigue quickly.
Skeleton muscle are striated muscles because they show alternate dark and light band.
They are under the control of somatic nervous system.
Muscles are attached to the bones by special structure called tendon.

FUNCTIONS:

With the help of skeleton muscles all the body parts can move.

2. SMOOTH MUSCLES:

The simplest type of muscles which form all the internal hollow body's organs and it found in throughout animal kingdom, called smooth muscles.

STRUCTURE:

Smooth muscles are structurally very simple muscles. They are spindle shapes uni-nucleated cells. They are arranged in a sheet around the hollow organs of the body.

CHARACTERISTICS:

These are unstrained muscles.

They are involuntary in function i.e. their movement is not in our control but they are controlled by hormones and autonomic nervous system.
They contract more slowly than skeleton muscles but it can prolonged for a long period of time.

LOCATION:

These muscles are found in the blood vessels, digestive tract and many other organs.

FUNCTIONS:

Smooth muscles push the food to the digestive track.
They empty the urinary bladder.
They control the diameter of the blood vessels.
They also control the diameter of the pupit of eye.

3. CARDIAC MUSCLES:

The muscles which are present only inside the wall of heart are called Cardiac Muscles.

CHARACTERISTICS:

These are striated muscles.
They are involuntary in function and fatigueless.
They contract and relax continuously in a rhythmic pattern. This rhythmic contraction called heart beat.
Cardiac muscles have more mitochondria to continuous supply of energy to the tissues of heart.
Cardiac muscles regulate by the sino atrial node (SAN) or pace maker.
Heart is quite independent of nervous system for its contraction and heart beat is generated by the cardiac muscles itself.

STRUCTURE:

They are uninucleated or binucleated and branched to create a meshwork of contractile tissue hence their fibres can not be separated like that of a skeletal muscle.

FUNCTIONS:

The function of cardiac muscle is pump the blood.

STRUCTURE OF SKELETON MUSCLES

MUSCLE FIBRE:

Each skeleton muscle is actually a bundle of long and parallel closely packed thread like multinucleated cells called the muscle fibers.

SIZE:

Skeleton muscle fibers are huge cells. Their diameters are 10 to 100 mm.

STRUCTURE OF MUSCLE FIBRE:

Each muscle fiber is bounded by thin elastic membrane called Sarcolemma. Similar to plasma membrane. Inside the sarcolemma, there is a semifluid called Sarcoplasm.

MYOFIBRIL:

Each muscle fibre contain a large number of many individual, ultra microscopic contractile fine thread like structure called Myofibril.
The diameter of myofibril is 1-2 mm that run in parallel fashion and extend entire length of the cell.

SARCOMERE:

The myofibrils consist of smaller contractile units called Sarcomere.

STRUCTURE OF SARCOMERE:

In each sarcomere a series of dark and light band are evident along the length of each myofibril.

MICROFILAMENTS:

The myofibril contains myofilaments or mocrofilaments. Microfilament is made up of two types of filament.

i. Thick Filament

ii. Thin Filament

i. THICK FILAMENT:

The central thick filaments extend the entire length of the A-band. The thick filament which is about 16mm in diameter is composed of myosin.

STRUCTURE OF MYOSIN:

Each myosin molecule has tail terminating in two globular heads. Myosin tail consists of two long polypeptide chain coiled together. The heads are sometimes called cross bridge because they link the thick and thin myosin filaments together during contraction.

ii. THIN FILAMENT:

The thin filaments extend across. The I-band and pathway into A-band. Thin filaments are 7-8 mm thick and composed of chiefly actin molecule.

STRUCTURE OF ACTIN:

The actiN molecules are arranged in two chains which twist around each other like twisted double strand of pcarls. Twisting around the chains are two strands of another protein tropomyosin. The other major protein in thin filament is troponin. It is actually three polypeptide complex. One bind to actin, another binds to tropomyosin while third binds calcium ions.

I-BAND:

The area which appear light and contain only thin filament is called I-Band.

H-BAND:

The area which appear bright and contain only thick filament is called H-Band.

A-BAND:

The area of sarcomere which appear dark and contain both thick and thin filament is called A-Band

MECHANISM OF CONTRACTION OF SKELETON MUSCLES:

There are two theories which explain the mechanism of contraction of skeleton muscles.

1. Sliding Filament Theory

2. Cross Bridge Theory

1. SLIDING FILAMENT THEORY:
INTRODUCTION:

H.Huxley and A.F. Huxley and their colleagues suggested a hypothesis in 1954 to explain all even in muscle contraction this is called Sliding Filament Theory.

STATEMENT:
According to this theory

The thin and thick filament of a muscle fiber move together by sliding over each other. This is like sliding the fingers of our hand between fingers of the other hand. The sliding of the filaments is the reason that the muscle gets shorter and thicker.

2. CROSS BRIDGE THEORY:
INTRODUCTION:

When the bulbous heads end of the myosin filament discovered so the another theory explain the mechanism of contraction of muscle which show physical contact are called Cross Bridge Theory.

STATEMENT:
According to this theory

The bulbarious head of thick filament myosin become attached to binding sites on the actin filament. The cross bridge are formed then contract to pull the actin filament towards center of sarcomere and the muscles become contract.

MOTOR UNIT:

A set of all the muscle fibers innervated by the branched of the single neuron and a single muscle fiber is made up of many motors units.

CONTROLS OF MUSCLE CONTRACTION:

The contraction of a muscle depends upon three factors.

1. Nerve Impulse

2. Energy

3. Calcium Ions

1. NERVE IMPULSES:

Nerve impulse cause muscle contraction. The nerve impulses (nerve message) are received from brain and spinal cord through motor nerves. The muscles entirely depend upon these nerve impulses. When these impulses do not reach to the muscles, they become fatigue. They loss stimulation and contraction stops gradually.

2. ENERGY:

Muscles also need energy for contraction. Energy required for muscle contraction comes from food. The energy from food is stored in muscles in the form of glycogen. It is transformed from glycogen to creative phosphate and finally to ATP where it is stored and is readily available for use of muscle.

3. CALCIUM IONS:

Calcium ions play very important role in the initiation of muscle fibre contraction. It is stored in sarcoplasmic reticulum.
When the nerve impulse reaches the acetyl chorine is released.
Due to acetyl chorine great number of calcium ions released from Sarcoplasmic reticulum.

The calcium ions bind to troponin molecule and exposed the active site of actin molecule.
The cross bridge is formed between actin and myosin and the muscles become contracted.
After contraction has occurred the impulse stops, calcium ions back into sarcoplasmic reticulum and the muscles fibers relaxed again.

FATIGUE:

Muscle fatigue is a state of physiological inability to contract.
OR
When the muscles become functionless it is called Fatigue.

CAUSES:

ATP Deficit
Muscle fatigue results from relative deficit of ATP, not its total absence.

LACTIC ACID ACCUMULATION:

Excess accumulation of lactic acid due to the breakdown of glucose in absence of O2 and ionic imbalances also causes muscle pH to drop and the muscle to ache hence causes extreme fatigue.

RECOVERY:

When the heavy exercise stops and continues the supply the excess oxygen to the fatigued tissues, which now break lactic acid into water and carbon dioxide. Lactic acid is converted the fatigued condition of the muscle is over. The amount of oxygen needed to remove lactic from the tired muscle is called Oxygen Dept.

ABNORMAL MUSCLE CONTRACTION:

There are two common abnormal muscle contractions

1. Tetany

2. Cramps

1. TETANY:

Tetany is a sudden involuntary contraction of striated muscle.

CAUSES:

Tetany is caused by the low level of calcium in the blood.

SYMPTOMS:

It excites neurons which influence the muscles contract before gaining the normal position of actin and myosin filaments, therefore it is called abnormal function. In tetany there is continue contraction of muscle fibers. Due to this continue contraction the Ca++ ions cannot be separated from the sarcoplasm of muscles and continue contraction becomes very rapid, so it is known as Tetany. If tetany occurs in respiratory organs, they may become functionless.

2. CRAMPS:

It is also known as titanic contraction of entire muscle. It lasts for just few seconds or several hours, causing the muscles to become taut and painful. It is most common in thigh and hip muscles, it usually occurs at night or after exercise.

CAUSES:

The main causes for cramps are as follows
Sugar level in blood is reduced
Sometimes dehydration occurs in the body.
Electrolytes (ions) are not in balance state.
Extra exercise is also harmful and causes cramps.

TREATMENT:

Simultaneous squeezing and stretching the cramped muscle may help.

ANTAGONISITIC MUSCLES:

The muscles work in pairs with one muscle working against the other are called Antagonisitic Muscles.

TYPES OF ANTAGONISITIC MUSCLES:

On the basis of their function and affect they produce the muscles are of following type.

1. PROTRACTOR AND RETRACTOR:
PROTRACTOR MUSCLE:

These muscle pull the lower part of limb in forward direction.

RETRACTOR MUSCLE:

These muscle pull the limb in backward direction.

2. ABDUCTOR AND ADDUCTOR:
ABDUCTOR MUSCLE:

These muscle pull the limb away from the body.

ADDUCTOR MUSCLE:

These muscle pull the limb towards the body.

3. FLEXOR AND EXTENSOR:
FLEXOR MUSCLE:

They close the joint.

EXTENSOR MUSCLE:

These muscle open the joint.

LOCOMATION IN PROTOZOA:

Protozoans are the unicellular animals. Then locomotion is carried out by single called structures. These are of three types Pseudopodia, cilia and flagella. These structures arise from the body surface and may also help to capture the food.

1. LOCOMOTION IN AMOEBA:
ORGANS OF LOCOMOTION:

Locomotion in Amoeba is called amoeboid movement. Amoeboid movement takes place by means of Pseudopodia.

METHOD OF LOCOMOTION:

The pseudopodia are finger like projections in the direction of movement. After the formation of pseudopodia the Amoeba attaches with the substratum and pull the body in the forward direction.
The exact mechanism of pseudopodia formation is still not known.

2. LOCOMOTION IN EUGLENA:
ORGANS OF LOCOMOTION:

Euglena moves with the help of flagellum.

METHODS OF LOCOMOTION:

As the flagellum is whipped backward the organism moves forward. However, when flagellum moves forward the Euglena does not move backward. Flagellum is at is anterior end of the body and pulls the organism forward. Wave of activity generated by itself and they pass in spiral fashion from its base in spiral fashion from its base to its tip.
Euglena increases amplitude and velocity. The activity of the flagellum caused the body of Euglena to rotate forward abouts its axis.

EUGLENOID MOVEMENT:

In this mode of locomotion, a wave of contraction and expansion passes from the anterior to posterior in entire body. The contraction and expansion is brought by the contraction of protoplasm. The body becomes shorter and wider first at the anterior, then in the middle and finally at posterior.

3. LOCOMOTION IN PARAMECIUM:
ORGANS OF LOCOMOTION:

Paramecium moves with the help of Cilia. The movement by cilia is called Ciliary movement.

STRUCTURE OF CILIA:

Cilia are short fine thread-like extensions of the cell membrane.

METHOD OF LOCOMOTION:

The locomotion in paramecium take place by the beating of these cilia. The beating action occurs in two strokes.

EFFECTIVE STROKES:

During effective stroke the cilia become rigid and bent backward but obliquely propel the animal forward.

RECOVERY STROKES:

During recovery stroke the cilia become softer and returns to it original position.
As a result of effective and recovery stroke paramecium swims against water. The body move forwards.

4. LOCOMOTION IN ANIMALS:

1. LOCOMOTION IN JELLY FISH:

Jelly fish has umbrella like body which floats on the surface of water at the mercy of waves. However it can swim slowly by muscular contraction.

MECHANISM:

In jelly fish the water enters in the umbrella like body (Bell). Then the muscle of the body contract and water is forced out in a jet, as a result animal movement is known as "Jet Propulsion". The jelly fish moves in jerks in the direction opposite to the expelled water.

2. LOCOMOTION IN SNAIL:
ORGANS OF LOCOMOTION:

Snail crawl or move very slowly by "foot".

MECHANISM:

The foot of snail produces a wave of muscular contraction on its under side. This wave is from front to rear and animal is pushed forward. The movement is lubricated by slime which is poured on land immediately from glands below the mouth.

3. LOCOMOTION IN STAR FISH:
ORGANS OF LOCOMOTION:

Starfish moves with the help of tube feet. The tube feet are present on both sides of radial canal that extends up to the tip of arm.

STRUCTURE OF TUBE FEET:

The tube feet are hollow muscular and are like rubber bulb of the medicine dropper. The tube feet consist of three parts.

Ampula

Podia

Sucker

MECHANISM:

In starfish locomotion is controlled by a special water vascular system. Water is drawn into the body through a small opening and is passed through a ring canal to large number of hollow muscular tube feet. The tube feet extend when water is pumped into them then they fix themselves by suction cup (sucker) with some object. When sucker muscle contract the water is pushed back into the ampullae, making the tube feet flaccid losing the grip and the starfish is pulled forwards.

Chapter 3

CO-ORDINATION AND CONTROLS

PLANT HORMONES: (PHYTOHORMONE)

DEFINITION:

Certain chemical produced by plants have profound effect on their subsequent growth and development. Such chemicals are called Plant Hormones or Phytohormone. Phytohormone are synthesized by plants in minute concentration and exert their effect by activating gene expression or inhibiting enzyme or changing properties of membrane.

TYPES OF PHYTOHORMONE:

There are five kind of plant hormones
1. Auxins
2. Gibberellins
3. Cytokinins
4. Abscisic Acid
5. Ethene

1. AUXINS:
DISCOVERY:

the first auxin was discovered by Fret Went in 1926.
Chemical Nature
Indol Acetic Acid (I.A.A)
Indol Acetic Acid (I.B.A)
Nephthalene Acetic Acid (N.A.A)
Site of Synthesis
It is synthesize at the apices of stem and foot, young leaves and young embryo.

ROLE OF AUXIN:

i. Cell division and cell enlargement
It stimulate teh cell division and cell enlargement and plant in increase the length of plant.

ii. Initiation of Root
Auxins also initiates development of adventitious roots when applied at the cut base of stem.

iii. Abscission

In mature leaves and fruits when auxin production diminishes, a layer of thin walled cells is formed at the base of petiole and stake of fruit. This layer is called Abscission layer and causes fall of leaves and fruit with slight jerk.
iv. Growth of Fruit
Auxins produced in young embryo promotes the growth of fruit.

v. Parthenocarpy
Use of auxin helps in producing parthenocarpic or seedless fruits.

vi. Apical Dominance
Besides growth promoting function on Auxin, also has inhibitory effect on growth. Growth of apical bud inhibits growth of lateral buds beneath the stem. This phenomenon is termed as apical dominance removal of apical buds initiates growth of lateral buds with more leaves and axillary bud.

vii. Weedicide
Auxins are selective weed killer 2-4 dichlorophenoxy acetic acid (-2-4-D) is used to kill weeds in lawn's and cereal crops.

2. GIBBERELLINS:
DISCOVERY:

Gibberellins was discovered by T.Yabuta and I.Hayashu in a fungus called Gibberellins funjikuroi. This fungus causes foolish seedling (Bakanae) disease in rice. In this disease the infected rice seedling elongated and ultimately fallover without producing grains.
Chemical Nature
The chemical nature of Gibberellins is Gibberellins acid 70 types of gibberellins have been discovered.

ROLE OF GIBBERELLINS :

i. Cell division and cell enlargement

Like auxins Gibberellin also promotes cell division and elongation.

ii. Control of Dwarfism

Gibberellins can control genetic and physiological dwartism plants.

iii. Seed Germination

They promote the synthesis of a-amylase enzyme is dorman seeds due to the production of this enzyme, the seed starts germination.

iv. Parthenocarpy

These hormones help in the formation of seedless fruit which are called Parthenocarpic fruits.

v. Increase of Crop Yield

The crop yield of sugar can can be increased by the application of gibberellin about 50 tons/ acre.

vi. Formation of Flower and Growth of Pollen Tube
They stimulate flowering and the growth of pollen tubes during fertilization

3. CYTOKININS:
DISCOVERY:

Cytokinins are discovered by Miller in coconut milk.

CHEMICAL NATURE:

Chemically there are two types of cytokinins.
Kinetin It is found in coconut milk etc.
Zeatin It is found in maize.

ROLE OF CYTOKININS:

i. Cell Division

They initiate rapid cell division only in the presence of auxin.

ii. Delay in Senescence

They also caused delayed senescence (old age).

iii. Breaking of Seed Dormancy

They break seed dormancy and promote fruit development some species.

4. ABSCISIC ACID (A.B.A):

In contrast to growth promoting hormones, abscisic acid is growth inhibitor, produced by plants during adverse environment conditions such as drought conditions.

ROLE OF ABSCISIC ACID:

It increases dormancy in buds and seeds.
It causes stomata to close.
It turn leaf primordia into scale.

5. ETHENE:
It is a gas which also acts as a growth inhibitor.

ROLE OF ETHENE:

It triggers ripening of fruits.
It contributes in leaf abscission and also breaks the dormancy of seeds and buds.
It also initiates flowering in plants e.g. pineapple.

RESPONSES TO ENVIRONMENTAL STRESS:

Changes in environmental conditions are the big threats for living organisms especially for plants. These factors which change the normal condition of light, CO_2, nutrients, temperature etc. causes severe stresses on plants. The common environmental stresses for plants are

1. Water Shortage (Drought condition)
2. Less Oxygen Supply
3. High Concentration of Salt in the Soil
4. High Temperature
5. Low / Cold Temperature
6. Herbivory / Over Grazzing

1. WATER SHORTAGE:

In dry condition, the guard cells of leaf become flaccid to close the stomata.
In this way the transpiration is stopped.
The dry condition also stimulates increased synthesis and release of abscisic acid.
This hormone help in keeping stomata close.
These plants produce deeper root system.

2. OXYGEN DEFICIENCY:

Those plants which grow in wet habitat or marshes, they develop aerial roots to absorb oxygen.
Some plants developed air tubes that provide oxygen to submerged roots.

3. SALT STRESS:

The plants especially halophytes, have salt glands in their leaves where desalination occurs.

4. HEAT STRESS:

In plants there are two methods to tolerate the heat stress.
Transpiration has a cooling effect on the plant body. By this method the effects of heat are reduced.
Above 40oC plants cell start synthesizing relatively large quantities of special protein called heat shock proteins.

5. COLD STRESS:

Plants respond to cold stress by altering the lipid composition, changes in solute composition is altered also by producing different polymers of pentose (Fructose) which allow the crystals to super cool without compound formation.

6. HERBIVORY / OVER GRAZZING:

Plants overcome excessive herbivory by developing horns and production of distasteful or toxic compounds.

DEFENCE AGAINST PATHOGENS:

Diseases of plants may arise from infections by viruses, bacteria or fungi and other pathogens in most cases. Against these diseases the plants produce immune system in their body.

FIRST LINE EFENCE:

The outer layer epidermis is a protective covering around the body of plant. This is the First Line Defence.

SECOND LINE DEFENCE:

When pathogens enter the body through stomata or any other way, then plants produce certain chemicals to kill them. This is called Second Line Defence.

PHYTOALEXINS:

In infected plants an antibiotic phytoalexins is produced which is effective to all micro-organisms.

BIOLOGICAL CLOCKS:

DEFINITION:

A control system is found in all living organisms which controls physiological and metabolic and metabolic functions according to time is called Biological Clock.

BIOLOGICAL RHYTHMS OR BIORHYTHMS:

DEFINITION:

In living things the behavior activities occur at regular intervals which are called biological rhythms OR biorhythms.

CIRCADIAN RHYTHMS:

DEFINITION:

[Circa => about; dies => day]
Biorhythms may occur, showing periodicity of about 24-Hours. These are called Circadian Rhythm, which means about one day, so they are also called diurnal rhythms.

CAUSES OF BIORHYTHM:

Biorhythms occurs due to the following reasons.
1. Exogenous Stimuli
2. Endogenous Stimuli

1. EXOGENOUS STIMULI:

There may be direct response to various changes in the external (exogenous) stimuli.

2. ENDOGENOUS STIMULI:

These rhythms can be controlled internally by an efficient time measuring system and are independent of light and temperature effects. These types of rhythms are called endogenous.

CO – ORDINATION:

DEFINITION:

The working together of all parts of the body or system is called Co-ordination.

TYPES OF CO-ORDINATION:

There are two types of Co-ordination.
1. Nervous Co-Ordination
2. Chemical Co-Ordination

1. NERVOUS CO-ORDINATION:

DEFINITION:

Co-Ordination brought about by the nervous system. It is quickest way of communication take place by electro-chemical messages called Nerve Impulse within the body of all animals is called Nervous Co-Ordination.

ELEMENTS OF NERVOUS SYSTEM:

The elements o nervous system which help in co-ordination are
i. Receptor
ii. Central Nervous System (CNS)
iii. Effector

I. RECEPTOR:

The sensory tissues or organs which receive any change in their external as well as internal environment (stimuli) are called Receptors.

II. CENTRAL NERVOUS SYSTEM:

The receptors convey the stimuli to the control centre, the nervous system (Central Nervous System) through sensory nerves.

III. EFFECTOR:

The central nervous system (CNS) analyses stimuli and sends an appropriate command, through it motor nerves to either endocrine organ to release hormones into the blood or to muscles called Effectors.

PATHWAY IN NERVOUS SYSTEM:

There are two types of pathway in the nervous system.
i. Afferent Nerve Pathway
ii. Efferent Nerve Pathway

I. AFFERENT NERVE PATHWAY:

From receptor the messages are carried to the Central Nervous System i.e. brain and spinal cord, this pathway is called Afferent Nerve Pathway.

II. EFFERENT NERVE PATHWAY:

From central nervous system the messages are transferred to the effector. This pathway is called Efferent Nerve Pathway.

NERVOUS TISSUES:

There are two types of nervous tissues
1. Neurons
2. Neuroglia OR Glial Cells

1. NEURONS:

DEFINITION:

The nervous system consist of special cells which can generate and conduct electric current are called Neurons.
OR
The chief structural and functional unit of nervous system is called Neurons.

STRUCTURE OF NEURONS:

Neurons are different from each other according to size and shape but the structure of neuron consists of three parts.

i. Some or Cell Body
ii. Dendrites
iii. Axon

I. SOMA OR CELL BODY:

Each neuron has a cell body or soma containing nucleus and various organelle embedded in the cytoplasm. Nissl's granules which are group of ribosomes, associated with rough E.R. and Golgi apparatus are present in the cell body.

FUNCTIONS:

The cell body or soma is the main nutritional part of the cell necessary for growth of neuron.
Soma receive message to dendrites and convey it to axon.

II. DENDRITES:

From the soma, a large number of small threads like terminal branches are arises are called Dendrites.
Functions
Dendrites receive stimuli and convey it to the soma.

III. AXON:

The unbranched, single elongated cytoplasm process which usually arises opposite to dendrites called Axon.

AXON HILLOCK:

Axon originates from a pyramid like area of soma called Axon-Hillock.

AXON TERMINAL:

At the terminal end of axon many fine branches are present called Axon Terminals.

MYELIN SHEATH:

The axon of some neurons is enclosed by a layer of fatty substance known as Myelin Sheath.
This serve as insulating layer.

FUNCTIONS:

Axon is specialized for conducting impulses to other neurons.

TYPES OF NEURONS:

According to the function, neurons are of the three types.
i. Sensory Neuron
ii. Motor Neuron
iii. Inter Neuron

I. SENSORY NEURON:

The neurons which transmit impulses from receptor to the central nervous system is called Sensory Neuron or Receptor Neurons.

II. MOTOR NEURON:

The neurons which transmit instructions of the central Nervous System to the effector are called Motor Neurons or Effector Neurons.

III. INTER NEURONS:

The neurons present between sensory and motor neurons are called Inter Neurons. They are found in Central Nervous System.

FUNCTIONS OF NEURONS:

Neurons is the functional unit of nervous system which receives stimuli, transfers them to the Central Nervous System (CNS).
It transfers the messages from CNS to the body parts effector.

REFLEX ACTION:

DEFINITION:

The automatic involuntary responses which occur either due to internal or external stimuli are called Reflex Action.
OR
An immediate response to a specific stimulus without conscious control is called a Reflex Action.

PARTS OF REFLEX ACTION:

Reflex action consists of
i. Receptor: (Skin) receive stimuli.
ii. Sensory Neuron: It carries message from receptor to the Central Nervous System (CNS).
iii. Motor Neuron: It carries message from Central Nervous System (CNS) to the effector.
iv. Effector: (Muscle of gland) which perform action.

REFLEX ARC:

DEFINITION:

The pathway of passage in impulse during a reflex action is called Reflex Arc.
Reflexes may be monosynaptic or polysynaptic.
Monosynaptic
The reflex action in which only one synapse is involved is called Monosynaptic.
Example: Knee Jerk
Polysynaptic
The reflex action in which many synapses are involve due to presence of inter neurons between sensory and motor neurons is called Polysynaptic.
Example: Hand withdrawal on the painful stimuli.

EXAMPLES OF REFLEX ACTIONS:

If our hand touch any hot object, it is quickly withdrawn.
Secretion of juices from the gland.
Blinking of eyes.
Contraction and expansion of lungs.
If a strong light is flashed across the eye, the eyelids are at once closed or start blinking.

NERVE IMPULSE:

DEFINITION:

The electrochemical signals developed by a neuron for communication is called Nerve Impulse.

METHOD OF DEVELOPMENT OF NERVE IMPULSE:

The neurons develop impulse in the following way.
1. Resting Membrane Potential (RMP)
2. Action Potential
3. Propagation of Impulse
4. Synapse

RESTING MEMBRANE POTENTIAL:

DEFINITION:

A typical neuron at rest is more positive electrically outside than inside the cell membrane. This net difference in charge between the inner and outer surface of a non conducting neuron is -65mv is called the Resting Membrane Potential.

FACTORS INVOLVED IN RESTING MEMBRANE POTENTIAL:

This popularity is due to the unequal distribution of ions across the neurolemma. The major factors which are involved in resting membrane potential are

SODIUM AND POTASSIUM IONS:

There is a greater concentration of sodium ions outside than inside the membrane. Similarly potassium ions are concentrated muscle inside than outside the membrane. This is attributed to the activity of ATP driven sodium potassium pump in the neurolemma.

ACTION POTENTIAL:

DEFINITION:

When neuron is stimulated reversal of the polarity of the neurolemma occurs, first changes to +40mv and then restores to -65mv again is called Action Potential. This action potential is extremely rapid as it occurs in a few milliseconds.

FACTORS INVOLVED IN ACTION POTENTIAL:

SODIUM AND POTASSIUM IONS:

The change in potential across the membrane is due to the presence to sodium and potassium channels in the neurolemma.
Changes Associated with Action Potential
Sequence of membrane potential changes associated with an Action Potential.
Resting Potential
Sodium gates open and Na+ diffuses into the cell causing a depolarization of the membrane from negative to zero and then proceeds upto +40mv.
Sodium gates close and potassium gates open.
K+ diffuses out, causing a repolarization of the membrane.
Sodium potassium pump restores original ion gradients and resting potential.

PROPAGATION OF THE IMPULSE:

DEFINITION:

When the action potential develops and spreads along the entire length of neurolemma, it is called propagation of nerve.

SYNAPSE:

DEFINITION:

The region where the impulse moves from one neuron to another is called a Synapse.

COMPONENTS OF SYNAPSE:

It consists of three components
1. Pre Synapting Membrane
2. Synaptic Cleft
3. Post Synaptic Membrane

1. PRE SYNAPTIC MEMBRANE:

The membrane of axon terminal is called Pre Synaptic Membrane.

2. SYNAPTIC CLEFT:

The narrow space between neurons is called Synaptic Cleft.

3. POST SYNAPTIC MEMBRANE:

The membrane of dendrites of another neuron is called Post Synaptic Membrane.

MOTOR END PLATE:

When it is the membrane of muscle cell it is called motor end plate.

NEUROTRANSMITTER:

The chemicals present in the vesicles which are released at the axon ending of the neurons, at synapse are called Neurotransmitter.

MECHANISM OF IMPULSE THROUGH SYNAPSE:

When an impulse is reached at axon terminals, the calcium channels are opened.
From synaptic cleft calcium ions are diffused into the calcium channels.
Due to this synaptic vesicles fuse with the pre-synaptic membrane, causing the release of neurotransmitter molecules into the synaptic cleft.
The neurotransmitter bind to the receptors on the post-synaptic membrane, which generate action potential in the post-synaptic cell.
The neurotransmitters are then reabsorbed by the pre-synaptic cells for reuse.

EXAMPLES OF NEUROTRANSMITTER:

Many different types of neurotransmitter are known. These are acetylcholine, norepinephrine, glycine, gab a, serotonin, dopamine etc.

EVOLUTION OF NERVOUS SYSTEM:

In different group of animals two types of nervous systems can be recognized, which are
1. Diffused Nervous System

2. Centralized Nervous System

1. DIFFUSED NERVOUS SYSTEM:

Diffused Nervous System is found in cnidarians and Echinoderms.
Nervous System of Hydra
In these animals, no anterior and posterior ends is present and their body is radially symmetrical.
The nerves cells are found in the form of network throughout the body.
The flow of information is not highly directional and it diffuses in all directions.
The transmission of impulses is slow because of synapses involved.
There is no brain but the nerve cells constitute the nervous system.

2. CENTRALIZED NERVOUS SYSTEM:

Centralized Nervous System found to varying degrees in more complex organisms from platyhelminthes to chordates including humans.
Nervous System of Planaria
In these animals, definite anterior and posterior ends is present and their body is bilaterally symmetrical animals.
It consists of an anterior brains (a concentration of neurons) which is connected with the Sensory Organs.
From the brain arise two cord like nerves running longitudinally through the body.
The two nerve cords are connected with each other at several points through the transverse nerves.
They co-ordinated the movement of the two lateral sides of the body.

NERVOUS SYSTEM OF MAN:

The nervous system of man is the most advanced, highly developed. It controls all functions of the body. It consists of two parts
1. Central Nervous System (CNS)
2. Peripheral Nervous System (PNS)

1. CENTRAL NERVOUS SYSTEM (CNS):

DEFINITION:

The nervous system consists of brain and spinal cord (hollow nerve cord) and also consists of upto 100 billion inter neurons is called Central Nervous System (CNS).
Components of Central Nervous System
The central nervous system consists of

Brain
Spinal Cord

Protection of Central Nervous System
Brain and spinal cord both are protected in three ways

i. Cranium
ii. The Vertebral Column
iii. Meninges
iv. Cerebrospinal Fluid (CSF)

I. CRANIUM:

Cranium, which is part of skill, protects the brain.

II. VERTEBRAL COLUMN:

Neural arches of vertebrate of vertebral column protect the spinal cord.

III. MENINGES:

Beneath the cranium, the brain and spinal cord are protected by triple layers of tough connective tissues called meninges.

IV. CEREBROSPINAL FLUID (CSF):

Between the layers of meninges, there is a plasma like fluid which bathes the neurons of brain and spinal cord is called Cerebrospinal Fluid (CSF).
It cushions against the bumps and jolts.

2. PERIPHERAL NERVOUS SYSTEM (PNS):
DEFINITION:

The nerves arises from brain and spinal cord that are spread in various part of body which transmits the signals between CNS and body parts make a nervous system called Peripheral Nervous System.
The peripheral nervous system consists of two types of nerves.
i. Cranial Nerves
ii. Spinal Nerves

I. CRANIAL NERVES:

In humans, there are 12 pairs of nerves which arise from the brain or lead to the brain these nerves are called cerebral or cranial nerves.

II. SPINAL NERVES:

In humans, there are 31 pairs of nerves which arise from the spinal cord or lead to the spinal cord are called spinal nerves.

TYPES OF PERIPHERAL NERVOUS SYSTEM:

The peripheral nervous system is divided into two types according to their functions.
1. Somatic Nervous System
2. Autonomic Nervous System

1. SOMATIC NERVOUS SYSTEM:

The peripheral nervous system which controls all the voluntary activities of the body such as contraction of skeletal muscles and movement of joint is called Somatic Nervous System.

2. AUTONOMIC NERVOUS SYSTEM:

The autonomic nervous system which controls involuntary activities of the body such as smooth muscles, glands, muscles of heart and other internal organs is called Autonomic Nervous System.

TYPES OF AUTONOMIC NERVOUS SYSTEM:

Autonomic nervous system divided into two types
i. Para Sympathetic Nervous System
ii. Sympathetic Nervous System

I. PARA SYMPATHETIC NERVOUS SYSTEM:

The autonomic nervous system formed by some cranial nerves, vagus nerves and the spinal nerves that are arising from the sacral vertabrate are called Para Sympathetic Nervous System.

II. SYMPATHETIC NERVOUS SYSTEM:

The autonomic nervous system whose nerves arise from the thoracic and lumber regions of spinal nerves is called Sympathetic Nervous System.

FUNCTIONS:

This system is important during emergency situation and is associated with "flight or fight". It increases the heart beat, breathing rate, slows digestion, dilates pupil etc.

BRAIN:

DEFINITION:

The most important part of Central Nervous System develops from dorsal, hollow nerve cord well protected in the cranium of skull and composed of inter neurons and is the seat of our intelligence, learning and memory is called Brain.

PART OF BRAIN:

The brain consists of three parts
1. Fore Brain
2. Mid Brain
3. Hind Brain

1. FORE BRAIN:

Fore brain can be divided into two regions
i. Telencephalon
ii. Diencephalon

I. TELENCEPHALON:

The largest part of fore-brain which is differentiated into two cerebral hemisphere or cerebrum is called Telencephalon.

CEREBRUM:

Cerebrum is the largest part of the brain and is divided into two halves called Cerebral Hemisphes.

CEREBRAL HEMISPHERE:

Each hemisphere consist of an outer grey matter or cerebral cortex and an inner white matter.

CEREBRAL CORTEX:

Cerebral cortex is the largest and the most complex part of human brain.
It is highly convulated to occupy the greater number of inter neurons.

CORPUS CALLOSUM:

The two cerebral hemisphere communicate with each other by means of large band of axons called Corpus Callosum.

PART OF CEREBRUM:

Functionally, the cerebrum is differentiated into four lobes.
Anterior Frontal Lobe
Lower Central Temporal Lobe Parietal Lobe
Dorsal Occipital Lobe

FUNCTION OF CEREBRUM:

Cerebrum is concerned with intelligence memory, learning, resoning and overall control of all voluntary actions.
It involved in all conscious activities.
It co-ordinated different senses together.

2. DIENCEPHALON:

The diencephalons consists of two parts
i. Thalamus
ii. Limbic System

I. THALAMUS:

The clearing house for sensory impulses is called Thalamus.
Functions
It receives them from different parts of brain and relays them to the appropriate part of the motor cortex.
It also involves in the perception of pleasure and pain.

II. LIMBIC SYSTEM:

The limbic system is located in an are between the thalamus and cerebrum.
Parts of Limbic System
The limbic system consists of
i. Hypothalamus
ii. Amygdala
iii. Hippocampus

I. HYPOTHALAMUS:

Hypothalamus is the part of limbic system which is called Thermostal of the body.
Functions
The hypothalamus is important in regulation of homeostasis.
It regulates pituitary gland.
It also regulate body temperature, blood pressure, hunger, thirst, aggression, pleasure and pain.

II. AMYGDALA:

The amygdala produces sensation of pleasure, punishment or sexual arousal stimulation.
It also involve in the feelings of fear.

III. HIPPOC AMPUS:

Hippocampus is involved in long term memory.

MID BRAIN:

In mammals mid brain is relatively very small. It consists of the optic lobes which are represented by four small bodies.

FUNCTIONS:

It receives sensory information like vision, odour etc. It receives sensory information from spinal cord and sends them to the fore brain.

HIND BRAIN:

Hind brain consists of
1. Medulla Oblongata
2. Cerebellum
3. Pons
4. Reticular Formation

1. MEDULLA OBLONGATA:

Medulla oblongata lies on the top of spinal cord.

FUNCTION:

It controls involuntary actions like blood pressure, heart beat, sneezing, coughing, breathing rate, hicupping, swallowing etc.

2. CEREBELLUM:

The cerebellum lies dorsally behind the optic lobes. It is highly convoluted. It is large in mammals than other animal.

FUNCTIONS:

The cerebellum plays an important part in controlling muscular co-ordination.
It specially maintains balance and also position of the body in space.

3. PONS:

Pons regulates activities like muscular co-ordination, facial expressions, breathing and sleeping.

4. RETICULAR FORMATION:

Reticular formation lies in pons, medulla and mid brain.

FUNCTIONS:

It monitors the messages to the brain which should be ignored or should be realized.

BRAIN STEM:

The oldest tissues formed by the combination of medulla oblongata, pons and mid brain is called as Brain Stem.

FUNCTIONS:

It involved in the control of sleep and wakening.

SPIRAL CORD:

DEFINITION:

A thick whitish nerve cord that lies below the medulla oblongata and extends down through the neural canal of vertebrate upto the hips is called Spinal Cord.

CROSS SECTION OF SPINAL CORD:

In cross section, the spinal cord is differentiated into two areas.

White Matter
Gray Matter

Unlike brain, spinal cord has grey matter inside surrounded by white matter on the outside. They grey matter has the shape of an "H". The first synapse of each sensory neuron is located in the grey matter.

CENTRAL CANAL:

The narrow central containing cerebrospinal fluid runs through the middle of the spinal cord. This fluid brings nutrients to the spinal cord.

SPINAL NERVES:

The nerve arises from spinal cord is called Spinal Nerves.
Each spinal nerve divides into two roots just before it joins spinal cord.
1. Dorsal Root
2. Ventral Root

1. DORSAL ROOT:

The dorsal root joints the dorsal part of the spinal cord and it contains axons of sensory neurons.
Dorsal Root Ganglion
The cell bodies of these neurons aggregate in a small swelling known as the dorsal root ganglion.

2. VENTRAL ROOT:

The ventral root which is attached to the ventral part of the spinal cord carrying axons of motors neurons, arised from the spinal cord.

FUNCTIONS OF SPINAL CORD:

Spinal cord serves as an express way for signals between autonomic nervous system. It is also the control centre for many reflexes.

RECEPTORS:

DEFINITION:

The single or group of either modified neurons or epithelial cells which receive stimuli either from external environments and relaying them in the form of impulses to the CNS are called Receptors.

RECEPTIONISTS:

The receptors are acts as receptionist of nervous system because they receive any kind of change, which is then transferred to the brain and spinal cord.

SENSATION:

Receptor converts stimuli into nerve impulses, this stage awareness of stimulus is called Sensation.

PERCEPTION:

In the control centre of the nervous system, the impulses are converted into perception.

TYPES OF RECEPTORS:

Receptors are classified according to type of stimulus which they can detect and give response. Following are some types of receptor.

1. THERMORECEPTOR:

The receptors which detect and respond to temperature fluctuations (heat and cold) are called Thermoreceptor.

2. CHEMORECEPTOR:

The receptors which can detect and respond to presence of certain chemicals in their surrounding are called Chemoreceptor.

3. MECHANORECEPTOR:

The receptors which can detect the stimuli of sound, motion, touch, pressure gravity and movement are called Mechanoreceptor.

4. PHOTORECEPTOR:

The receptors which respond to the stimulus of light and ultraviolet rays are called Photoreceptor.

5. PAIN RECEPTOR:

The receptors which produced sensation of pain or damage tissues are called the Pain Receptor.

WORKING OF SENSORY RECEPTORS IN SKIN:

In human, the receptors in skin are concerned with at least five different senses i.e., touch, pressure, cold, warm and pain.

TYPES OF SENSORY RECEPTOR IN SKIN:

There are two types of sensory receptors in the skin.

i. Free Nerve Ending Receptors
ii. Encapsulated Receptors

I. FREE NERVE ENDING RECEPTORS:

The simplest types of receptor which contain free end without any protective capsule and are located just beneath the epidermis are called Free Nerve Ending Receptors.

FUNCTIONS:

Free nerve ending receptors adapt very slowly to stimulation.
Types
They are of different types

a. Mechanoreceptors Receive touch and pressure.
b. Nociceptors Feel pain
c. Thermoreceptors Feel change in temperature

II. ENCAPSULATED RECEPTORS:

The type of receptor contain a protective capsule of connective tissues at their ends and lie in skin are called Encapsulated Receptors.

TYPES:

Encapsulated receptor are of following two types

i. Meissner's Corpuscles
ii. Pacinian Corpuscles

I. MEISSNER'S CORPUSCLES:

The encapsulated receptors that are found in those parts which do not have hairs such as finger tips, eyelids, lips palms, soles, nipples etc are called Meissner's Corpuscles.

STRUCTURE OF CAPSULE:

Their capsules consists of thick collagen fibers with spiral and highly coiled nerve endings.

FUNCTION:

There are touch receptors means very sensitive to touch.

II. PACINIAN CORPUSCLES:

The encapsulated receptors which are found in dermis layer and also in some internal organs and moveable joints are called Pacinian Corpuscles.

STRUCTURE:

Their nerve endings are surrounded by an onion like capsule made of concentric layers of membrane. Between the membranes fluid filled spaces are present.

FUNCTIONS:

They are pressure receptor and detect rapid and deep pressure changes produced by vibration and touch.

SENSORY RECEPTORS WITH REFERENCE TO ARTERIES:

The aortic arch and the carotid artery contain many receptor which are

Mechanoreceptor
They detect the pressure changes in arteries.
Baroreceptor
They detect the pulse pressure

FUNCTION:

These receptors transfer these changes to the medulla oblongata which controls blood pressure.

AORTIC BODY AND CAROTID BODY:

The aortic arch and the carotid sinus also contain chemoreceptor called Aortic body and carotid body.

FUNCTION:

They are sensitive to CO_2 concentration and hydrogen ion concentration of the blood.

EFFECTS OF DRUGS ON CO-ORDINATION:

DRUGS:

A chemical substance that causes the specific physiological response in the body are called drugs.

IMPORTANCE:

Many drugs are useful medically to treat emotional stress or certain illness.
Drugs which people take to alter the mood or emotional state affect body functional interfering with the working of neurotransmitters.
Therefore their abuse often causes harmful effects.

NICOTINE:

It is a drug found in tobacco.
It acts as a stimulant and is widely used as a neurological agent.
Nicotine affects post synaptic membrane in CNS and PNS.
It minimize the action of acetylcholine on nicotine receptors. So it is stimulant to nerve impulse.
It increase the heart beat, rate, blood pressure and digestive tract mobility.
Nicotine may induce vomiting and diarrhea.
It may cause water retention relation by kidneys.
It stimulate the nervous system thereby reducing fatigue, increasing, alertness and improving the concentration.

NERVOUS DISORDERS:

The abnormalities appear in brain, spinal cord, central nervous system and peripheral nervous system causes diseases called Nervous Disorders.
Some common disorders of nervous system are as follows
1. Parkinson's Disease
2. Alzheimer's Disease
3. Epilepsy

1. PARKINSON'S DISEASE:

It is a brain disorder.

CAUSES:

It either caused by degeneration or damage of nerve tissues within the basal ganglia of the brain.

SYMPTOMS:

It is characterized by involuntary tremors, diminishing motor power and rigidity. It causes stiffness, weakness and trembling of the muscles. The mental faculties are not affected.

TREATMENT:

Leopoda is the effective medicine which is helpful in minimizing the symptoms by can not halt the degeneration of neurons of brain.

2. ALZHEIMER'S DISEASE:

It is the progressive degeneration of neurons of brain, especially cortex and hippocampus.

CAUSES:

There is a genetic pre-disposition to the disease in some people, so it tends to run in families.

STAGES OF DISEASES:

The disease progresses in three broad stages.

FIRST STAGE:

At first, the patient notices his forgetfulness.

SECOND STAGE:

In second phase, there is a severe loss of memory particularly for recent events. Anxiety increases with sudden changes in mood.

THIRD STAGE:

In the third and last stage the disease become severe. He losses memory, hears voices or see faces in the absence of any person. This disease is called Hallucination. He does not share his ideas and does not accept ideas of other persons, such disease is called paranoid delusions.

SYMPTOMS:

The main symptom of the disease is the loss of memory called dementia.

TREATMENT:

Effective medicines should be used.
Psychological treatment is better to control the disease.
Personal care of patient is necessary otherwise he may get any harm.

CHEMICAL CO-ORDINATION:

DEFINITION:

The co-ordination brought about by the endocrine gland system. It is not very rapid, but shows slow and prolonged effect takes place by chemical substances called hormones and neurotransmitter within the body of all animals is called Chemical Co-ordination.
Endocrine glands secreat their secretions (hormones) directly into the blood stream. They are transported by the blood to the target cells.

TYPES OF HORMONES:

Chemically the hormones are organic compounds which are classified into three types.
1. Peptide Hormones
2. Modified Amino Acids Hormones
3. Steroid Hormones

1. PEPTIDE HORMONES:

The hormones which are composed of protein are called Peptide Hormone. There are two types of peptide hormones.
i. Small Chain Amino Acids
ii. Large Chain Amino Acids

I. SMALL CHAIN AMINO ACIDS:

The peptide hormones consists of small chain of amino acids are called Small Chain Amino Acids.

EXAMPLES:

Glucagon
Antidiuretic Hormone (ADH)
Oxytocin

II. LARGE CHAIN AMINO ACIDS:

The peptide hormones consists of long chain of amino acids are called Large Chain Amino Acids.

EXAMPLE:

Insulin
Preleclin

2. MODIFIED AMINO ACID HORMONES:

The hormones consists of modified amino acids are called Modified Amino Acid Hormones.

EXAMPLE:

Thyroxine
Epinephrine
Nor-epinephrine

3. STEROID HORMONES:

The hormones which are composed of lipid are called Steroid Hormones.

EXAMPLE:

Estrogen
Progesterone
Testosterone
Aldisterone

HORMONE ACTION:

To explain the action of hormones two models have been proposed.

1. First Model
2. Second Model

SIMILARITY BETWEEN BOTH MODELS:

Both model agree that the plasm membrane of cells contain certain receptors to accept the hormones.

DISSIMILARITY BETWEEN BOTH MODELS:

After receiving the hormones continue their way of action called signal transduction pathway. It is different in both models.

1. FIRST MODEL:

According to the first model peptide hormones are involved. The receptor molecule is attached to an enzyme adenylate cyclase in the inner part of plasma membrane. The hormone is attached to the receptor. By the activity of enzyme ATP molecule is changed into cyclic adenosine monophosphate (AMP) in the cytoplasm. The cyclic (AMP) acts as a second messenger and activates the particular enzyme which actually helps in the function. Some other messenger molecules also take part in the process.

2. SECOND MODEL:

According to the second model, steroid hormones are involved. These hormones are fat soluble, so they enter the cell directly through the plasma membrane, so they do not need second messenger. In the cytoplasm they are attached to the particular receptors which transfer into the nucleus. In the nucleus. In the nucleus hormone receptor complex activities the genes due to which actual function is started.

FUNCTIONS OF HORMONES:

They do not initiate new biochemical reactions but produce their effects by regulating the enzymatic and other chemical reactions, already present.
They may either stimulate or inhibit a function.
Hormones may also control some long term changes, such as rate of growth, rate of activity and sexual maturity.

ENDOCRINE SYSTEM:

DEFINITION:

Endo => Inside => Krinein => separate i.e. to secrete.
In the body of vertebrates there are certain dustless gland which poured their secretions (hormones) directly into the blood or in body fluids are called endocrine glands or ductless glands constitute a system called Endocrine System.

ENDOCRINE GLANDS OF MAN:

In the body of man and other mammals, following important endocrine glands are mostly found.
1. Hypothalamus
2. Pituitary Gland
3. Thyroid Gland
4. Parathyroid Gland
5. Pancreas
6. Adrenal Gland
7. Thymus Gland
8. Pineal Gland
9. Gonads

1. HYPOTHALAMUS:

The part of forebrain which forms a connection between Nervous System and endocrine system is called Hypothalamus.
Hormones
The hypothalamus contains specialized nerve cells called neurosecretory cells which produced two types of hormones.
i. Releasing Hormone
ii. Inhibitory Hormone

I. RELEASING HORMONES:

The hormones which are produced to increase the secretion of another glands are called Releasing Hormones.
Function
Releasing hormone control the secretion of hormones from pituitary gland.

II. INHIBITORY HORMONES:

The hormones which are produced to prevent the extra secretion of hormones are called Inhibitory Hormones.
Function
Hypothalamus produced two hormones which are
Oxytocin
Antidiuretic Hormones (ADH)
These two hormones are stored in the posterior lobe of pituitary gland.

2. PITUITARY GLAND (HYPOPHYSIS):

Pituitary gland is called "master gland" because it controls the secretion of other endocrine glands.

LOCATION:

The pituitary gland is located in the brain. It is attached to the base of hypothalamus by short.

SIZE:

The pituitary gland is small pea size gland.

LOBES OF PITUITARY GLAND:

Pituitary gland has three lobes
i. Anterior Lobe
ii. Median Lobe
iii. Posterior Lobe

I. ANTERIOR LOBE:

Anterior lobe produces three types of hormones which are
a. Tropic Hormone
b. Growth Hormone or STH
c. Prolactin

A. TROPIC HORMONE:

The hormones which control the activity of other hormones are called Tropic Hormones.

KINDS OF TROPIC HORMONE:

The tropic hormone secreted by the pituitary gland are as follows

THYROID STIMULATING HORMONE (TSH):

It control the working of thyroid gland including secretion of thyroxin.

ADRENO-CORTICO TROPIC HORMONE (ACTH):

In controls the activity of outer part of cortex of adrenal gland.

FOLLICLE STIMULATING HORMONE (FSH):

FSH in females stimulate follicle developing and secretion of oestrogens from the ovaries.
In males it stimulates development of the germinal epithelium of the testis and sperm production.

LEUTINIZING HORMONE (LH):

This hormone helps in the formation of sperms and testosterone hormone in male. In female it takes part in ovulation i.e. release of ovum from the ovary.

B. GROWTH HORMONE OR SOMATOTROPIN HORMONE (STH):

It regulates the normal growth by controlling many metabolic processes, such as protein synthesis, involved in growth of bones and soft tissue.

C. PROLACTIN HORMONE:

This hormone stimulate mammary glands and production of milk.

II. MEDIAN LOBE:

Median lobe produced one hormone called Melanocyte Stimulating Hormone (MSH).

FUNCTIONS:

This hormone controls darkening of skin in many vertebrates. In human, very small amount of MSH is produced by the anterior pituitary rather than median.

III. POSTERIOR LOBE:

From posterior lobe of pituitary gland following hormones are secreted.
a. Antidiuretic Hormone (ADH)
b. Oxytocin

A. ANTIDIURETIC HORMONE (ADH):

It stimulates the re-absorption of water by tubules of kidney and thus decreases the amount of urine passed.

B. OXYTOCIN:

It stimulates contraction of muscles of uterus during child birth and release of milk during breast feeding.

ABNORMAL CONDITIONS DUE TO PITUITARY GLAND:

Due to abnormal production of somato tropic hormone (STH) or growth hormone, following abnormalities occur.
i. Gigantism
ii. Dwarfism
iii. Acromegaly

I. GIGANTISM:

It is disease of childhood.

CAUSES:

It occurs due to over secretion of somatotropic hormones (STH) or growth hormone.
Symptoms
The affected individuals becomes abnormally tall.

II. DWARFISM:

It is a disease of childhood.

CAUSES:

It caused due to less secretion of somato tropic hormone or growth hormone.
Symptoms
The affected individuals becomes abnormally short.

III. ACROMEGALY:

It is a disease of adulthood.

CAUSES:

It occurs due to overproduction to somatotropic homrone (STH).
Symptoms
In this condition, hands, feet and jaw bones and cartilages and soft muscles become larger in size and swollen.

3. THYROID GLAND:

LOCATION:

Thyroid gland is located in the neck region in front of trachea. It consists of two lobes, one on either side of trachea.
Shape
It is butterfly in shape.
Secretions
It secreats three main main hormones.
i. Thyroxine or T4 (Tetra lodo Thyroxine)
ii. T3 (Tri lodo Thyroxine)
iii. Calcitonin

I. THYROXINE OR T4:

Thyroxin increases the metabolic rate and promotes both physical growth and mental development.
It increases the oxygen consumption and production of heat.

II. T3 HORMONE:

Tri lodo thyroxine performs the same function as that of thyroxine or Tetra lodo Thyroxine.

III. CALCITONIN:

Calcitonin plays and important role in calcium homeostasis.

Calcitonin is produced when calcium Ca++ level is increased in blood.

It respond to decreased the blood calcium level by stimulating the deposition of excess calcium in bones.

ABNORMALITIES OF THYROID GLAND:

There are two conditions of abnormalities of Thyroid Gland.
i. Hyperthyroidism
ii. Hypothyroidism

I. HYPERTHYROIDISM:

The state of over secretion of hormones by thyroid gland is called Hyperthyroidism.
Due to hyperthyroidism following symptoms usually appear.
High blood pressure
Increase body temperature
Intolerance to heat
Profuse sweating
Loss in weight etc

II. HYPOTHYROIDISM:

The state of deficiency of T4 and T3 hormones is called Hypothyroidism.
It causes following diseases
i. Myxedema
ii. Goiter
iii. Cretinism

I. MYXEDEMA:

It occurs in adult stage.

CAUSES:

It occurs due to the deficiency of T3 and T4 Hormones

SYMPTOMS:

Myxedema produces following symptoms
Overweight (Obesity)
Loss of hairs
Dry Skin
Mental activity or body movement become slower
Intolerance to cold

II. GOITER:
CAUSES:

It occurs due to deficiency of iodine in diet which results in decreased level of thyroxin hormones (T3 and T4).

SYMPTOMS:

Thyroid gland works more than normal to produce more thyroxine. As a result of which they become swollen and enlarged.

III. CRETINISM:

It is disease of childhood.

CAUSES:

It occurs due to deficiency of thyroxin hormone in early age, such persons are called cretinism and the mechanism is known as cretinism.

SYMPTOMS:

This disease shows following symptoms
Mental retardation

Stunted growth
Physical weakness
Abnormal facial features

4. PARATHYROID GLAND (PTG):
LOCATION:

Parathyroid glands are present in the neck regiort with two parts of thyroid gland.
Size
Their size is like pea seeds.
Secretion
Parathyroid gland secrete only one hormone called Parathyroid Hormone (PTM).

FUNCTION:

Parathyroid hormone plays an important role in calcium's homeostasis.
Parathyroid hormone is produced when calcium Ca++ level is decreased in blood.
It response to increased the calcium ion in blood in two ways.
It increase the absorption of calcium ions in kidney.
It induces the bone cells (Osteoblasts) to released calcium from bones into the blood.
This process is called Demineralization.

5. ADRENAL GLANDS:

The adrenal glands are just above the dorsal of the kidney, each weighing 6 grams.
Each gland consists of a peripheral part called the cortex and a central area known as medulla.

CORTEX:

The cortex produces a number of hormones, more than 50 hormones have been identified, the most widely-known are:

1. ALDOSTERONE:

This hormone is steroid in nature, the target of aldosterone is kidney and it controls retention of sodium and loss of potassium in urine.

2. CORTISOL-CORTISONE AND RELATED HORMONE CORTICOSTEROID:

These hormones are steroid in nature their targets are many cell. These hormones regulate storage of glycogen by liver and conversion of protein into glucose.

DISORDER:

Hyposecretion or under-activity of adrenal cortex produces addission's disease which occurs occasionally. Hypersecretion or over activity produces cushion disease which causes male characters to appear in woman.

ADRENAL MEDULLA:

The adrenal medulla secretes two hormones.

i. ADRENALINE:

* It increase heart rate, amount of glucose in blood, rapid respiration and metabolism during emotions and emergency.

* It also takes part in the contraction of blood vessels in intestine and dilation of blood vessels in muscles.

ii. NON-ADRENALINE :

* It also functions like epinephrine, but its main function is control of blood pressure during fight and flight.

* The over secretion of both these hormones causes high blood pressure.

DISORDER:

Adrenal medulla is never under active but it's over activity is dangerous.

6. THE PANCREAS:

Pancreas is a gland which acts as both exocrine and endocrine gland.
Location
Pancreas is located in abdominal cavity below the liver.
Islets of Langerhans
The cells of pancreas are called Islets of langerhans.
They perform the function of endocrine gland.
This is under control of the pituitary trophic hormones STH and ACTH and responds directly to the level of blood glucose which is normally 90ms/100mg.
The islets of langerhans are of two distinct types.
i. Alpha Cells
ii. Beta Cells

I. ALPHA CELLS (A-CELLS):

Alpha cells secreat hormone called Glucagon.

II. BETA CELLS (B-CELLS):

Beta cells secreat hormone called Insulin.

I. INSULIN:

It is secreted in response to increase sugar level in blood.
It decrease the blood glucose level mainly by following mechanism:

i. It increases glycogen synthesis in liver and also increasing cell utilization of glucose.
ii. It also stimulates both lipid and protein synthesis which reduces glucose level.
iii. Insulin inhibits the hydrolysis of glycogen in the liver and muscles.

DISORDERS OF INSULIN DEFICIENCY:

Due to deficiency of insulin, a diseased appeared called Diabetes mellitus.
Diabetes Mellitus
When there is deficiency of insulin, the amount of sugar is increased in blood, it is called Diabetes Mellitus.

SYMPTOMS:

High level of blood sugar
Sugar in the urine
Disturbance of the body's osmotic equilibrium
Dehydration
Derangement of the nervous system

TYPES OF DIABETES MELLITUS:

There are two types of Diabetes Mellitus.
i. Insulin Dependent Diabetes
ii. Insulin Independent Diabetes

ii. GLUCAGON:

* It is secreted in response to decrease sugar level in blood.

* It increase the blood glucose level mainly by promoting breakdown of glycogen to glucose in the liver and muscles.

* It also increase the rate of breakdown of fats.

7. THYMUS GLAND:
LOCATION:

It is present in the upper region of thorax, behind the breast bone. It consists of two parts which are attached together in the front region of trachea.

STRUCTURE:

It secret hormone called Thymosine.

FUNCTION:

Thymosine controls the production of Thymphocytes and also their differentiation. These are the cells of immune system and control the infection of virus bacteria.

8. PINEAL GLAND:
LOCATION:

Pineal gland is a tiny gland present at the upper side of diencephalons in the brain.
Secretion
Pineal gland secretes a hormone called Melatonin.

FUNCTIONS:

Metatonin regulates the seasonal reproductive cycles.
It also regulates the growth and development of gonad in many mammals.
It controls the sensation of light and darkness of eyes.
It produced a/c to the time of day, night or weather.

9. GONADS:

The testes and ovaries also functions as endocrine glands and produce sex hormone chemically sex hormones are steroids. Secretion of gonadial hormones is controlled by gonadotropic hormones pituitary gland.

I. TESTES:

Testes are the male reproductive organs.
Secretion
Testes produced male sex hormone called Testosterone.

FUNCTIONS:

Tests is responsible of sexual maturity and development of secondary sexual characts such as appearance of beard and moustache in males.
It also stimulates the growth of bones and muscles.

II. OVARIES:

Ovaries are female reproductive organs but they acts as endocrine glands.
Secretion
Ovaries secrete two hormones called as
i. Oestrogen
ii. Progesterone

I. OESTROGEN:

Oestrogen causes development of female secondary sexual characters.
It also helps in thickening of the wall of uterus and prepare it for implantation of fertilized ovum.

II. PROGESTERONE:

It is concerned with maintenance of pregnancy by preventing the contraction of walls of uterus.

Chapter 4

REPRODUCTION

REPRODUCTION:

A type of process in which living organisms produce their offspring of their own kinds is called as Reproduction.
The process of reproduction rakes place because

1. To maintain their own species.
2. For continuation of life generation after generation.
3. To transfer the hereditary characters to the new generation.
4. Introduction of new characters which help in evolution.

There are two types of reproductions
Asexual reproduction
Sexual reproduction

(1)ASEXUAL REPRODUCTION:

The type of reproduction in which only one parent or partner takes place to rise their offspring from a single parent without the reaction of fusion of gametes is called as Asexual reproduction. In this process only mitosis is involved. It occurs mostly in plants and lower animals.

ADVANTAGES:

☐ This is a very quick method of that results in rapid increase in the number of organisms.
☐ In this reproduction method the new organism resemble to their parents physically and genetically.
☐ There is no need of fertilization. No new variety is produced.

There are different types of asexual reproduction:
Budding, Grafting, Spore formation, Binary fission, apomixes, parthneocarpy, Cloning, Tissue
Culture.

SEXUAL REPRODUCTION:

The type of reproduction in which two parents or haploid gametes unite together to form a diploid zygote or a baby organism is called as sexual reproduction. This zygote develops into new organisms. In the formation of gametes the reaction of meiosis takes place. These gametes may come from a single parent or from separate male and female parents. Sexual reproduction occurs in many higher animals and plants.

APOMIXES:

It is a modified form of asexual reproduction. The production of embryo or seeds without meiosis and fertilization is called as apomixes.
Apomixes is a type of asexual reproduction and naturally occurs in some plants.

Those plants which are reproduces by Apomixes are called "Apomicts" in apomixes fertilization and meiosis fails to occur. Apomixes occurs by following different methods.

(i) Development of somatic cell into a diploid embryo.

(ii) Direct development of unreduced megaspore (by suppression of meiosis) into a diploid embryo.

(iii) Development of embryo from haploid synergids or antipodal cells. Plants develop from such embryos are haploid and sterile. There are tow types of apomicts

TISSUE CULTURE:

The growth of the tissue in an artificial liquid culture median takes place in 1902. He regenerated a whole plant from somatic cells of a carrot mature and specialized plant cells' nucleus retain the ability to grow into a new plant under suitable condition.

Two methods are used in tissue culture;

FIRST METHOD:

A small piece of plant tissue is taken from root or stem. This tissue is separated into individual cells by treating it with enzyme. These cells are then treated with specific plant hormones. This hormone induce cell division and differentiation. Thus a complete plant is produced from a single cell

SECOND METHOD:

A small piece of plant tissue is placed in a nutrient medium. The cells start division and produce a shapeless mass called "Callus". This callus produces a completed plant in the presence of specific hormone.

ADVANTAGES OF TISSUE CULTURE:

Tissue culture plants are stronger than plants produced by seeds.
Plants with desirable character are developed.
These plants have resistance against disease.
By plant culture useful chemicals are obtained such as shikonin which is used;
☐ In Chemical silk industry.
☐ Treatment of injuries caused by burning.

DISADVANTAGES OF TISSUE CULTUTE:

These plants are sterile; do not reproduce by sexual method.
This technique may cause change in structure or number of chromosomes.

CLONING:

The artificial technique of asexual reproduction in which genetically identical individual are
produced from a single parents' cells is called Cloning.
Cloning is a Greek word which means 'twig'

Organism produced by cloning are called "clones".
Clones are genetically duplicate copies of their own and single parent.
Clones show little genotypic differences from their parent due to mutation.
Sea urchin was the first animal cloned in 1800.
In November 2001 the first human embryo was cloned.

ADVANTAGES:

This method is used in orchards and pinus trees to obtain wood.
Cloning is used for preservation of best quality genes, e.g. In 2001 an endangered wild sheep
named "Mouflon" was cloned.
Cloning also help to increase the agricultural output.

DISADVANTAGES:

Clones have short life span.
Clones are less resistant to diseases and environmental stresses.

SEXUAL REPRODUCTION IN PLANTS

The reproduction occurs in lower and higher plants but sexual reproduction is different in different type of plants. This variation enabled the plants to migrate from water and spread in different land habitats. Sexual reproduction occur in different plants are as under;

(1) The sexual reproduction can take place in Algae. Algae have flagellated sperm which fertilizes egg in water. After fertilization zygote develop into new plant without any protection.

(2) The sexual reproduction can take place in bryophates. The Bryophytes are first land plants and grow in damp and shady places. Because they have flagellated sperm and less protected sex organs.

(3) Pterdophytes also grow in damp and shady places. Their gametophyte produces flagellated male gamete which moves toward the egg in the presence of moisture.

(4) SEXUAL REPRODUCTION IN HIGHER VASCULAR PLANTS:

In higher vascular plants sexual reproduction is more developed. Their seeds provide protection
and stored food to the embryo. These plants do not require water for sexual reproduction. Higher
vascular plants are divided into two groups:
□□Gymnosperm: with naked seeds.
□□Angiosperms: with seeds enclosed inside fruits.

(II) ANGIOSPERM:

Angiosperms are flower producing plants. Pollen grains produce in another of stamen while megaspore produce in the ovary of carpel. Pollination occurs with the help of winds, water or
insects. Pollen grain form pollen tube having two sperms. Megaspore develops into female gametophyte containing an egg. Pollen tube helps in fertilization.

MAINAXIS ELONGATED:

RECEME:

In this infloreascence main axis is elongated. The flowers present on it are pedicelate and bisexual. The flowers are born acropetal succession

SPIKE:

The main axis is elongated. The flower are born on it are sessile and bisexual.

CATKIN:

The main axis is elongated the flowers are sessile having unisexual sessile flowers. Example Mulberry, willow, poplar

SPADIX:

The main axis is elongated flowers are sessile and the inflorescence is covered by a large bract called spathe. For example maize and banana

MAIN AXIS COMPARATIVELY SHORTENED:

CORYMB:

The main axis is comparatively short and unbranched. The stalks of lower flowers are longer than upper younger flowers. Thus all the flowers come at the same level.

UMBEL:

The main axis is shortened producing the pedicel late flowers. All flowers arise from a common point or tip of main axis. Younger flowers are present in the center while older towards the periphery. When numbers of umbels are present on the tip of main axis this is called as compound umbel.

PANICLE:

A much branched receme is called as penicle.

CAPITULUM:

The main axis becomes a flat disk called Receptacle, on which small sessile flowers are grouped together. The outer flowers are older than the inner ones. The whole inflorescence look like a single flower.

PARTHENOCARPIC FRUITS:

The formation of seedless fruits without fertilization is called as partenocarpic fruit while this type of process is called as parthenocarpy. In some plants pollination and fertilization do not occur. Such plants produce seedless fruits.

CAUSE:

This ovary is then changed into fruit directly without pollination and fertilization. Example fruits are Banana, Pineapple, Grapes.

BENEFIT:

Parthenocarpy is sometime artificially induced for commercial purposes by adding auxins as in tomato, pepper etc.

DORMANCY:

The inactive or sleeping stage of bud or seed before germination is called Dormancy. In dormancy the viable seeds or bud fail to germinate even under favourable condition. Dormancy is a temporary arrest in growth.

DURATION:

In different plants the period of dormancy is different. The seeds any remain inactive for few days or 1 – 2 years. Naturally the length of dormancy period is equal to the length of unfavourable time period. Thus breakage of dormancy and completion of unfavourable conditions occur at the same time.

CAUSESOF SEED DORMANCY:

Main reasons seed dormancy is;
(i) Hard seeds coat (ii) immature embryo (iii) chemical inhibitors
(iv) Light sensitive seeds.

METHODS OF BREAKING DORMANCY:

(i) PRESSURE:

A pressure of 2000 atm 18oC for about 5 – 20 minutes can break seed dormancy.

(ii)LOW TEMPERATURE:

If seeds are treated in moist medium at 5 – 20oC for sometime can also break seed dormancy.

(iii) PLANT HORMONE:

Seed dormancy is also artificially broken by using different plant hormones.

ADVANTAGES OF DORMANCY:

- Dormancy increases the chances of survival.
- Dormancy help the plants to overcome unfavourable condition which may be harmful for their vegetative and reproductive growth.
- Without dormancy if the seeds germinate under all conditions then they will become useless to human for consumption as food.

VERNALIZATION:

The conversion of winter variety into spring variety by low temperature treatment is called as Vernalization.

OR

The production of early flowering in plants by chilling treatment is called Vernalization. Vernalization is Latin word means "springificaiton or spring"

REPRODUCTION IN ANIMAL:

The ability of living organisms to produce individual of their own kinds is called Reproduction.

(1)ASEXUAL REPRODUCTION:

The production/development of new offspring from a single parent without fusion of two gametes is called Asexual reproduction. In this process; No gametes are produced, No formation of zygote. Offspring identical or similar to parents. Asexual reproduction is of the following types;

(i) BINARY FISSION:

In this process the parental organism divides into two daughter animals. First the parent nucleus divides into two daughter nuclei. Then cytoplasm also divides forming two new organisms. Binary fission occurs during favorable condition.

(ii)MULTIPLE FISSION:

The formation of many daughter organisms from a single parent organism is called multiple fission. In this process the parental cell form a cyst around itself. The parental nucleus divides into many nuclei. Cytoplasm also divides and surround each nucleus. Thus many daughter organism are formed within the cyst. In favourable conditions the cyst breaks and releases the daughter organisms. Multiple fission occur during unfavorable condition.
Example: Amoeba, Plasmodium.

(iii) BUDDING:

In this process a small outgrowth develop on the parent body called bud. This bud gradually increases in size and may separate or remain attached to the parent. This bud develops into new individual. Bud may be of two types;
The formation of bud from external body surface is called exogenous bud.
The formation of bud from internal body cells is called endogenous buds. These internal buds disintegrate the parent body and form new individuals.

REGENERATION:

The ability of organism to replace or repair their lost or damaged body part is called as regeneration. Examples: Salamander can regenerate their limbs and tail. In human damaged part of liver is regenerated again. Planaria, Earthworm.

PARTHENOGENSIS:

The development of egg without fertilization to form a new individual is called parthenogenesis. It is a Greek word parthenos means "Virgin" and genesis means "origin". Parthenogenesis literally means the birth of an individual from virgin. The individual reproducing by parthenogenesis are called parthenotes. Parthenogenesis occurs naturally but can also be induced artificially by certain chemicals. Some
organism reproduces only be parthenogenesis. e.g. some wasp. But some animal show
alternation of parthenogenesis and sexual reproduction e.g. Apid, hone bee.

OVIPAROUS ANIMAL:

Those animals which lay eggs and in which the whole development of new individual occur outside the mother body are called oviparous. Example; fishes, Birds, Reptile, Amphibian etc.
In these animals fertilization is internal or external. Their egg contain large amount of yolk which act as food for developing embryo till hatching. If the egg contain less yolk then zygote will hatch into a large e.g. egg of frog. If the egg contains more yolk then young one will hatch e.g. Birds, reptiles.

REPRODUCTIVE CYCLE IN FEMALE

In female production of egg is a cyclic activity as compared to males. In mammals the female reproductive cycles are as follows;

(1)OESTRUS CYCLE:

In some animals the female mate with a male at regular intervals. This desire to mate at a specific time is called oestrous or heat period.
This cycle is found in all female mammals except human female. During this cycle structural and physiological changes occur in the reproductive tract of female. These changes are due to the secretions of estrogen hormone. In the female body a special kind of heat is produced and become ready for mating. Release of egg occur during the period of oestrus. This cycle take place during breeding season.

(2) MENSTRUAL CYCLE:

The periodic discharge of blood, broken tissues and unfertilized egg through vagina is called menstrual cycle. During one cycle only one egg is released. The first menstrual cycl is called Menarche. It starts at the age of 12, 13, 14 years. The stoppage of menstrual cycle at old age (45 – 55) is called Menopause.

DURATION:

The average duration is about 28 days. But it may very from 20 – 45 days from person to person.

(i) FOLLICULAR STAGE: (1 – 5 day)

This stage starts from the end of the previous menstruation period till the beginning of ovulation. Duration this stage one or more egg start to develop. Follicle cells around the developing egg are arranges in layers forming a cavity. Some follicle cells starts secretion of a hormone called estrogen. Estrogen causes the thickness and vascularization of uterus. Thus uterus becomes soft and spongy because of increase blood supply.

(ii)OVALATION:

The release of mature ovum from Graafian follicle is called ovulation. The ovum enters the oviduct for fertilization. This release of egg occurs on the 14th day of menstrual cycle. Pituitary gland secretes luteinizing hormone which helps in the release of egg from the follicle.

(iii) LUTEAL STAGE:
This stage continues from the 14th – 28th days of the cycle. After ovulation graafian follicles are converted into a yellow body called corpus lustrum.
This corpus lustrum secretes a hormone called progesterone.
Progesterone perform the following functions.

(i) Progesterone increase thickness of uterus.

(ii) It prepare the uterus for implantation of zygote.

(iii) Prevent contraction of uterine wall

(iv) Suppresses ovulation.

MENSTRUAL STAGE:
When ovum is not fertilized, corpus lustrum degenerates and stops progesterone secretion. It results in the breakdown of thickened spongy part of the uterus. The broken tissues along with blood and unfertilized egg are discharged. This is called menstruation.

PREGNANCY:
The period from implantation of zygote in the uterus till birth of baby is called pregnancy or gestation period. OR the period of development between fertilization and birth is called pregnancy.

DURATION:

This period covers the duration of usually 9 months. The time of pregnancy is divided into 3 periods or trimesters.

(i) Beginning (ii) Middle (iii) Final stage

DELIVERY:

All those changes which cause birth of the baby are called as delivery.
Birth occurs in three stages:

(i) DILATION OF CERVIX:

A few days before birth the baby's head turned down in the uterus and points towards the cervix. Baby's head help in the dilation of cervix.

(ii) EXPLUSION:

In this stage pituitary gland secrete a hormone called oxytocin. The muscles of uterus start periodic contraction and relation. This contraction causes labour pain. Eventually the contractions push the baby out of the mother's body.

(iii) DELIVERY OF PLACENTA:

Further contractions of uterus push the placenta and umbilical cord (after birth) out of the mother's body.

Chapter 5

GROWTH AND DEVELOPMENT

GROWTH:

The permanent increase in the size is called as growth.

GROWTH IN PLANTS:

The growth is a quantitative increase in the plant's body. When the growth takes place in plants their size and overall weight increases.

There are three kinds of meristems.

APICAL MERISTEMS:

These cells are present at the tip of root and stem.
They take part in the formation of branches, flowers and leaves.
They increase the length of plant at both the stem and root sides.

INTERCALARY MERISTEMS:

They are found in monocots and are located near the nodes or sometimes at the base of the leaves. They are responsible for increase in length.

LATERAL MERTISTEMS:

They are located at the sides of the plants Vascular cambium is an example of lateral meristems. They are responsible for growth in thickness this increase is called as secondary growth.

PHASES OF GROWTH:

CELL DIVISION:

It is the first phase of growth. And it is usually present at the tips of root and stem. The number of cells increases in it.

CELL ELONGATION:

It is the second phase of the growth. It lies just behind the first phase that is cell division. Here the cells simply elongate to attain their maximum size.
During elongation the cell volume increases up to 150 times due to uptake of water. The cells synthesize new cytoplasm, cell wall material and a large central vacuole is formed. Thus cells show increase in weight and attain different shapes.

MATURATION PHASE:

This is the last phase of the growth and it is present behind the phase of cell elongation. Here the cell walls become thicker and cells attain their final size and shape. The cells modified into different tissues according to their location and function. Some cells form parenchyma, collenchymas, xylem and phloem.

CONDITIONS FOR GROWTH:

There are certain factors which affect the process of growth. These factors are;
(a) External factors (b) Internal factors

(a)EXTERNAL FACTORS:

(i) TEMPERATURE:

Normally rate of growth increases with rise of temperature and decreases with decrease of temperature.
Very high or low temperature affects growth. Optimum temperature for maximum growth is 25 - 37oC. Because all hormones and enzymes work best at this temperature. At very high temperature (40 – 45oC) growth stops and the plants dies.

(ii)LIGHT:

Most plants grow in light while some grow in shade. Light affect growth in three ways:

LIGHT INTENSITY:

Increases cell division and chlorophyll formation.

LIGHT QUALITY:

Red light increases cell elongation. Ultra violet light also reduces cell elongation. In complete darkness plant become pale and show stunted g

LIGHT DURATION:

Duration of light effects the growth of vegetative and reproductive organs. It also plays a role in inducing or suppressing flowering.

INTERNAL FACTORS:

(i) SUPPLY OF WATER:

Water keeps the growing cells turgid.
By absorbing water the cells elongate.
Plants can use nutrients only in solution form.
Plants under shortage of water show suppressed growth.

(ii) SUPPLY OF FOOD:

Growth is an anabolic process and require food supply which can be converted to body. For not only provide building material but also energy to the newly formed cells for their growth.

(iii) HORMONES:

Some hormones also play important role in plant growth such as, Auxin and Gibberilins.

GROWTH CORRELATIONS:

The relationship of growth among different organs of a plant is called Growth correlation.

TYPES OF CORRELATION OF PLANT:

There are two types of growth correlation in plant.

INHIBITORY CORRELATION:

When the activity of apical bud inhibits or control the growth of lateral buds (branches) is called inhibitory correlation.
It is also called Apical dominance.
In apical dominance the apical buds dominate and control the growth of lateral buds.
Apical dominance depends upon the distance between apical and lateral buds.
Apical dominance is of two types:

DEVELOPMENT:

An animal develops from a diploid zygote formed as a result of two haploid cells is sperm and ovum. This zygote undergoes series of programmed progressive changes to become a complete multicellular adult containing all the functional organs.
This series of progressive changes is called development.

DEVELOPMENT OF CHICKS:

In order to understand the process of development, we will consider the example of chicks

EGG:

A fully formed egg of hen is almost 3 to 4 cm bread and 6cm long. Externally it is protected with hard shell composed of CACO3. Just beneath the shell in a thin two layerer structure is present known as ammin and chorion. Below this membrane album is present a spirally twisted chalazae is present on both the side which keeps the yoek suspended on in the centre.
The egg of hen is polyecithal type have huge amounts of yolk. It is released from the ovary as a primary oocyte with a diameter of 3 cm. The protoplasm of egg is restricted to a small area called germinal disc or blastodisc. It is towards the animal pole. Afetr the release from the ovary, the primary oocyte undergoes maturation division to become secondary oocyte, egg or ovum.

FERTILIZATION:

In hen, the fertilization is internal. The sperms which are deposited in female, fertilize the ovum in terminal part of oviduct.
Thus zygote formed is diploid and maturation occurs by the release of two polar bodies which soon degenerate. After fertilization, it is covered by two membranes and hard shell. The shell is secreted by shell glands. The fertilized egg is laid after 24 hours of fertilization.

INCUBATION

The process of development requires 36 C to 378C which either provided naturally by mother or artificially in incubator. The development is completed in 21 days.

CLEAVAGE:

After fertilization, the zygote undergoes a series of mitotic divisions called cleavage. The cleavage is restricted to only blastodisc or germinal disc which is lyring at the top of yolk and this type of cleavage is termed as discoidal cleavage. The first cleavage is vertical and divides the zygote into two cells but the yolk is not divided.

The common macro nutrients present in pond are C, H, O, K, Mg and S and micronutrients are Fe,mn,cu,zn.

MORULA:

The conversion of zygote into a solid ball of cells is called morula. In morula the central cells are smaller called micromeres. While the outer cells are larger called megamers. Morula lies closely to yolk.

BLASTALATION:

The conversion of morula into blastula is called Blastalation. A hollow cavity appears inside morula called blastocoels. These blastocoels are filled with a fluid. The cap of cells above the blastocoels is known as blastoderm. After Blastalation the egg is laid and gastrulations start.

GASTRULATION:

The process by which the blastula become three layered embryo is called gastrulation. During gastrulation the blastoderm divides into two layers:

EPIBLAST:

The upper layer of cells is called epiblast. It is the future ectoderm and mesoderm.

HYPOBLAST:

The lower layer of cells is called hypoblast. It is the future endoderm. The central cells of blastoderm is called area pellucid. The peripheral cells of blastoderm are called area opaca. The epiblast cells form a thick central longitudinal band or line called primitive streak. The upper end of primitive streak has a swelling called Hensen's node. In gastrulation the cells are migrated and arranged at suitable places in the embryo. These cells take part in the formation of three layers:

(i) ectoderm
(ii) endoderm and
(iii) mesoderm.

ORGANOGENESIS:

The formation of organs from the three germinal layers of gastrula is called organogenesis.

ECTODERM:

It gives rise; epidermis, nervous system, parts of eyes, ear and inner parts of mouth and anus.

MESODERM:

It forms Heart, blood vessels, excretory organs, Skeleton, notochord.

ENDODERM:

It gives rise" Alimentary canal (except mouth and anus), liver, pancreases, lungs. Hensen's node forms a notochord. The cells of ectoderm become thick to form a band called neural plate. Neural plate is then converted into neural tube. At this stage the embryo is called neurula. The upper part of neural tube forms brain. The remaining tube forms spinal cord. Mesoderm form compact masses of cells called somites. Organs formed from the germinal layers are smaller in size called organs rudiments.

EMBRYONIC INDUCTION:

When one body part differentiates in response to a signal from an adjacent body part is called embryonic induction. Or The interaction between two embryonic cells types in which one cell stimulate the other cell to produce a structure is called embryonic induction. The embryonic tissue which produce inductive influence is called embryonic induction. The tissue on which inductor acts is called responsive tissue. The inductor transmits some chemical substance called morphogen or messenger. Thus induction occurs by the transfer of morphogen from inductor to responsive tissue.

HISTORY:

The idea of embryonic induction was first introduced by Hans Spemann in 1924. He was awarded Nobel Prize in 1935 for this discovery.

EXPERIMENT NO#1:

Spemann cut out a piece of ectoderm form an embryo. This ectoderm have the power to develop into a nerve tube and then form central nervous system. He placed this piece of ectoderm in a dish. The embryo healed and lived but it never develops a normal nervous system. The isolated piece of ectoderm also did not develop into nervous system.

CONCLUSION:

Spemann concluded that: The piece of ectoderm is required by the embryo in order to develop a proper nervous system.

EXPERIMENT NO#2:

Spemann removed the ectoderm from the top of an embryo. Then he removed the mesoderm and discarded it. He again put the ectoderm on its original place. The ectoderm healed and looked quite healthy. But it did not develop into nervous system.

CONCLUSION:

He concluded that of Mesoderm influence the ectoderm to differentiate into nervous system.

EXPERIMENT NO#3:

In this experiment Spemann used two embryos in early gastrula stage. From one embryo he removed a piece of mesoderm from the dorsal lip of blastophore. From the second embryo he removed a similar sized piece from ventral or lateral side of mesoderm of dorsal lip. He transplanted the piece of first embryo into the ventral or lateral position of second embryo. The transplanted embryo formed blastophore and moved inside the embryo. The embryo healed and survived this surgery. This embryo developed normally but it had tow nervous systems. First nervous system was at the normal position. Second nervous was away from the normal position. This second nervous system was in response to the transplanted dorsal lip of blastophore. This embryo developed into a Siamese twin with two heads and one trunk.

CONCLUSION:

He concluded that: if the mesoderm of the dorsal lip region is removed the animal produces no nervous system. If it is put in a strange place, the animal develops an extra nervous system. This area of mesoderm seems to control or induce the differentiation.

ROLE OF NUCLEUS AND CYTOPLASM IN DEVELOPMENT:

We know that genes are present in all cells. But each cell differentiates and functions differently.
For example
Stomach cells produces enzymes which help in digestion.
Cells on the tips of fingers and toes produces keratin protein for the formation of nail.
This indicate the presence of some controlling mechanism within the cells. This controlling mechanism allows only certain genes to express itself. Both the nucleus and cytoplasm play important role in the normal development. The nucleus determines the characteristics of the individual. While the cytoplasm selectively "turn on" some genes and "switches off" others.

ROLE OF NUCLEUS IN DEVELOPMENT:

Hamerling performed an experiment to explain the role of nucleus in development. In this experiment an alga plant Acetabularia is used.

HABITAT:

Acetabularia is found in European sea water

SIZE:

Acetabularia is unicellular and 2 – 3 cm in length.

STRUCTURE:

Acetabularia consists of: Acetabularia attached with the ground by a base which contain a single nucleolus. Stalk is long and arises from the base. A cap like structure is present at the tip of stalk. There are two species of Acetabularia which differ in shape and structure of their cap.

ACETABULARIA MEDITERRANCEA:

Which has an umbrella like cap.

ACTEABULARIA CRENTULATA:

Which has irregular cap.
If the caps of these algae are removed, a new one is regenerate.

EXPERIMENT:

(1) When caps were removed from both types.
Result: each plant again produced the cap of its own type.

(2) Then he cut the caps and stalks from both alga plants. Each alga was grafted with stalk of other type.
Result: Each type again produced the cap of its own shape inspite of having separate stalk.

(3) Finally he cut the nucleus containing base from both types. He grafted the base of A. Mediterranean into A. cranulata.
Result: He found that the new regenerated cap had the shape of A Mediterranean.

CONCLUSION:

Only the nucleus present at the base determined the shape of cap. Nucleus exerts a strong influence on the development of cap through mRNA. Stalk do not play any role in the formation of cap.

ROLE OF CYTOPLASM IN DEVELOPMENT:

Cytoplasm is also important in the development of an embryo. To explain the role of cytoplasm experiment was performed on frog embryo. In unfertilized egg of frog the upper half part is pigmented. While the lower half part is non-pigmented and contain yolk. After fertilization some pigments are migrated in the upper part. AS a result a less pigmented part is formed in the middle which is called grey crescent.

EXPERIMENT:

In this experiment frog's zygote was used. During normal cleavage the first division is vertical. Zygote divide into two equal parts through the middle of grey crescent. In this way each cell contain half amount of grey crescent. If these two cells are carefully separated then such cells will grow to form a normal tadpole. If these two cells are separated in such a way that one cell contain complete grey crescent. Then only that cell will develop into normal tadpole which contain grey crescent. While cell without grey crescent will develop into an undifferentiated mass of cells.

CONCLUSION:

The cytoplasm in the grey crescent directs embryonic development.

AGING:

The natural phenomenon of getting old is called aging. OR The negative changes both structural and functional in our body are called aging. The study of aging is known as "Gerontology". Every organism on the earth has a limited period of life. No one can live for ever. During the life cycle the living organism passes through various stages such as: Growth Maturation Physical and Mental deterioration Finally Death. After adult stage some physical changes occur in the bodies which are degenerative in nature.

AGING RATE:

life span varies greatly depending on diseases and accidents. Aging rate is different in different animals. E.g.
Frog 12-y 15 years,
Dog 15 years
Crow 100 years
Human 70 years

SIGN OF AGING:

Hair become colorless (white) Poor vision, weak memory
Hearing impairment, Loss of reproductive capacity.
Dryness and wrinkling (folding) of skin, arthritis.
Decreased body immunity.

CAUSES OF AGING:

The exact process of aging is still unknown. But the following two causes are very important:

GENETIC ORIGIN:

It is the main cause of aging. Mitosis is genetically programmed which decline at a particular stage of the life cycle. Some scientists also believe that cells gradually lose the capacity for DNA self repair.

GENE MUTATION:

Sometime changes occur in the genes and DNA replications affected. Mutation in the DNA replication leads to nonfunctional protein production. Thus function of the cells become weak causing aging.

AGING AFFECTS:
LIMITED CELL DIVISION:

The dividing capacity of aging cell is gradually decreases. After birth the muscle and nerve cells of human do not divide. These non-dividing cells die off leading to memory loss and weakness. Accumulation of lipo fusion pigment in the cells also decline cells division.

LOSS OF HORMONAL ACTIVITIES:

Diabetes mellitus is common in old age due to less secretion of insulin. In women menopause occur due to loss of estrogen and progesterone.

CROSS LINKAGE OF PROTEIN:

During aging changes in intra cellular substances take place. Elastic tissue loss their elasticity with the passage of time. Aging is an inevitable process, no one can stop it.

Following can slow down aging process
Balance diet
Regular exercise
No smoking
Proper rest
Relaxed life

ABNORMALITIES IN DEVELOPMENT:

Any interference or error in the normal process of development of an organism is called abnormal development. Development is pre planned programme. In all organisms development occur in systematic and an accurate way. This embryonic development is under strict control of genes. Any error in normal gene function can lead to the formation of abnormal body parts. Such a development is called abnormal development. The study of abnormal development is known as teratology.

EXAMPLE:

Common examples are:

MICROCEPHALY:

Individual born with abnormal small skull.

CLEFT PLATE:

Individual born with an upper lips folded or hare lip.

POLYDACTYLISM:

More than fingers in the hands or feet.

SYNDACTYLISM:

Individual born with webbing of the fingers.

CAUSES OF ABNORMAL DEVELOPMENT:

Abnormal developments occur due to some faults in the control mechanism.
Mutation: Any change in the genetic material is known as mutation. Mutation changes the appearance and function of the organisms.

TERATOGEN:

Environmental factors causing abnormal development are called Teratogens. Such as UV rays, x – rays and certain drugs bring changes in the genes of the developing sperm and egg.

SEX CHROMOSOMES:

Abnormal development is also related to the presence of defective genes on sex chromosomes. It leads to colour blindness, haemophilia etc.

NON – DISJUNCTION:

When a pair of homologous chromosomes in meiosis fail to separate from one another is called non-disjunction. This process occur during gametes formation. When these abnormal gametes unite to form a zygote. Then the individual will have less or more than the normal number of chromosomes.

KLINEFELTER'S SYNDROME:

This is due to one extra sex chromosome in male (xxy)

TURNER'S SYNDROME:

When one sex chromosome is missing in female (Xo)

DOWN'S SYNDROME:

one extra chromosome in pair number 21.

UNCONTROLLED CELL DIVISION:

It leads to a kind of abnormal development called cancer. In leukemia there is abnormally increased WBC's which leads to abnormal blood function.

ABNORMAL GLAND FUNCTIONING:

Malfunctioning of the body glands also caused abnormal development such as gigantism, dwarfism, sterility etc.

CHAPTER 6

CHROMOSOMES AND DNA

Chromosomes are thread like structures that appear inside the nucleus at the time of cell division. They were first observed and named by a German embryologist Walther fleming in 1882. Chromosomes are the bearer of hereditary character in the form of genes. The number of chromosomes remain constant for a particular species and it remains constant from generation to generation.

STRUCTURE:

Each chromosomes consists of two very fine thread like structure called chromatids.

CENTROMERE:

This is the point where the chromotids share with each other or they are attached with each other.

KINETOCHORE:

It is a small proteineous disc present in centromere. Spindle fibres get attachment with kinetochore.

CHROMOMERE:

Small un-equal sized regions of denser material arranged at irregular intergular intervals along the chromosomes. This gives the beaded appearance to chromosomes.

SISTER CHROMATIDS:

The two chromatids of the same chromosomes are called sister chromatids.

NON-SISTER CHROMATIDS:

The two chromatids of different chromosomes are called non-sister chromatids.

TYPES OF CHROMOSOMES:

According to the position of centromere, there are four different types of chromosomes:

1. **METACENTRIC:**

Chromosome with equal arms and centromere in center.

2. **SUB METACENTRIC:**

Chromosome with un-equal arms resembling j shape.

3. **TELOCENTRIC:**

Location of centromere is at the end of chromosome.

4. **ACROCENTRIC:**

Rod like chromosome with one arm very small and the other very long. The centromere is sub terminal.

HOMOLOGUS CHROMOSOMES:

Chromosome morphologically similar and with the same sets of genes are called homologus chromosomes.

KARYOTYPE:

When chromosomes are arranged by pairs according to there size shape and general appearance, in mitotic metaphase it is called karyotype. Any individual possesses a particular karyotype. Karyotype of an individual are often examined for identification of chromosomal number their abnormalities and their defects. karyotype of an individual is prepared from a blood sample i.e from W.B.C.

CHEMICAL COMPOSITION OF CHROMOSOMES:

Chromosomes are composed of DNA and protein. The protein is histone type while DNA is composed of billions of nucleotides. Each nucleotide is composed of phosphoric acid, De-oxyribose sugar and four Nitrogen bases.

ULTRA STRUCTURE OF CHROMOSOME:

The chromosome of a eukayotic cell has 40% DNA and 60% protein. A significant amount of RNA is also associated with chromosome because DNA is responsible for RNA formation. The DNA of a chromosome is very long double stranded fiber that stands unbroken through the entire length of chromosome.

A typical human chromosome has 140 million nucleotides in its DNA. The amount of information Coded in one chromosome fills about 280 books of 1000 pages. If a strand of a chromosome is laid in straight line, it would be 5cm long.

NUCLEOSOME:

The coiling of DNA is like string of beads. DNA duplex cells around a core of eight histone protein forming a coplex structure called nucleosome. Mostly the proteins have negative charge but histone have positive charge. The DNA have negatively charge so it is strongly attracted to histone and wrap tightly around the histone core. The core thus acts as magnetic forms that promotes and guide the coiling of DNA. Nucleoprotein (histone) gives DNA fiber as beaded structure. The nucleosome is repeated after every 200 nucleotides of DNA.

SPACER DNA:

The DNA present from one nucleosome (bead) to an other is called Spacer DNA.

SUPER COIL:

Further coiling of DNA occurs when the string of nucleosome wraps into higher order coils called Super Coil.

CHROMATIN:

The super coil network is called chromatin. Chromatin is again classified into euchromatin and heterochromatin on the basis of staining properties.

HETEROCHROMATIN:

Stains deeply because it is more coiled and compact it is inactive and never expresses it self.

EUCHROMATIN:

Stains more during nuclear division and is involved in transcription (Protein Synthesis).

CHROMOSOMES AS CARRIER OF GENES:

Genes are present on chromosomes and they are very small units and can't be seen with best microscope but genes are molecules born in chromosomes so genes and chromosomes are bearer of hereditary characters. In genotype, each pair of gene is contributed from one member and the other by the other member, so zygot gets two genes, one from each parent. At the time of gamete formation, genes segregate.

CHROMOSOMAL THEORY OF HEREDITY:

Chromosomes play central role in hereditary which was first suggested by Karl Corren in 1900 and the chromosomal theory of inheritance. The chromosomal theory of inheritance was formulated by Walter Sutton in 1902. There are so many points which support this theory.

OBJECTIONS:

The problem with this theory which was pointed out that if Mendelian traits are determined by genes located on chromosomes and if there is independent assortment of these chromosomes in meiosis, then why the number of genes that assort independently in given organism is often greater than the number of chromosome pairs that the organism possesses. This seemed a fatal objection to Sutton's theory.

HEREDITARY MATERIAL:
INTRODUCTION:

In the first half of 20th Century, attempts were made to discover the chemical basis of heredity, investigations showed that chromosomes and genes are composed of DNA and Protein. The question was whether the protein or DNA is the hereditary material or whether both are responsible for inheritance.

DNA AS HEREDITARY MATERIAL:
GRIFFITH'S EXPERIMENT:

In 1928, Fred Griffith during his experiments unexpectedly opened a door to the molecular world of heredity.

Griffith attempted to develop a vaccine against a bacterium streptococcus, pneumonia which causes the lungs disease pneumonia. Griffith isolated two strains of bacterium which he designated, 'S" (Due to smooth surface) and "R" (Due to rough surface appearance). "S" cells are virulent while "R" cells are non virulent. When the two strains are cultured separately the two types give rise to bacteria of their own types.

1. Laboratory mice were injected with live "R" cells no illness effected on them.

2. Mice were injected with live "S" cells the mice contracted pneumonia and died, the "S" strain obviously was Pathogenic.

3. "S" cells were killed with high temperature and mice injected with these heat killed cells did not develop Pneumonia.

4. Live "R" cells were mixed with heat killed "S" cells and injected, communication came down with Pneumonia and mice died.

DNA STRUCTURE:

WATSON AND CRICK'S MODEL OF DNA:

In the early 1950's James Watson a post-doctoral student from Indiana university teamed up with Francis crick a Cambridge researcher and suggested a model of DNA in 1953. It was based on X-ray diffraction data provided by Murice H.F Wilkins for their pioneer work the three scientists received noble prize in 1962.

STRUCTURE:

Watson and Crick suggested ladder type organization of DNA.

Each molecule of DNA is made up of two polynucleotide chains which are twisted around each other and form a double helix. The uprights of ladder are made up of sugar and phosphate parts of nucleotide and the rungs are made up of paired nitrogenous bases. The pairs are always as follows.

Adenine always pairs with thymine and cytosine always pairs with guanine. There is no alternative possible. Two nucleotide chains are held together by weak hydrogen bond.

There are two hydrogen bonds between A=T and three hydrogen bonds between C=G. both polynucleotide strands remain separated by 20A° distance. The coiling of double helix is right handed and complete turn occurs after 34A°. since each nucleotide occupies 34A° distance, along the length of polynucleotide strand there are 10 mono-nucleotide which occurs in each complete turn.

REPLICATION OF DNA:

The discovery of DNA structure was a turning point in studies of inheritance i.e how the hereditary material is replicated.

The weak hydrogen bond that hold together the double helix of DNA is broken up by an enzyme DNA helecase starting from the ends like a zip, one bye one, each purine is separate from its pyrimidin partner. Each separation leaves an unmatched purine and pyrimidin bases. Then free nucleotides which are present in cellular pool could pair with exposed bases on both unwound strands. Each parent strand remains in fact and a new companion strand is assembled on each one.

During the replication, each parent strand is twisted into a double helix with its new partner strand.

Through these steps, a new upright, (of sugar and phosphate) would be supplied for each ladder. Thus each strand will have replaced the nucleotide partners it has lost with ones of exactly the same kind.

DNA REPLICATION IS SEMI CONSERVATIVE:

In semi conservative replication, the two strands of the duplex separate out each acting as a model or mold, along which new nucleotides are arranged thus giving rise to two new duplexes.

The conservative model stated that the parental double helix would remain intact and generate DNA copies consisting of entirely new molecules.

MATTHEW MESELSON AND FRANKLIN STAHL'S EXPERIMENT TO PROVE THAT DNA REPLICATION IS SEMI CONSERVATION:

The three hypothesis of DNA replication were evaluated by Mathew Meselson and Franklin Stahl of the California Institute of Technology in 1958.

They grew bacteria several generations in a medium containing heavy isotopes of Nitrogen N_{15} So the DNA was denser than the normal then the transferred growing cells.

- A, DNA molecule in which both strands are heavy.
- A, DNA molecule in which both strands contain lighter Nitrogen.
- A hybrid DNA in which one DNA molecule is heavy and one is light has an intermediate density.

So there were the exact results to be expected if DNA replication is semi-conservative.

GENE:

The double helix model of DNA opened a new door for genetic researches. Every cell contains DNA. Each DNA contains specific segments called genes. That control specific cellular functions, either by synthesizing enzymes, proteins or by regulating the action of other genes.

GENETIC CODE:

Genetic code is combination of three nucleotides which specify a particular amino acid. There are three nucleotides in a codon because a two nucleotide codon would not yield enough combination to code for 20 different amino acids that commonly occurs in protein. If we take four DNA nucleotides, only 16 different pairs of nucleotides could be formed but if the same nucleotide can be arranged in 64 different combination of three, more than enough to code for 20 amino acids. So genetic code is triplet code and the reading occurs continuously without punctuation.

Experiment with different organism have shown that a given codon say AUG specifies metheonine while CAG means Glutamine. Out of 64 codons, three codons are to stop the signals and they do not code for any amino acids.

A bird, a bean and human, all living organisms have the same genetic code. The difference among the species is not in the arrangement of letters within codon but in the sequence of codon.

DECODING:

The messenger RNA exposes only a three nucleotide before the ribosome which is a genetic code. The transfer RNA carrying a particular amino acids, recognizes this particular code, it possess anticodon series for this site and thus binds to "RNA". The phenomenon is known as decoding. The decoding is an essential process of translation.

GENE EXPRESSION (PROTEIN SYNTHESIS):

How, gene expresses, gene prepares messenger RNA which directs ribosome what type of protein should be prepared to form a character. The nature of protein is based on the number and sequences of amino acids which are found in cell the process of gene expression occurs in following steps.

1. Transcription
2. Translation

TRANSCRIPTION:

Transcription is the first step which is a message of particular type protein to ribosome. Messenger RNA are also prepared by DNA. The transcription is initiated by an enzyme RNA polymerase this enzyme binds to a particular nucleotides on DNA strand than RNA polymerase assembles RNA with a sequence complementary to DNA RNA. Polymerase moves along the strand of DNA (gene) and adds complementary nucleotides when the enzyme reaches at stop signal the RNA is separated from DNA thus it is RNA transcript (copy).

TRANSLATION:

Translation is a stage of polypeptide formation by ribosome the messenger RNA direts ribosome that what type of protein should be formed nucleotide information is translated into amino acids sequence information.

Translation begins when ribosomal RNA molecule in ribosome binds at one end of messenger RNA, the ribosome move along "RNA" at each step amino acids are added till it reached at the "stop" codon which means end of polypeptide. The rate of linkage is 35 amino acids per seconds.

CHANGE IN HEREDITARY INSTRUCTIONS:

The gene is responsible to determine the characters of Phenotype. Any change in gene is called Mutation which may cause a change in Phenotype.

CHROMOSOMAL MUTATION OR CHROMOSOMAL ABERRATION:

Change in heredity instruction is also brought about by chromosomal aberration During meiosis when chromosomes become interwind, there is plenty of opportunity for various kinds of structural aberration.the chromosomal; aberration is visible, and are of following types:

1. Deletion
2. Abnormality

CHAPTER 7

CELL CYCLE

All living things substances are composed of cells. A cell is structural and functional unit of life. In 1855 a German physician proposed hypothesis in his own words.
'Omnis Cellula-e Cellula' i.e. a cell is formed by the division of pre-existing cell. In our body millions of cells must divide every second to maintain the total number of 60 trillions.
So when cells reach to a certain size, they must either stop growing or divide. The activities of growing and dividing of cell can be described as cell cycle. Such cycle starts each time when new cell are formed and ends when these cells complete their division some cells, like nerve cells blood cells do not divide are mature.
The process that occurs during cell division of eukaryotic cells is.

INTERPHASE:

Interphase is not a dividing phase this period is of great biochemical activities most of the time taken by cell cycle is spent in interphase typically interphase lasts for at least 90% of the total time required for cell division.

SUBSTAGES OF INTERPHASE:

- G1-Phase (Gap-One)
- S-Phase (Synthesis)
- G2-Phase (Gap-Two)

G1-PHASE:

It is the first subphase before DNA Synthesis.

- In this Phase DNA bases are accumulated.
- Enzymes are prepared which are required for DNA Synthesis.
- Number of mitochondria, ribosomes and other organalies are increased.
- RNA is Synthesized.
- At the late of G1-Phase the cell follow two paths.
- Either withdraws from cell cycle G-0.
- Or enters S Phase.

S-PHASE:

- In this phase DNA is synthesized i.e DNA replication occurs.
- At the begning of S-Phase each chromosome is single but at the end of S-Phase each chromosome is doubled i.e two sister chromatids are formed.

G2-PHASE:

It is a time from DNA replication to the onset of cell division.

- In this period energy is stored for the movement of chromosomes.
- Proteins are synthesized which are needed for cell division.
- Microtubule subunits are also synthesized.

DURING INTERPHASE:

- Nucleus is visible.
- Nuclear membrane is visible.
- Nucleolus is visible.
- Chromosomes are so thin that they look like granular mass.

  At the end of G2 phase the cell enters in mitotic division. At each stage there are specific check points which determine the fate of new phase. The length of cell cycle varies from organism to organism. in man cell cycle is completed in 24 hours while in yeast cell it is completed in 90 minutes.

MITOSIS:

It is a division in which a cell divides into two cell but the number and properties of chromosomes remains same. The process of mitosis occurs in body cells (somatic cells) when it is required. Mitosis in plant cell and in animal cell has only slight difference. Mitosis occurs in diploid cell and in haploid cells. Mitosis is a continuous process but it can be divided in two phases.

1. Karyokinesis: It is the division of nucleus.
2. Cytokinesis: It is the division of cytoplasm.

1. KARYOKINESIS:

It is the division of nucleus and occurs in 4 different phases.

- Prophase
- Metaphase
- Anaphase
- Telophase

- **PROPHASE:**

This is the main phase of nuclear division it is the longest stage. The following main changes which occurs in nucleus are as follows.

i. Changes in Nucleus

ii. Changes in Cytoplasm

ROLE OF MITOTIC APPARATUS:

Current hypothesis is based on the idea that the microtubules generate some force of pulling or pushing which cause the separation of chromatids.

- **METAPHASE:**

i. In this stage the chromatids arrange themselves at the equatorial plane.

ii. Each pair of chromatids is get attached to spindle fibres by kinetochore, a part of centromere.

iii. Chromatids attain their maximum thickness at this stage.

iv. The faces of chromatids are towards the opposite poles as they are ready for separation.

- **ANAPHASE:**

i. In this stage the centromere divides into two parts and chromatids can't remain attach further.

ii. The spindle fibers contract and pulls the two sets of chromatids which migrate to the opposite poles.

- **TELOPHASE:**

i. When the two sets of chromosomes reach to opposite poles telophase begins.

ii. The daughter chromosomes become thin and long.

iii. They coil with each other forming network again.

iv. Nuclear membrane and nucleolus reappears.

v. Spindle fibers disappear.

vi. Hence two identical nuclei are formed in one cell with equal and identical number of chromosomes.

2. CYTOKINESIS:

Cytokinesis means division of cytoplasm.

i. In plant cell, a cell plate appears in the cytoplasm at the equatorial position and divide the mother cell into two daughter cells.

ii. In animal cells a constriction appear at the equatorial position dividing the cell into two daughter cells.

SIGNIFICANCE OF MITOSIS:

- By mitosis zygote divides which causes the formation of tissues, organs and organism (development).

- By mitosis new cells are formed so growth of the organism takes place.
- Mitosis helps in replacing the old and worm-out cells and cells like RBC and WBC are formed in bone marrow.
- Mitosis causes equal distribution of DNA to daughter nuclei which is a hereditary material.
- Mitosis is also a mean of asexual reproduction in some plants and animals.
- Regeneration of an organ or healing of wounds also takes place by mitosis.
- Tissue culture and coloning seeks help through mitosis.

MEIOSIS:

Meiosis is a cell division in which one cell divides into four cells and the number of the chromosomes is reduced to half. Meiosis occurs in diploid cells during gemetogenesis. Meiosis consists of two successive divisions. Division I and division II. Division I is reduction division while division II is mitotic in nature. Each division passes through four phases but prophase I is complicated and passes through five phases.

SIGNIFICATION OF MEIOSIS:

- Meiosis maintains the definite and constant number of chromosomes in an organism.
- Crossing over provides an opportunity which is a major tool evolution.
- Four chromatids of a homologous pair of chromosomes are passed to four different combinations which brings genetical variations in daughter cells.

COMPARISON OF MITOSIS AND MEIOSIS:

	MITOSIS	MEIOSIS
1.	Mitosis occurs in somatic cells.	Meiosis occurs in gamete producing organs.
2.	One parent cell gives rise to two daughter cells which are identical with parents cells, in number and properties of chromosomes.	One parent cell give rise to four daughter cells which differ from parent cells in two fundamental characters. (i) They contain half the number of chromosomes. (ii) The chromosome bears different combinations of genes as a result of crossing over.
3.	The daughter cells are added to bulk of body causes growth or replace worn out cells.	The daughter cells do not cause growth but capable of bringing about reproduction.
4.	The prophase of mitosis is completed in one sequence.	Meiosis is completed in two sequences division I division II.
5.	Synapsis b/w maternal and paternal chromosomes does not occur.	Synapsis b/w material and paternal chromosomes occur.
6.	Crossing over does not take place.	Crossing over b/w maternal and paternal chromosomes occurs.

7.	Mitotic division produces colonies, genetically identical copies of a parent cell.	Meiosis with fertilization promotes variation in traits among off springs.
8.	Mitosis is a mean of asexual reproduction in single celled species.	Meiosis is used in sexual reproduction by multicellular species.

DOWN'S SYNDROME:

Down's Syndrome which was discovered in 1866 by Langdon Down also called Mongolism. This name given due to epicanthic fold in the eyelid which is a phenotypic character of the member of Mongoloid race.

CAUSE:

Down's Syndrome is the only human. Autosomal trisomy. The chromosome 21 is one of the smallest chromosome in the human cell. A person who inherits three instead of two is categorized as trisomic 21 and shows Dow's Syndrome.

SYMPTOMS:

- They are short and may have small rounded head..
- They have protruding furrowed tongue which cause the mouth to remain partially open.
- They are prone to respiratory disease and heart malformation and show an incidence of leukemia.
- Muscles and muscle reflexes are weak.
- Development of speech and motor function is hampered.
- Mental retardation with low IQ in 20-50 range.
- Broad flat face.
- Short hands and feet.
- Female, may be fertile and may produce normal or trisomic progeny (Down's Syndrome).
- Male never reproduce.
- Life span is about 17 years only 8% can survive upto 40 or above.
- The defect is one in 700.
- Older women above the age of 30-40 Show increased risk.

KLINE FILTER AND TURNER'S SYNDROMES:

Around 1940 two human Sex abnormalities were discovered.

KLINEFILTER'S SYNDROME:

Individual with klinefilter's Syndrome most often have XXY i.e inheritance of two X and Y chromosomes which is a trisomic condition.

SYMPTOMS:

- XXY male are taller then average.
- They are sterile or less fertile.
- Their testis are much smaller although penis and scrotum are normal but testis fail to produce sperms.
- Facial hairs are often spars.
- There may be some breast enlargement.
- Some XXY shows mild mental impairment.
- It effects 1-500 to 2000 persons.
- Injections of hormones can reserve the famined trait but cannot increase the fertility.

TURNER SYNDROME:

Turner Syndrome is due to monosomic condition i.e they have 45 chromosomes i.e inheritance of one X without a partner X or Y. It is a female sexual defect and occurs one in 2500 to 10000.

Turner Syndrome is not common as 98% with XO zygote get aborted early in pregnancy. The survivals shows following abnormalities.

- They grow well proportioned but a bit short at 4 feet 8 inches in height.
- Individuals have female external genitalia and internal ducts but ovaries are not functional therefore they do not produce ova or hormones.
- Without sex hormones breast and other secondary sex characters do not appear.
- They have webbed neck and shield like chest.
- Some patients are benefitted from hormone therapy and corrective surgery.

CHAPTER 8:

VARIATION AND GENETICS

GENETICS:

The branch of biological science which deals with the study of heredity and variation is called genetics.

The scientist study in genetics was started with the time of Gregor Johann Mendel (1822-1884). He is considered as the pioneer in the field of genetics and appropriately called 'the father of genetics'. His conclusion constitutes the foundations of Modern Genetics.

GENE POLE:

Total variety of genes and alleles present in a sexually reproducing population. In a population, there are many possible alleles for all genes. Thus, the gene pool is the total genetic make up of an entire population.

IMPORTANCE OF GENE POOL:

1.The gene pool helps us to know the total genetic make up of an entire population.

2.According to Villie and Dethier, population is characterized by a certain gene pool.

3.The genotype frequency is used in predicting possible outcomes of particular crosses.

ALLELE (GENE) FREQUENCY:

A gene pool is characterized by frequency of given alleles expressed in a ratio or percent within a population. In a population, several forms of each gene may exist and these are called alleles.

BIOGRAPHY OF MENDEL:

Mendel was born on 22nd July, an Austrian monk. In 1851, he went to Vienna to study Natural Selection and Mathematics, and returned to the monastery in 1853. In 1854, he taught physics and natural science for fourteen years. He concluded hybridization experiments on fruits, trees, flowers, vegetables, and more on garden peas. On the basis, he began his scientific investigation on inheritance in 1856.His experiments opened a new chapter in biology and published his conclusion 'Inheritance of characters' in 1866 in the ' Annual Proceedings of the Natural History Society'. But his work was recognized only in 1900, when three scientists of Holland, Austria and Germany independently drew a conclusion like Mendel. Since Mendel's Laws were widely accepted , this led to the establishment of genetics as a science.

MENDEL'S EXPERIMENTS:

SELECTION OF MATERIAL:

He selected the garden pea plant as a best material for his hybridization experiments, because;

1.Its life cycle is comparatively short.

2.Plants are annual and easy to cultivate.

3.Peas have many distinct, well-defined and easily observable morphological characteristics (traits).

4.Flowers are bisexual and naturally self-fertilizing, but they can also be easily cross-fertilized.

5.The offspring of cross-fertilized plants are fertile.

The traits that Mendel studied are listed below:

1.Form of ripe seed (R) – smooth or wrinkled

2.Color of seed albumen (Y) – yellow or green

3.Color of flower (P) – purple or white

4.Form of ripe pods (I) – inflated or constricted

5.Color of unripe pods (G) – green or yellow

6.Position of flowers (A) – axial or terminal

7.Length of stem (T) – tall or dwarf

REASONS FOR MENDEL'S SUCCESS:

1.Mendel at first prepared genetically pure variety for a single character to get the exact results in the breeding.

2.He studied the inheritance of one character at a time.

3.Sufficient data were collected and analysed carefully.

4.He carried out experiments to F_2 and F_3 generations only.

5.Great care was taken in carrying out all experiments, eliminating the chance of cross- pollination/ self pollination wherever required.

MENDEL'S LAW:

Karl Correns, a German genetist formulated the two laws of inheritance but the laws were not formulated by Mendel. The two laws of inheritance that were formulated by Correns where later update and revised and were classified into three laws namely:

1.1ST LAW OF INHERITANCE OR LAW OF DOMINANCE:

It states that ' When two pure plants with contrasting characters are crossed, only one form of the character appears in F1 generation, the other remains unexpressed. The character which appears itself in F1 generation is called dominant , the alternative factor that fails to show itself in F1 generation is called recessive.

2.2ND LAW OF INHERITANCE OR LAW OF SEGREGATION OR LAW OF PURITY OF GAMETES:

It states that, The characteristics of an organism are determined by internal factor which occurs in pairs, only one of a pair of such factor can be represented in a single gamete that separates at the time of gametogenesis.

3.3RD LAW OF INHERITANCE OR LAW OF INDEPENDENT ASSORTMENT:

It states that when two pairs of independent alleles are brought together in the hybrid (F1), they, at the time of gamete formation, segregate or assort independent at random and freely. This shows that genes are independent influence each other.

TEST CROSS:

A cross between F1 hybrid (Aa) and its homozygous recessive parent (aa) is called Test Cross. This cross is called test cross because it helps to find out whether the given dominant phenotype is homozygous or heterozygous.

INCOMPLETE DOMINANCE:

The two alleles of a gene may having partial or incomplete dominance, so that, in a heterozygous condition, an intermediate effect is expressed. This is called incomplete dominance or partial dominance. This is observed by Correns in the 4 O' clock plant Mirabilis jalpa.

CO- DOMINANCE:

(1) In co-dominance both the gene expressed for a particular character in F1 hybrid progeny. There is no blending of characters, whereas both the characters are expressed equally.

(2) Co-dominance is seen in animals for coat colour. When a black parent is crossed with white parent, a roan color in F1 progeny is produced.

POLYGENIC INHERITANCE (MULTIPLE GENES):

Two or more pairs of different genes interacting to produce the same trait are multiple genes or polygenes and the inheritance of polygenes or quantitative traits is called polygenic inheritance.

EPISTASIS:

The suppression of the expression of a gene on one locus on a chromosome by a gene at some other locus of the same chromosome is called epistasis.

Epistasis is a phenomenon that consists of the effect of one gene being dependent on the presence of one or more 'modifier genes' (genetic background). Similarly, epistatic mutations have different effects in combination than individually. It was originally a concept from genetics but is now used in biochemistry, population genetics, computational biology and evolutionary biology. It arises due to interactions, either between genes, or within them leading to non-additive effects. Epistasis has a large influence on the shape of evolutionary landscapes which leads to profound consequences for evolution and evolvability of traits.

LINKAGE:

The phenomenon of tendency of linked genes to inherit together in the same combination for more than two generation is called linkage.

MORGAN'S VIEW:

The degree of linkage between two genes depends on the distance between location of genes and they vary and form crossing over, if they are located at the distance. This phenomenon is explained by T.H. Morgan in 1911 in Drosophila melanogaster with grey body long wing and black body, vestigial wing. He stated that the pairs of genes of homozygous parents tried to enter the same gametes and to remain together, whereas same genes from heterozygous parents tend to enter different gametes and remain apart from each other.

CHROMOSOMES THEORY OF LINKAGE:

According to Morgan and Castle,

1.They concluded that chromosomes bear many genes.

2.The genes which show linkage are situated in the same chromosomes are bounded by the chromosomal material.

3.Gene are arranged in a linear fashion.

4.The strength of linkage depends upon the distance between the linked genes in the chromosomes.

5.Linked gene remained in their original combination during the course of inheritance.

TYPES OF LINKAGES:

1.COMPLETE LINKAGE:

If the parental combination of characters appear together for two or more generation in a continuous manner and regular manner. Such linked is called complete linkage.

EXAMPLE:

Drosophila melanogaster

INCOMPLETE LINKAGE :

Incomplete linkage produces new combinations of the genes in the progeny due to the formation of chiasma or crossing over in between the linked genes present on homologous chromosomes.

SIGNIFICANCE OF LINKAGE:

1. Linkage does not permit the breeders to bring the desirable characters in one variety.

2. Linked characters are maintained for generations because linkage prevents the incidence of recombination.

linkage group, in genetics, all of the genes on a single chromosome. They are inherited as a group; that is, during cell division they act and move as a unit rather than independently. The existence of linkage groups is the reason some traits do not comply with Mendel's law of independent assortment (recombination of genes and the traits they control); i.e., the principle applies only if genes are located on different chromosomes. Variation in the gene composition of a chromosome can occur when a chromosome breaks, and the sections join with the partner chromosome if it has broken in the same places. This exchange of genes between chromosomes, called crossing over.

CROSSING OVER:

Crossing over may be defined as an exchange of genetic material between non-sister chromatids of homologous chromosomes resulting in a new combination of genes.

The crossing over takes place during the early stage of prophase first of meiosis ce;; division.

MECHANISM OF CROSSING OVER:

The process of crossing over involves the following stages:

1.Synapsis

2.Duplication of chromosomes

3.Crossing over

4.chiasmata formation

5.Terminalisation

1.SYNAPSIS:

During zygotene substage of prophase I, the maternal and paternal homologous chromosomes come close to each other and start pairing along their length. The pairing of homologous chromosomes is called synapsis. They paired homologous chromosomes are called bivalents. It is mechanical basis of crossing over.

2.DUPLICATION OF CHROMOSOMES:

The synapsis is followed by duplication of chromosomes. During pachytene substage of prophase I , the chromotids of each homologous chromosome splits lengthwise and forms two identical sister chromatids.Thus each bivalent contains four chromatids so it is known as tetrad.

3.CROSSING OVER:

The non-sister chromatids of homologous pair twist over each other at one or more points. The chromatid segments break at the corresponding points and the segment of one side fuses with the segment of the opposite side due to the action of enzyme. Thus the crossing over includes breaking of chromatid segments, their transposition and fusion.

4.CHIASMATA FORMATION:

Chiasmata are the points of attachment between two homologous chromosomes, where the crossing over occurs. The number of chiasmata depends on the length of the chromosomes; greater the length greater is the number.The crossing over may take place at one or several points in one tetrad and may result in the formation of one or more chiasma.

5.TERMINALISATION:

After the process of crossing over, the non- sister chromatids start to repel each other due to lack of attraction force between them. The repulsion of chromatids starts from the centromere towards the chiasma and the chiasma itself moves in a zipper fashion towards the end of the tetrad. The movement of chiasma is known as terminalization. Due to terminalisation the hlomologous are separated completely.

SEX-LINKED INHERITANCE IN MAN:

The inheritance patterns shown below for red-green colour blindness can equally well apply to other sex-linked genes such as haemophilia. Since most sex-linked genes are usually only carried on the large X chromosome, a dash (-) signifies the presence of the relatively inert Y chromosome. The colour blindness gene is recessive to the gene for normal sight. Because the males have only one X chromosome and, therefore, only a single sex-linked gene at each locus, they are said to be hemizygous. The females, however, with two sex-linked genes, can be either homozygous or heterozygous

SEX- LINKED INHERITANCE:

Sex linked inheritance is the phenotypic expression of an allele related to the chromosomal sex of the individual. This mode of inheritance is in contrast to the inheritance of traits on autosomal chromosomes, where both sexes have the same probability of inheritance. Since humans have many more genes on the X than the Y, there are many more X-linked traits than Y-linked traits.

In mammals, the female is the homozygous sex, with two X chromosomes (XX), while the male is heterozygous, with one X and one Y chromosome (XY). Genes on the X or Y chromosome are called sex linked genes. In birds, the opposite is true: the male is the homozygous sex, having two Z chromosomes (ZZ), and the female (hen) is heterozygous, having one Z and one W chromosome (ZW).

1. **COLOUR BLINDNESS:**

A.MARRIAGE BETWEEN COLOUR BLIND MAN AND NORMAL VISIONED WOMAN:

When a normal visioned woman marries a colour blind man, all their male and female children will have normal vision, but the female children are heterozygous, who, if married with a normal man, will produce two normal visioned female, one normal visioned male and one colour blind male.

B.MARRIAGE BETWEEN NORMAL VISIONED MAN AND COLOUR BLIND WOMAN:

when a colour blind woman is married with a normal visioned man, in F1 generation they are produce all colour blind sons and normal visioned daughters because the son receives one X- linked recessive gene for colour blindness from their mother and Y chromosome from father; while the daughter receives one X-linked recessive gene for colour blindness from mother and another X- linked dominant gene for normal vision from father.

2. **HAEMOPHILIA:**

It is a disease in which blood doesn't clot properly. It is very rare found in only few humans also known as bleeder's disease. A person who contain the recessive gene for hemophilia lacks in normal clotting substances antihemophilic globutian in blood. It is well known in the royal families of Europe. The gene of haemophilia is recessive and present in the X-chromosome. Thus, a single gene produces the disease in males while two genes will produce the disease in females.

3. **EYE COLOUR IN DROSOPHILA(A SEX LINKED TRAIT):**

T.H Morgan (1910) performed various breeding experiments on common fruit fly drosophila and discovered a sex linked character which was an eye colour.

The normal eye colour in drosophila is bright red. One day a male with white eyes appeared in culture and was a true breeder. The cross was made between red eyed female and white eyed male. The result was according to simple Mandelian ratio.

SEX DETERMINATION:

(1) Fixing the sex of an individual as it begins life is called sex determination. The various genetically controlled sex-determination mechanisms have been classified into following categories

(2) Chromosomal theory of sex determination:

The X-chromosome was first observed by German biologist, Henking in 1891 during the spermatogenesis in male bug and was described as X-body. The chromosome theory of sex determination was worked out by E.B. Wilson and Stevens (1902-1905).

(3) They named the X and Y chromosomes as sex-chromosomes or allosomes and other chromosomes of the cell as autosomes.

(4) Sex chromosomes carry genes for sex. X-chromosomes carries female determining genes and Y-chromosomes has male determining genes.

(5) The number of X and Y chromosomes determines the female or male sex of the individual, Autosomes carry genes for the somatic characters. These do not have any relation with the sex.

SEX DETERMINATION BY CHROMOSOMES:

Those chromosomes which are involved in the determination of sex of an individual are called sex chromosomes while the other chromosomes are called autosomes.

1) XX – XY type:

In most insects including fruit fly Drosophila and mammals including human beings the females possess two homomorphic sex chromosomes, named XX. The males contain two heteromorphic sex chromosomes, i.e., XY. Hence the males produce two types of gametes / sperms, either with X-chromosome or with Y-chromosome, so they are called Heterogamety.

2) ZZ – ZW type: In birds and some reptiles, the males are represented as ZZ (homogamety) and females are ZW (heterogamety).

3) XX – XO type: In round worms and some insects, the females have two sex chromosomes, XX, while the males have only one sex chromosomes X. There is no second sex chromosome. Therefore, the males are designated as XO. The females are homogametic because they produce only one type of eggs. The males are heterogametic with half the male gametes carrying X-chromosome while the other half being devoid of it.

CHAPTER 9

BIOTECHNOLOGY

BIOTECHNOLOGY:

The industrial use of living organisms or their components to improve human health and food production is called biotechnology OR the utilization or exploitation of living organisms or their product for the benefit and welfare of human being is called biotechnology. The term biotechnology was first used by Karl Ereky in 1917. The history of biotechnology is as old as human civilization. The preparation of curd, ghee, wine bear, and vinegar in homes is traditional biotechnology. The modern biotechnology started during First World War. Germany was deprived of the supply of vegetable fats necessary for glycerol production. From this glycerol explosives were made by Germans. So Germany started fermentation of plant materials by yeast as an alternative source.

RECOMBINANT DNA AND GENE CLONING:

The introduction of genes from one organism into the genome of another organism is called Recombinant DNA technology. Recombinant DNA is artificially produced. Recombinant DNA is artificially produced with the help of:
Gene of interest which is to be cloned.
Restriction enzyme or molecular scissor.
Ligase enzyme or molecular glue.
Vector
Expression system

ISOLATION OF DNA OR OBTAINING GENE OF CHOICE:

The first step in gen cloning is to obtain a gene of interest from a healthy organism.
DNA isolated directly from laboratory from an organism.
DNA made in the laboratory fro mRNA.

RESTRICTION ENZYME:

Gene can isolated from the DNA by using restriction enzymes. These enzymes cut the DNA into many small fragments. One of these fragments carries the gene of interest. The restriction enzyme creates sticky ends on the DNA fragments. These enzymes are specific in their recognition and cutting action. These enzymes cut specific base sequence in DNA molecule. In 1970 Hamilton D.Smith isolated the first restriction enzyme. They are called restriction enzymes because they restrict the growth of viruses. These enzymes protect bacteria from viral infection. About 400 different such enzymes have been isolated out from bacteria.

VECTOR:

The body which transfers the DNA molecule into another living body or host cell is called Vector. The isolated gene is then transferred into the vector. The vector may be of different kinds e.g. plasmid, pheges etc. The most common vectors are plasmids. Plasmids are small circular DNA ring present in bacteria. The plasmid ring is cut open by restriction enzyme. The DNA fragment is mixed with the open plasmid ring. The gene of choice attaches itself to the sticky end of plasmid.

LIGASE ENZYME:

This enzyme joins the DNA fragment with open ends of plasmid by covalent bonds and closing the ring again. This form recombinant DNA or chimaeras DNA.

EXPRESSION SYSTEM OR VECTOR:

When bacteria are kept with calcium chloride ($CaCl_2$) they absorb recombinant DNA. This bacteria is called expression vector. Both bacterial cell and rDNA multiply by cell division. The gene of choice will express itself by producing the desired protein in the bacterial cell. For example; a bacterium containing human insulin gen it will synthesize human insulin hormone.

DNA FINGER PRINTING:

A technology which help in the identification of individual at genetic level is called DNA finger printing. About 99 % DNA is similar in all human being. Only a short portion is differ in each person. This sequence is 20 – 40 bases long which is repeated several times. These bases are called Restriction Fragments Length polymorphism. RFLP was first isolated by A.Wyman and R.White in 1980. DNA fingerprinting was developed by Jeffery's in 1984 by using RFLP.

BASIC REQUIREMENTS:

DNA fingerprinting require the availability of biological sample such as: Skin cells, few blood drops, semen, bone marrow cells, hair with its root.

METHOD:

The DNA is isolated from the blood semen or other cells. This DNA is cut into fragments by restriction enzymes. DNA fragments are separated by electrophoresis. Double stranded DNA is separated into single strand by heating. A copy of fragments is transferred to a nylon membrane. A radioactive P32 single stranded DNA probe is added to the DNA bands on nylon membrane. X – Ray film is laid over the nylone membrane. The radioactive probes on the DNA develop images or prints on the film. In this way finger print of DNA is obtained called autoradiograph.

PRACTICAL APPLICATION OF DNA FINGERPRINTING:

Parenthood Dispute: DNA fingerprinting help to solve the problem of paternity and maternity (father + mother) child dispute.
Personal identification: This technology helps in the classification of different organisms.
Immigrant dispute: it can also be used for confirming legal nationality.
Criminal Identification: It helps in the identification of criminals. The DNA of suspect is compared with the DNA isolated from skin cells, DNA from a blood or hair left at the place of crime. Similarly DNA from a single sperm is enough to identify a suspected rapist.

TRANSGENIC PLANTS:

Those plants in which foreign gene have been inserted by genetic engineering are called transgenic plants. Transgenic plant will help in improving the health of

malnourished people in poor countries. Transgenic plants are used by the scientists for the production of:
(i) Antibodies (ii) Protein (iii) Vitamin and (iv) Polyhydroxybutyrate used in the preparation of biodegradable plastic. Some transgenic plants are as follows:

GOLDEN RICE:

This rice contain high amount of provitamin – A. it show resistance to viral diseases.

FLAVR SAVR:

Transgenic tomato having tough coat (epicarp). These tomato can be store for longtime.

NEW LEAF:

This is transgenic potato showing insect resistance

ROUNDUP READY:

This transgenic plant produce enzyme which detoxify herbicide.

BOLL GARD:

This transgenic cotton produces an insecticidal toxin and kill many insects but harmless to bifacial insects.

TRANSGENIC ANIMALS:

Those animals which are produced by the introduction of foreign functional gene in zygote stage are called transgenic animals. Transgenic animals can be used as Bioreactors for large scale production of valuable recombinant chemicals such as; Protein, hormones, interferon's etc. The main purpose to produce transgenic animal is:
To produce new animal products
More wool production in transgenic sheep.
Increase growth rate of livestock.
To Study genetic disease model.
Increase feed utilization and disease resistance.

HUMAN GENOME PROJECT:

An international research effort to amp and sequence the genes of entire human genome is called human genome project. Human genome project was started in 1990 in U.S.A. This project completed in thirteen years.

OBJECTIVES OF HGP:

Identification of all genes (30000 – 35000) in the human DNA. Storing of this information in a data base. Locating the 50,000 – 100,000 genes within human DNA.

GENE THERAPY:

The introduction of normal gene is place of defective gene in the patient body is called gene therapy. OR A technique in which an abnormal or defective gene is

replaced by a healthy and dominant in the patient body is called gene therapy. The first gene therapy experiment was done in 1990 in a four year old girl suffering form sever immunodeficiency disease called adenosine deaminase deficiency. The main goal of gene therapy is to cure all genetic disease. It can also be used to study cell functions.

TYPES:

SOMATIC GENE THERAPY:

The introduction of functional gene into the somatic cells of the body.

REPRODUCTIVE GENE THERAPY:

The introduction of functional genes into germ cells or zygote to correct the genetic defects in the offspring.

STRATEGIES FOR GENE TRANSFERRING:

Gene can be transfer into the cells by the following method:

MICROINJECTION:

Used to transfer gent into, oocytes, eggs, embryos.

GENE GUN:

Used to transfer gene into tissues such as; liver, skin, muscles.

DETERGENT MIXTURE:

Dextrin or liposome's can also be used for gene transfer.

VIRUSES VECTORS:

Different harmless viruses are also used as gene transfer vectors. e.g. inactivated retroviruses.

METHODS OF GENE THERAPY:

Two methods are used in gene therapy.

EX VIVO GENE THERAPY:

The transferring of gene into the patient cell outside the body is called ex vivo gene therapy. The main steps in ex vivo are;
Normal gene is isolated and is cloned. Gene is inserted in retrovirus vector. Bone marrow cells are taken from patient with genetic defect. Marrow cells are infected with retrovirus. These infected cells are returned to the patient by injection in into a vein.

IN VIVO GENE THERAPY:

The transfer of gene into the cells inside the patient body is called in vivo gene therapy. Main steps in this gene therapy:

Normal gene is mixed with liposome. This mixture is spread over the surface of defective organ. Liposome widens pore size of the cell membrane. The gene in liposome enters the body cells.

AMNIOCENTESIS:

A diagnostic method in which fluid is taken by a needle from fetal sac for tests is called amniocentesis.
The test of this fluid shows us the following defects.

Down's Syndrome: Chromosomal disorder.

Spina bifida: Vertebrate fail to attach with each other.

Ancencephaly: missing or incomplete brain.

Sex of the baby: male or female baby.

To determine Rh incompatibility or infection.

APPLICATION OF BIOTECHNOLOGY IN AGRICULTURE AND MEDICINE:

Biotechnology has great use and application in the field of agriculture and medicines.

BIOTECHNOLOGY IN AGRICULTURE:

Pests and herbicide resistant Some plants like corn, cotton, potato, and soyabean have been produced that both insect and herbicide resistant. Because their cells now can produce toxin.

SALT TOLERANT:

Salt tolerant plants have been developed which grow on salty soil. Improving Food Quality: Biotechnology had improved food quality in many crops. Soybean produced oleic acid, vernolic acid, recinolic acid. These acids are used in paints and plastic to make them.

PRODUCING BIODEGRADABLE PLASTIC:

A weed called mouse eared cress has been developed that produce biodegradable plastic.

BIOTECHNOLOGY IN MEDICINE:

HORMONES PREPARATION:

Biotechnology is also used in the production of certain hormones such as growth hormones insulin.

VACCINE PREPARATION:

Biotechnology is also used in the production of certain hormones such as growth hormones, insulin.

ANTIBODY PRODUCTION:

One type of antibody made by corn can deliver radio isotopes to tumor cells. Transgenic soybeans made antibodies which can be used for treatment of genital herpes.

GENE BANK:

Gene bank is a facility to conserve individual tissue or reproductive cells of plants or animals. The function of gene is not easy to study because there are thousands of genes. But one can study only one gene at a time in one experiment. A new technology has been developed called "DNA Microarray". In DNA microarray a single chip can have whole genome of an individual. Thus researchers are able to now the interactions among thousands of genes at the same time. The DNA microarray can be seen on the screen as DNA as DNA fingerprinting.

Chapter 10

EVOLUTION

THEORY OF ORGANIC EVOLUTION:

According To this theory once life appeared on earth. It evolved slowly that means a species slowly changed into new species whether its original stocxk may persist or vanished.

LARMARK'S THEORY OF EVOLUTION:

According to the landmark
The life is created long ago in a simple state., has gradually improved due to its environment. Hence The theory is called as landmarck's theory of inheritance
This theory is based on three factors.
Influence of Environment
Use and disuse of Organs
Inheritance of Acquired characters

WEISMANN'S THEORY:

The male gametes fuse with the female gamete forming zygote. The zygote during its development give rise to two types of cell.

THEORY OF NATURAL SELECTION DARWINISM:

It is a matter of common observation that all animals have high rate of reproduction. For example A single codfish lays 5-7 million eggs in a single season.

A starfish produces one million eggs in a year. The elephant which is the slowest breeder in its 90 years life time produces six young.

NATURAL SELECTION OR THE SURVIVAL OF THE FITTEST:

Those individuals that posses the most favorable combination of characteristics are most likely to survive and reproduce passing their traits to next generation

FORMATION OF NEW SURVIVAL:

The survivors of one generation becomes the parent of next generation to which they transmit their favorable variations

OBJECTION TO DARWIN'S THEORY:

- Darwin's theory was so reasonable and was accepted by many biologists yet some objections were raised.
- Darwin did not clearly differentiate between heritable and non heritable variations
- He emphasized the role of minor variations while mutation plays an important role in evolution.
- Darwin has no explanation for the presence of natural variation.

- The theory explains. The survival of the fittest but does not explain the arrival of the fittest.
- Darwin could not tell the cause of variations.

DE-VERIES THEORY OF MUTATION:

A dutch botanist Hugo de-varies purposed mutation theory.

According to this theory new species suddenly through mutation and not by accumulation of small fluctutation variations extended over many generations. Mutation is due change in germ cells and are heritable while fluctuating variation occurs in somatic cells and are non heritable, so mutations are the cause of evolution. De-varies assumed that new species appear as mutants but natural selection only determines whether these new forms will survive or not.

EVIDENCES IN FAVOUR OF ORGANIC EVOLUTION:

In favour of evolution a number of evidences were given. Which are as follows:

1. **EVIDENCE FROM FOSSIL RECORD PALEONTOLOGY:**

A fossil is a trace of life of past birds evolved from reptile can be proved from Archaeopteryx. Archaeopteryx was a fossil bird which was discovered in 1861 in Germany. The bird had lived some 150 billion years ago. Archaeopteryx shows bird like and reptile like characters.

REPTILE LIKE CHAREACTERS:

- It has teeth.
- It has tail with 20 vertebrae.

BIRD LIKE CHARACTERS:

- It is of the size of crow.
- It has wings containing fingers with claws.

So, Scientists believe that birds have evolved from reptiles and Archaeopteryx is connecting link between birds and reptiles.

2. **EVIDENCE FROM CLASSIFICATION (TAXONOMY):**

The plants and animals are classified according to their characters. The closely resembling species are put into genera, genera into families, families into class and classes into phylums.

EXAMPLE:

All members of phylum chordate have a notochord, nerve chord and Gills slits at least in their embryonic stage. These resemblances in different groups of chordates can be assumed in their common ancestors in the past.

3. **EVIDENCE FROM HOMOLOGY:**

The animals of a group, show similarity in their fundamental plane of structure. They may differ in their outward appearance under the stress of environmental conditions. For example. If we examine the arm of man, fiber of whale, the wing of a bird, the four legs of horse, we see that they are of different shapes to meet the different needs but their anatomy is similar having same type of muscles and bones. Biologists believe that homology indicates their common origins.

4. EVIDENCES FROM VESTIGIAL ORGANS:

Vestigial organs means the organs which are of no use, but they persists in reduced form, from generation after generation.

5. EVIDENCES FROM COMPARATIVE EMBRYOLOGY:

Detailed comparative embryological study shows similarities between various groups of animals.

6. EVIDENCES FROM DOMESTICATION:

Domestication means artificial selection is breeding provides evidences for evolution.

EXAMPLE:

Vast diversity has been achieved, domestic dogs and pigeons by artificial selective breeding procedure over a short period of time by man. This is the evidence that evolution is possible.

HARDY WEINBERG LAW:

An English mathematics named hard hardy and German physician Weinberg in 1980described the relationship between allel's frequency and genotype. According to this the frequency of dominant and recessive allele remains constant in a population.

ENDANGERED SPECIES:

The species facing a sever problem of survival are considered an endangered species. After some time such type of species will disappear from the nature. This disappearance of species known as extinction. The main reasons which threatens them is the deforestation, some time the barrier which prevents them from breeding, and also in some other cases aggressive nature of the organism itself leads to their extinction. In Pakistan certain animals are considered as endangered animals they may extinct such as, Tiger, Asian Leon, Indian Rhino cheer pheasants, crocodile, Gazal (Deer) etc.

The animals which are near to extinction are:

(1) Indus Dolphin

(2) Black Buy

(3) Leopard

(4) Bonbara bustard

(5) White headed Duck

(6) Great Indian bustard

(7) Marbled teal

(8) Sundh Ibex

(9) Green turtle

Chapter 11

ECOSYSTEM

LEVELS OF ORGANIZATION:

The ecological studies begin tith the group of organisms and ends on ecosystem. Living organism are unable to live separately with out their surrounnding. They cannot survive in hostile status. They get their requirements from their environment living organism interact with living and non living component present in their environment

ECOLOGY:

Ecology is derived from a greek word oikas means home and logos means to study so we can say that thus ecology is the study ff the relationship between the living organisms to their environment and to each other

INDIVIDUAL:

Single member of a population is koown as individual. The structure and physiology of an individual has to be studie in order to understand that how it is adapted to its environment.

POPULATION:

A population is a group of members of a single species that live togather in the same area at the same time. A population of particular locality is well adapted to its surrounding

COMMUNITY:

A community consists of all the population of different species living and interacting together within a certain area.

ENVIRONMENT:

All conditions in which an organism lives is called environment. The conditions include, temperature,soil,water,vegetation and animals

HABITAT:

The type of environment in which a particular organism or population lives. For example fresh water habitat, land habitat. The population or organism is influenced by enviromental conditions such as rain fall, temperature, soil composition or topographic factors or by biotic factor

BIOMES:

A major regional community of plants and animals with similar life, forms environmental condition is called biomes. It is the largest geopraphical biotic unit

and is named after the dominant type vegetation such as tropical rain forest, grass land.

BIOSPHERE:

The different ecosystem whether terrestrial or aquatic are linked togathr and collectively constitute a giant ecosystem called biosphere or ecosphere. The biosphere consist of earth's surface with few meter depth, water and air capsule which is about 20km surrounding the earth. No living organism can survive outside biosphere.

APPORACHES OF ECOLOGY:

Ecology is the study of relationship of living organism to their environment. We can study the ecology by various approaches same of them are as follows.

AUTO ECOLOGY:

When we are studying a single population relationship to its environment. It is called autecology for example we study 50 to 100 plants of mango for effect of water pollution on their yield. We are studying single population this is autoecology.

SYNECOLOGY:

In this approach we do not study individual species instead we study the entire community and its environment. It is study of various communivies and their relation between themselves and their environment.

ECOSYSTEM APPROACH:

In this approach we study the living organisms and their non living environment in term of their interaction. Coordinate, flow of energy and cycling of matters. Ecosystem is a functional unit it is as smaller as a pond ecosystem and as larger as a whole world

ECOSYSTEM:

It is structural and functional unit of community which shows relationship between flow of energy and cycling of matters in between biotic and abiotic component.

COMPONENTS OF ECOSYSTEM:

ABIOTIC COMPONENTS:

abiotic components include
Light, temperature, water, atmosphere and wind, fire

BIOTIC COMPONENTS:

The living things in an ecosystem are considered as biotic components. The biotic components are two types
Producers
Consumers

TOPOGRAPHIC FACTOR:

Topopiaphy means external features of soil such as altitutde, slope, latitude, exposure and direction of mountains. The topography has great influence on distribution of organisms

EDAPHIC FACTOR:

Factors pertaining to the composition and condition of soil are called edaphic factors. The scientific study of soil is callf pedology.soil is link between living and non living componemts of terrestrial ecosystem the soil consists of two layers Top soil, sub soil

BIOTIC COMPONENTS:

PRODUCERS:

The plants are considered as producers which are Autotrophs.

CONSUMERS:

Animals, fungi and bacteria are consumers and they are heterotrophs.

DECOMPOSERS:

Saprotrophic fungi and bacteria are decomposers. They drive their energy by decomposing dead remains of dead organism. Decomposers use some nutrient from dead organism while rests are added to this environment so they play an important role in recycling of nutrients.

BIOGEO CHEMICAL CYCLES:

All organisms require a variety of organic and in-organic nutrients carbon, hydrogen and oxygen are necessary for photosynthesis which they get from water and air. They also require Nitrogen, Phosphorus and other minerals. Nitrogen is essential for protein formation Phosphorus for ATP and these minerals are required over and over again by autotrophs. The path way by which nutrients are transferred from environment to organisms and organisms to environment so the out flow and in flow of these elements is constant and regular and are in cyclic manner are called biogeo chemical cycles.

NITROGEN CYCLE:

INTRODUCTION:

Nitrogen is an important element needed by plants and animals. It is an important constituent of protoplasm, protein, chlorophyll, DNA, and RNA.

SOURCE:

The only source for Nitrogen is atmosphere which contain 78% Nitrogen. It is not directly taken in by plants and animals.

CYCLING PROCESS:

First the atmospheric nitrogen is transformed into nitrates by the following methods.

LIGHTENING:

During lightening, an extremely high temperature is generated by which Nitrogen combines with oxygen forming nitrous and nitric oxide gases. These gases are dissolved in rain water and form nitrous and nitric acid. These acids are soaked in soil and react with other chemicals forming nitrate.

NITROGEN FIXING BACTERIA:

Bacteria of this types use carbohydrates and atmospheric nitrogen and form nitrate compounds which are released in soil, such process is called Nitrogen fixation.
Some bacteria obtain carbohydrates from soil humus. Some live in root cells and cause tiny swellings called nodules. These bacteria release nitrates into plant tissues and soil.

RELEASE OR RETURN OF NITROGEN:

TRANSFORMATION OF PLANT AND ANIMAL PROTEIN:

Saprophytic bacteria and fungi decompose plant and animal proteins. In this process, ammonia is released which is immediately dissolved in soil water. This ammonia combines with soil chemicals forming various ammonium compounds which are converted into nitrates by nitrifying bacteria.

NITRIFYING BACTERIA:

These are of two types.

NITRITE BACTERIA:

These bacteria convert soil ammonium into nitrite (a less oxygen in their molecules).

NITRATE BACTERIA:

These bacteria combine nitrite with oxygen and form nitrate. By this process, nitrogen of protein is made available to plants. The same series of bacteria make nitrate out of nitrogen containing compounds like animal's feaces and urine. Lightening and nitrifying bacteria replace nitrates removed from soil by plant roots.

DENITRIFYING BACTERIA:

These bacteria remove nitrogen form soil nitrate and return it to atmosphere as a gas. These bacteria are present in water logged areas and are anaerobic type. Denitrifying bacteria obtain energy by breaking down nitrite and nitrates in soil nitrogen and oxygen gases. These gases pass into atmosphere where the nitrogen is no longer available to plants.

INTERACTION AND INTERDEPENDENCE OF ORGANISM:

Living world needs a regular flow of energy. Organisms interact and inter-dependence between organisms may be:

Useful to both partners
One partner get benefit and other is harmed.
Beneficial for one partner and other remain unaffected.
Interaction and interdependence between organisms may be of following type:

Predation
Parasitism
Symbiosis
Grazing

PREDATION:

When members of one species eat those of another or same species is called Predation. An animal that preys on other animals for food is called predator. The animal that is caught and eaten is called prey. A predator animal is often larger than its prey. Predators select food on the basis of size and strength of prey. If prey population increases it will support more predators. If the prey is killed in large number, the predator's population will also decrease. Predation maintain the biological fitness of the two populations and stability of ecosystem. The presence of prey in an area without its predator is disastrous.

PARASITISM:

Parasitism is a one sided relationship between two dissimilar organisms in which one is benefited and the other is harmed. The organism which get food, and shelter is called parasite. The organisms which provide food and shelter is called host. In parasitism the weak takes benefit from the strong. The parasite may or may not harm the host. Diseases in living organism caused by parasites are called infestation. Most parasite infect only a specific host. Parasite may be:

VIRAL PARASITES:

Such as plant and animals viruses.

MICROBIAL PARASITES:

Such as bacteria, fungi, protozoan etc.

PHYTOPARASITES:

Such as plant parasites.

ZOOPARASITES:

Such as animal parasites.

ECTOPARSITES:

They live outside the host's body e.g. leeches

ENDOPARASITES:

They live inside the host's body e.g. liver, fluke.

PARTIALPARASITES:

They spend only a part of their life cycle as parasite.

PERMANENT PARASITES:

They spend their entire life as parasite.

SYMBIOSIS:

Symbiosis is an association between two dissimilar organisms which live together for mutual benefit. Symbiosis means "living together" This type of association may be continuous or transitory obligate or facultative. There are two types of symbiosis.

Mutualism
Commensalism

MUTUALISM:

The symbiotic association in which both the partners get benefit and neither can survive without the other is called Mutualism.
Following are some of the examples of mutualism.

ROOT NODULES:

In root nodules of legume plants nitrogen fixing bacteria (Rhizobium) live. The bacterial fix atmospheric nitrogen for the roots. The root provide food and shelter to the bacteria.

POLLINATION:

Certain insects such as bees and butterflies get food from the nectar of plants and in return bring about cross pollination.

LICHENS:

The symbiotic association between algae and fungi is called lichen. The fungus absorbs water and minerals. Algae prepared food by photosynthesis. Neither of the two can grow independently.

CELLULOSE DIGESTION:

A flagellate protozoan Trichonympha lives in the intestine of wood eating termites where it digests cellulose. The protozoan gets food and shelter from termite. A similar relationship occurs between cow and bacteria.

COMMENSALISM:

In this type of relationship only one partner get benefit while the other member neither benefited nor harmed. Following are same of the examples of commensalism.

EPIPHYTES:

Epiphytes are the plants growing on other plants. They use other plants only as support. Tree is neither harmed nor benefited.

BARNACLES AND WHALES:

Barnacles attached to the backs of whales and turtles, get a free ride to better feeding places.

CRABS AND SEA MUSSELS:

Certain crabs live in the mantle cavities of sea mussels for protection.

SHARKS AND REMORAS:

Remoras are small fish which attached to the body of shark. As the shark feeds, the remoras pick up the scraps. The remoras benefit from this relationship the shark is not affected at all.

GRAZING:

Grazing is the relationship between herbivores and the grasses of grassland. Animals that feed on grasses are called grazers. Cows, sheep, horses etc, are all grazers. Significance: Grazing is useful as well as harmful. Some of its effect is as under. Grazing help is shaping the grassland ecosystem. Grazing removes the seeding and reduces the competition in grassland. It provides secondary productivity like meat and milk from the sheep, goat etc. Overgrazing destroys the grassland ecosystem and converts it to desert. Trampling by grazing animals make the soil compact and makes it unsuitable for vegetation.

SUCCESSION:

A long term process of gradual changes in the community structure over a period of time is called Succession. The term succession was first used by Hult in 1885. Cowles in 1899 laid the foundation of successional studies. Clements elaborated the principles and theory of succession. Succession is unidirectional process. Succession is initiated by hardy invaders called pioneers. These species are gradually replaced by others. In succession the final stable and mature community is called climax.

CAUSES OF SUCCESSION:

The causes of succession may be:

CLIMATIC:

Such as flood, fire, erosion, volcanic activity.

BIOTIC:

Such as activity of organisms like overgrazing, human activities.
All these causes destroy the existing populations in an area.

TYPES OF SUCCESSION:

The succession may be of the following two types.

Primary Succession

Secondary Succession

PRIMARY SUCCESSION:

The succession occurring for the first time on an originally bare area is called primary succession. It start on bare rock, river delta, glacial debris etc.

SECONDARY SUCCESSION:

The kind of succession occurs in the area where the vegetation has been destroyed is called secondary succession. It usually starts after forest fire, cutting of the trees, flood and erosion. The pace of the secondary succession is faster than the primary succession. Depending on the habitat succession may be.

HYDROSERE:

Succession that starts in aquatic environment

MESOSERS:

Succession that starts in area with sufficient moisture.

XEROSERE:

Succession that starts on a dry soil or habitat.

HYDROSERE:

This type of succession occurs in ponds, pools and lakes and they are ultimately converted to land community. Succession occurs both in plants and animals. It is much visible in plants. The serial stages of hydrosere in a pond are as follows:

PHYTOPLANKTON STAGE:

Algal spore along with soil particles is brought by wind deposited on water so unicellular and colonial planktonic forms are first invaders of water and are called phytoplankton stage.

SUBMERGED STAGE:

When the phytoplanktons and zoo planktons settle in the bottom and make the soil suitable for growth of rooted hydrophytes. The plants of submerged hydrophytes are hydilla, potamegeton, vallisnaria and elodea, first inhabitate a pond. The pond animals are blue fish, sun fish and daphnia. When these organisms die, they are decomposed and release nutrients.

FLOATING STAGE:

The death and decay of submerged plants in ponds becomes suitable for rooted plants. Their leaves floats on the surface of water. The example of such plants are nymphea, eichornia and trapa. Some free floating plants can also be seen at this stage, like azolla, lemma and pistia. Most of these plants loose water by transpiration so the level of water in ponds is reduced. Among the animals hydra, snail, frog, diving beetles are common.

REED SWAMP STAGE:

This stage is also referred as amphibian stage. The example of such plants are typha, polygonum, phragmites and sagitaria. In these plants, roots are fixed in the bottom but most of their parts are above the water table. Due to this, the death and decay of these plants make pond more shallow. Their stem is rhizome type and they form thick vegetation. Among the animals, lymnea, phyase water scorpions and gaint bugs are common examples.

SEDGE MEADOW STAGE:

Continuous decrease in water table and favourable changes in substratum makes the pond suitable for plants growth. Such plants have much branched rhizome type stem, dense growth which increases transpiration and it ultimately exposes the marshy soil. The nutrient present in soil are now oxidized to nitrates and sulphates. The common plants of this stage are juneus, cyperus and carex. The animal of this stage are snail like anodonta and psidium.

WOOD LAND STAGE:

The soil at this stage becomes more drier, thus the marshy vegetation disappears and terrestrial vegetation appears like salix (shrub) and populs (tree). The animals at this stage are zebras, deer etc.

CLIMAX STAGE:

The wood land stage is finally invaded by trees. The climax community is dependant upon environment. If there is heavy rain fall, it favours the tropical rain forests but if the rain fall is moderate, then mixed forest is developed.

XEROSERE:

This type of vegetation occurs on bare rocks, land or where there is lack of water and organic matter. These stages are designated on the basis of dominant plants.

CRUSTOSE LICHEN STAGE:

Bare rock and land do not have moisture and organic matter. Lichens are pioneers of this area. Lickens can survive in extreme temperature. They have ability to produce acid which is helpful for weathering rocks and thus produce a better substratum for other species. The common lichens of this stage are rhizo-carpon, rinodine and leccanora.

FOLIAGE LICHEN STAGE:

In this stage, lichens have large leafy structure. It produce shade on crustose lickens as a result their growth is decreased. They also hold up soil particles and make substratum more rich, ultimately layer of soil develops on rocks. The common examples are dermatocarpon, permelia. The animals of this stage are mites, ants and spiders present in the cracks.

MOSS STAGE:

This is the third stage. The thin layer of soil on rock favours the growth of mosses. They require little water and they compete with lickens and due to death of lickens, the soil becomes more rich in nutrients. The example of plant species are polytrichum, grimmia, selaginella. Among animals, mites and spiders are presents.

HERBACEOUS (PLANT) STAGE:

Due to enough accumulation of soil, small seedling of herbaceous plants are established. Xeric conditions are also changed and shallow rooted grasses also develop. More moisture is available. Aristida, poa etc are the example of herbaceous plants and nematodes larval insects and mites are the example of animals.

SHRUB STAGE:

At this stage, habitat becomes more suitable for the growth of shrubs because soil becomes rich in moisture and mineral. The shrubs over shadow the grasses. The common example of shrubs are rhus and phytocarpous. The animals of this stage are slugs, snails, millipede, centipedes, salamanders, frogs, reptiles, birds and mammals like shrew, squirrels and foxes

CLIMAX STAGE:

The soil at this stage is improved up to much extent and now allows the growth of woody plants. First xerophytic plants appear which further converted into mesophytes. Woody plants dominate and at this stage, the succession remains essentially same. If nothing changes in environment to upset the balance because it is a stable stage in succession. The woody forest is considered to be the climax stage of this region.

CHAPTER 12

SOME MAJOR ECOSYSTEM

ECOSYSTEM:

An ecosystem is defined as "An area which include living organism and non living objects which interact with each other. It is regulated by flow of energy and cycling of nutrients".

The ecosystem is divided into two major types:

(A) Aquatic Ecosystem
(B) Terrestrial Ecosystem

An ecosystem is further divided into fresh water habited and marine habit. The fresh water ecosystem can further be divided into two types i.e. standing water or lentic likes ponds lakes and swamps while running water or lotic like river, springs and streams.

POND ECOSYSTEM:

Pond ecosystem is an example of fresh water ecosystem. The pond water is stationary. It may develop behind a dam or near a river.
The life span in a pond ranges from few weeks to several hundred years.
Following are the basic components of pond ecosystem.

ABIOTIC COMPONENTS:

The primary productivity of pond ecosystem is various nutrients.

MACRO NUTRIENTS:

The common macronutrients present in pond are C, H, O, K, Mg, and S.

MICRO NUTRIENTS:

The micronutrients present are Fe, Mn, Cu, and Zn.

- These nutrients play major role in building up protoplasm.
- These nutrients enter in pond from surroundings.
- These nutrients also regulates the rate of functioning of entire ecosystem.

BIOTIC COMPONENTS:

The biotic components consist of:

PRODUCERS:

The pond water favours particular type of plants which are autotrophic and may be of two types:

i. MACROPHYTES:

They may be of three types:

LARGE ROOTED PLANTS:

Large rooted plants like Typha Sagitaria occupying the outer most zone of pond.

ROOTED PLANTS (PARTIAL, SUBMERGED):

Rooted plants with floating leaves, like Nymphae (water lilies).
Lotus, Echornia and water hyacinth.

SUBMERGED PLANTS:

Submerged plants like Hydrilla, potamgeton vallisnaria and Trapa.

ii. MICROPHYTES (PHYTOPLANKTONS):

These are the minute floating plants like, chamydomonos, nostoc and Diatoms. They are distributed throughout the pond where light can penetrate. The presence of microphytes give greenish appearance to pond water.

CONSUMERS:

Many types of animals are also present in a pond ecosystem.

i. PRIMARY CONSUMERS:

The primary consumers are herbivores which includes zooplanktons like crustaceans and rotifers which feed on phytoplankton.

ii. SECONDARY CONSUMERS:

The secondary consumers include living beetles, carnivore fishes etc.

iii. TERTIARY CONSUMERS:

Among the tertiary consumer turtle is an example.

DECOMPOSERS:

The decomposers are aquatic bacteria, and fungi distributed throughout the pond. They are abundant at the mud water, where the dead plants and animals remains are accumulated. The bacteria and fungi decompose them and the nutrients present in them are released for reuse by the plants.

MARINE HABITAT:

Ocean is the greatest reservoir of living organisms along with nutrients. It covers 70% of earth surface. The seas are continuous, however factors like, salinity, temperature and depth restricts animals and plants in particular areas.

Generally sea water contains 3.5% salt. Red sea has 4.6% and Baltic sea has 1.2% however even this percentage varies from sea to sea. The average temperature of sea is 32°C. The temperature also varies from sea to sea.

The concentration of nutrition also varies.

Horizontally sea can be divided into two parts.

1. Neritic Region
2. Oceanic Region

Vertically the sea can be divided into 3 zones.

1.EUPHOTIC ZONE:

Where light can reach and plants can prepare their food.

2. BATHYAL ZONE:

It ranges to the depth of 2000 meters, and again consists of (i) Pelagic (ii) benthic zone.

3.ABYSSAL ZONE:

The sea below 2000 meters depth is called Abyssal zone.

1.NERITIC REGION:

It is a shallow water zone present at the edge of continental shelf. Its depth may be 180 meters. The neritic zone is most productive zone. It gets enough light and contains O2 and other nutrients which are helpful for luxuriant plant growth. The common biotic components are as follows.

PRODUCERS:

The producers are mainly phytoplankton diatoms and algae like Caulerpa, Ectocarpus, Cladophora, Dictyota and Limiaria. The plants also have jelly like substance called agar which absorbs large quantity of water to avoid desiccation.

CONSUMERS:

Consumers of this zone are zooplanktons and other active swimmers zooplanktons including Copepods, Protozoan, Jellyfish, Moluses, Echinoderms and various minute worms. Bottom living consumers are sessile or inactive animal. However the distribution of bottom living species differ according to type of bottom whether sandy, muddy or rocky.

DECOMPOSERS:

Bacteria are most abundant in this zone.

2. OCEANIC ZONE:

i.Euphotic or Light Zone
ii.Aphotic or Dark Zone

EUPHOTIC OR LIGHT ZONE:

This zone is more transparent than coastal zone.

APHOTIC ZONE:

This zone is continental slope reaching up to 2000 meters.

PRODUCERS:

The common producers are phytoplankton like diatoms and algae like Caulerpa, Ectocarpus, Dictyota and Cladophora type plants. But this zone has less number of species.

CONSUMERS:

The common consumers are baleen and toothed whales.

DECOMPOSERS:

The animals which feed upon dead bodies are present.

TERRESTRIAL HABITAT (LIFE ON LAND):

Life on land is very different from aquatic life. There are many factors which determine the nature of communities. The factors effecting may be climate, Temperature, Moisture light, Physiology, Gravity and Soil.

Among the ecological factors the climatic factor is most important factor which effects plant and animal life. It is mainly climatic variation that vegetation of different areas is different. The different biomes present are: Tundra, Coniferous Forest, Temperate Deciduous Forests, Deserts, Grassland, Savannah and Tropical rain forests.

DESERTS:

Deserts occur in that regions where there is less than 25cm of rainfall. And even this amount is unreliable and unevenly distributed. There may be frequently rains during one particular year but many years go completely dry.

Due to low rainfall the humidity is less and temperature in summer months may reach to 55°C. Winter is some what better but short. Desert occupy about 17% of land. Surface of earth.

XEROPHYTIC ADAPTATIONS:

- Some plants have shallow root systems them spread below the surface of soil, to absorb water very quickly before it is evaporated.
- Others have deep root system to absorb water from deeper layers of soil.
- The plant organs show succulent characters.
- The leaves fall off to reduce the rate transpiration or become small or leathery.
- Stomata are sunken type or covered by hairs.
- The vegetation of sandy hills consists of Acacia, Euphorhia, Capparis, Calotropis while plants of plains are Prosopis, Capparis and Lycium.

There is also dry forming of sorghum and Bajra.

PRODUCERS:

The common producers of these deserts are xerophytes. For example, Accacia, Prosopis, Salvadora and Caparis. The ground vegetation is Calotropis, Penimeum, Tribulus.

ANIMALS (CONSUMER):

The desert animal shows various adaptations for conserving water.

- Many animals live in burrows where humidity is higher and temperature is low.
- Animals are nocturnal which is a mean to avoid intense heat.
- Many animals don't drink water and rely on the water present in succulent foods.
- Animals have ability to pull on with less water. The common desert animals are:

  Tenebrionidbeetles, Mantis, Grasshopper, Centipedes and Spider like arthropods. Among reptile. Lizards, Uromastics, Calottes and among Snakes, Vipers, Cobra, Kraits and Boas are found. Among birds Quail, Bustard and Partridge are present, Among mammals anteater, headgehog, porcupines, burrowing, rodents, wild cats, wild boars and foxes are present.

DECOMPOSERS:

Decomposers are few due to poor vegetation some thermo bacteria and fungi are present.

FOREST ECOSYSTEM:

Forest occupies roughly 35-40% of land surface of earth. In Pakistan 6% of land is occupied by forests. The forest of the world is classified into three kinds.

(i) Coniferous forests

(ii) Temperate forests

(iii) Tropical forests

CONIFEROUS FOREST:

The conifers are evergreen plants belonging to gymnosperm group. They are found at high altitude, markedly cold resistant.

- Coniferous forests cover more area in northern hemisphere. The area from Alaska to Central America.
- The winters are severe long and are constantly covered with winter snow.
- The Temperature may be as low as 10°C.
- The growing season shrinks to 3-4 months. The common animals and plants are as follows

TEMPERATE DECIDUOUS FOREST:

Deciduous plants are those plants which shed off their leaves during winter season. The deciduous forest may be dry monsoonal (tropical) and moist semi deciduous.

- The average rainfall is about 100cm.
- The summer and winter are quite distinct therefore these area are largely used for cultivation.
- In northern hemisphere they are found in parts of North America, South America, Eastern Asia, Himalaya, Japan and Central Europe.

TEMPERATE DECIDUOUS FORESTS OF PAKISRTAN:

Shogran, Neelam valley and Azad Kashmir are rich in Beech, Oak and Maple.

TROPICAL RAIN FOREST:

Tropical rain forests are those forests where the rainfall is abundant all the year. The annual rainfall exceeds 2000mm. Temperature remains light and constant throughout the year, vegetation is extremely dense.

The tropical rain forests are found in the areas close to equator such as Central Asia, North America, Australia and Africa.

ABIOTIC FACTORS:

Among the abiotic substance the soil is highly rich in organic and inorganic substances. Dead organic debris of plants and animals after decomposition make the soil fertile.

PRODUCERS:

- The large number of species as many as 300 species of different trees are found, which are in the form of thick, jungles, steamy and impenetrable.
- There is a competition among the plants or light which has resulted in the forest being highly stratified.
- Trees which are the main part of forest form three layers.

1. The upper layer consisting of very tall trees about 40 meters in height. It is dense and allows very little light to pass.
2. The second layer consists of trees having 30 meters of height.
3. The lower layer consists of small trees having 20 meters height.

Due to less light to lower area, soil is covered with Hygrophytes epiphytes. These forests are of great economic importance as they are source of timber.

CONSUMERS:

i. PRIMARY CONSUMERS:

Among the primary consumers Ants, beetles, leaf hoppers, bugs spider, monkeys, shrew, bats, mongoose are common. About 85% birds of different species of the

world are found in these forests. Majority of birds feed on seeds, fruits and nector of plants.

ii. SECONDARY CONSUMERS:

Most of these animals live on trees they are found at various levels. Snakes, predatory birds and frog are secondary consumers.

iii. TERTIARY CONSUMERS:

Among the tertiary consumers tigers are not common, snakes and predatory birds are common.

DECOMPOSERS:

The soil of tropical rain forest is very rich in a wide variety of bacteria and fungi. Rate of decomposition is much more than any other soil.

SAVANNAH:

Savannah is a Spanish word (Sabana) means meadow Savannah is a term, applied to any tropical vegetation ranging from pure grassland to woodland with much grass. The grass is much taller than the temperate forests.

- The annual rainfall is upto 125cm.
- Drying season is very long.
- The temperature ranges more than 18°C throughout the year.
- The savannah covers louth Amazon forests of Sudan. East Africa high lands, South America, South India and Australia.
- Due to relatively large dry season an uneven distribution of rainfall, forest can't be developed and varieties of plants and animals can be seen.

GRASSLAND:

- Grassland coves about 19% of earth's surface.
- Grasslands are found where annual rainfall in about 250-260mm.
- Grasslands are found in temperate climate and do not have woody plants.
- Grasslands are open land communities with limited moisture condition, irregular rainfall, sharp seasonal variations and very high radiations.
- Soil of this region has large amount of humus.

GRASSLANDS OF PAKISTAN:

In Pakistan grasslands are fond in Chitral, Gilgit, Waziristan and Kashmir.

ABIOTIC COMPONENTS:

The abiotic substances are inorganic and organic substances found in soil and atmosphere

PRODUCERS:

Plants of the grassland depends upon the amount of rainfall and it ranges from 150-250cm tall species and grass of 5cm.
The soil of grassland is rich in humus so the grassland is suitable for cultivation of ceral crops like corn, Wheat, oat and barley, so this area is called Breadbasket of the world.

CONSUMERS:

i. PRIMARY CONSUMERS:

Among the primary consumers Buffalos, Cows, Sheeps, Deers, Rabbits, Goats and Antilopes are common. Among the insects grasshoppers locust leafhoppers and beetles are common.

ii. SECONDARY CONSUMERS:

These are the carnivores which are frogs, lizards, snakes, birds of prey foxes, jackals and leopards.

iii. TERTIARY CONSUMERS:

Large carnivores are of cat and dog families.

DECOMPOSERS:

Many bacteria and fungi like molds yeast and mushrooms are common decomposers of grassland.

TUNDRA:

It is used to describe types of vegetation in treeless high latitudes between taiga and polar ice caps and at high altitude across the mountain above timberline such as mountain karokaram and koh hindukush in Pakistan. The ground is carpeted with small perennial flowers and dwarf willows no more than a few centimeters tall often with large lichen called rein deer moss. The standing pools superb mosquito habitat. The mosquitoes and other insects provide food fore numerous birds. The tundra vegetation supports lemmings, which are eaten by wolves, snowy owls, arctic foxes and even grizzly bears.

MAN'S ROLE IN ECOSYSTEM:

Man is carnivorous and is the final trophic level of food chain. If this ecosystem is maintained our food problems can be solved.

PESTICIDES:

Pesticides are used by man all over the world.

- Pesticides not only kills the pests but also their predators, thus after the use of pesticides pests may develop again in ecosystem but their natural enemies are also killed, so pests may cause more harm to the community.

- DDT (a pesticide which is now banned) incorporate human tissues reduces the fertility of eggs, while this may also be lethal to the birds. They enter

in tissue through food chain and accumulate to dangerous limit in consumer, so, excessive use of pesticides is not only harmful for birds but also to plants and animals hence man's role may disbalance an ecosystem.

- Development of pesticide resistant pest has become common so we can only use biological method in controlling them.

- Malaria is very common in most countries. It may be controlled by draining and spraying of oils. But introducing such predators which feed on mosquito is the best biological control.

- Pesticide also effect biological cycles. The bacteria which play important role in nitrogen cycle also kills the bacteria, hence the fertility of soil is reduced which ultimately, effects the productivity of plant on one hand and increases the concentration of ammonia in soil on the other hand, hence ecosystem is effected.

- Excess amount phosphate and nitrate is also toxic, when it is drained off from field to lakes where they enhance the algal growth but after the death of algae O_2 production is reduced which cause suffocation and lake may devoid of animal life.

PHYTOPLANKTON:

Phytoplankton ocean produce large amount of O_2 if ocean water is polluted and phytoplankton will die and O_2 will not be available more over CO_2 ratio will also be disbalanced. This will have a negative effect on human and other living organisms.

THE FLOW OF ENERGY:

The autotrophs and heterotrophs are essential vbiotic components of an ecosystem. The autotrophic are green plants and photosynthesis bacteria which capture sunlight and convert into ATP (useable energy) and store it in food. This food is taken in by heterotrophs hence energy is transferred to animals, fungi and other non green living organisms.

The energy which is absorbed by autotrophic is finally released in space either by loss of heat at various trophic levels or finally by death and decay of living organisms. Thus in an ecosystem flow of energy remains continuous.

CHAPTER 13

MAN AND HIS ENVIRONMENT

ENVIRONMENT:

the environment is a treasure of all types of resources like land, water. air and minerals and forests to sustain human life on earth.

Early man found land amazingly rich in these resources,but human changed this environment by his activities and this environment is not same as it was thousand years back and now there is crisis for all these resources and we can't say that what will be in future,better or worse.

ENVIRONMENTAL RESOURCES:

Environmental resources are the elements of nature which serves as primary resource for existance of humans. There resources are of two types.

RENEWABLE RESOURCES:

These are product of natural system. they replace themselves quickly to keep pace with consumption. these resources are constantly replaced by natural cycle

WATER:

Water is most important natural resource. almost 70 percent of land is covered with water. water comprises 70 to 90 percent of body weight. total estimated water resources of the world is 1500 million cubic kilometer. the ocean water is 93 percent. water in earth crust is 4 percent.

LAND:

Land is an important natural resources and is used in many ways. all the renewable and non renewable resources are related to land. the most striking resources of land are plants and animals. forest are the main sources of timber wood,fuel,cloth and pulp

So many grasslang provide fodder for cattle. Gras land occupies 23 percent of the land in world and cattle provide meat and milk for human food. Only 30 percdnt of earth is land. 11percent of total area of land is under cultivation.

WILD LIFE:

wild life means all the non-cultivated plants and non domesticated animals. unfortunately man is not aware of the role of wild life.

Wild lide plays an important role in balance of nature. Wild plants provide food, clothing,fuel and so many products used in cosmetics,perfumes and pharmaceutical industries

In advances countries wild life is a source of recreation. Wild life is economically important for developing countries. Most of the wild animals are captured by people and they earn money by selling them

ENERGY:

energy forms the basic life support system on the planet earth like other resources, the energy may be renewable or non renewable.

NON-RENEWABLE ENERGY:

by non-renewable energy means fuels which are found on earth in fixed quantity and once they consumed will not be available in future. the non- renewable energy is coal, petroleum, natural gas, tar, oil. and amond the nuclear energy is uranium,thorium,deuterium and lithium.

FOSSIL FUEL:

Coal, oil and gas are collectively known as fossil fuels. they supply us about 95 percent of our energy requirement. the fuel is used in various transport systems,generation of electricity, industry and mechanized agriculture.
they are called fossil fuels because they are remains of plants and animals that lived millions of years ago and formed by the fossilzation of these organisms.

Discovery of coal, oil and gas become valuable to man. Petroleum is natural gas and very important source of energy. Pakistan is wdll sufficient in natural gas. It has large deposits of coal. Extesive drilling for oil is being carried out in various regions which has been sufficiently successful

Fossil fuels are fairly cheap and can be transported easily through pipe lines.petroleum and gas are produced from organic matters which are formed by the decomposition of plant matter.

NUCLEAR ENERGY:

splitting of nucleus of a radioactive atom releases tremendous amount of energy,called nuclear energy or atomic energy.

The process of splitting of the atom is called fission. This energy is used by the scientists to generate electricity in nuclear reactors.

NON CONVENTIONAL RESOURCES:

some non-conventional resources of energy are as follows

GEO THERMAL ENERGY:

It is the type of energy which is produced due to matural radioactive decay in earth core. this energy comes to the surface as hot water springs,hot rocks or streams. the under ground water system may be heated to an dxtent that a high temperature streams at temperature upto 250c may be ejected from below the ground at velocities upto 1640 feet per second.

SOLAR ENERGY:

solar energy is an renewable resource and we would continue receiving it for the remaining life time. the average flow of solar energy on earth's surface is 1400 watts per square meter.sun light can be directly captured and used for heating.

It is economical and even solar air conditioning is being proposed. The solar energy can be stored by solar cells to generate electricity but gt is very expensive, so at large scale it is difficult. The present cost of generating electricity from solar energy is 4-6 times greater than produced by fossil fuels. It is hoped that new technology will bring the cost down. So it can be used as commercial scale.

SOLID WASTES:

It include trash, papers and its products, discarded cartons, organic maures, plastic and polythene material, automobile tyres,bottles,cans, wood trimmings, food,agricultural and industrial wastes. their quantity is million of tons in each country.

They can be converted into oils or gas by hydrogenation,pyrolysis or by bio conversion.

It has been estimated that by burning 400 tons of solid waste 15000 kilo wattt electric power can be produced.

WIND ENERGY:

Wind energy has been used as a source of power generation in the recent past. Wind mills are still in use. In some European countries especially in Holland. Electricity generated by wind mills is only a fraction of that required by any country. Uncertainty of weather, visual pollution due to large number of unsightly wind mill generators over vast area of land and high costs, involved in their setting up, are major problems in the exploitation of this energy sources.

OCEAN THERMAL GRADIIENTS:

In tropical regions the temperature of surface water in ocean is about 25C and at the depth of few hundred meters it is 50C. thus an ocean thermal gradient develops and heat is conducted from region of higher to lower temperature. Technology has been developed to use this difference in temperature to drive a turbine for generation of electricity. However, there are some environmental problems in the use of ocean thermal gradients. Ocean thermal gradient power plants may change temperature of water of different regions of ocean to it is disadvantageous to marine life. Thus disturbing marine ecosystem with for reaching consequences.

TIDAL POWER:

A tidal power station consists of a long barrage called tidal barrage. The difference between height of water at high and low tides causes the flow of water through this barrage, which turns its turbines that in turn drive the generator to produce electricity.

HYDRO-ELECTRIC POWER:

The kinetic energy of falling water is harnessed to turn turbines fixed at the base of dams. The turning turbines will then drive generators to produce electricity, which is known as hydroelectric power or electricity.

ENERGY CONSERVATION:

The use of energy is increasing day by day. Fossil fuel and electricity are the cheapest source and is being used from the last 150 years. But now this source being nonrenewable is exhausting at one hand, while on the other hand it has become very costly.

* Nuclear power is very cheap but it has its own demerits, so we have to develop alternative source for generation of electricity such as solar and wind energy.

* 75% electricity is being wasted through the use of inefficient modern machines and appliances, such as electric motors, heater, air conditioners and refrigerators. These appliances not only water electricity but also produce heat, which is a cause of global warning.

* new bulbs, refrigerator and air conditioners have been introduced which consume less electricity.

DEFORESTATION AND AFFORESTATION:

DEFORESTATION:

Destruction of trees that leaves the soil barren is called deforestation.
It may be for town planning, cultivation or to obtain timber.
It is an important cause of desertification.

AFFORESTATION:

Establishment of new forests where no forests existed previously.
Its beneficial for environment, to make atmosphere pure and healthy.
Desertification can be prevented.

HEALTH AND DISEASES:

To pass a good life a goo environment and balanced nutrition play a very important role in the human health.
There are three basic factors which may cause various diseases in man.

POLLUTION:

The most horrible ecological crisis of this world is pollution.
"Pollution may be defined as undesirable physical, chemical or biological change of air, water and land, that may be harmful to man or other living species". The thing which can change the condition is known as pollutants.

AIR POLLUTION:

The befouling of air by anything that may be harmful to living organisms is air pollution.

SOURCES OF AIR POLLUTION BY BURNING OF COAL, PETROLEUM AND OTHER SOLID WASTE:

By burning the fossil fuel so many poisonous gases are produced such as Sulphur dioxide, Carbon mono oxide, Nitrogen oxide, Bromine, Chlorine, Florine Ozone, etc.

BY AUTOMOBILES:

Automobile plants and transport vehicles produces N2O which after combining with sunlight changes into photochemical oxidant. All these gases produce various diseases like anemia, diseases of heart, respiratory tract, and cancer of lungs. Some other substances like asbestos which is a construction material also effects the lungs. Cigarette smoke pr

ACID RAIN:

Process through which acid fall on Earth either dissolved in rain or as microscopic dry particles is called acid rain.

GREEN HOUSE EFFECT:

Increase in temperature of earth due to retention of heat rays is known as greenhouse effect.

DEPLETION OF OZONE LAYER:

The decline in thickness of the ozone layer is caused by increasing level of chlorofluorocarbons (CFCs), which contains chlorine, fluorine and carbon. As CFCs rise to the atmosphere, ultraviolet rays cause chlorine to release. The chlorine released destroys the ozone molecule in the ozone layer. As the ozone layer becomes thinner, more ultraviolet rays from the sun are able to reach Earth. If more ultraviolet rays reach the Earth's surface, they will affect all life on Earth by increasing temperature. They cause skin cancers and cataracts in human. They can also affect crops, plants, trees and even marine plankton and distort weather patterns.

WATER POLLUTION:

Anything in the water that may be harmful to living organisms is water pollution. Water pollution is caused by three major sources.

i. Domestic

ii. Industrial
iii. Agricultural

LAND POLLUTION:

Land pollution is caused by solid wastes which include house hold trash, sewage, sludge, garbage, agricultural residues and industrial wastes. The solid wastes which are called Hazardous wastes includes Mercury, Cadmium and Beryllium. These wastes cause human illness and some times to death. Nuclear wastes include radio active elements which may cause cancer.
Many chemicals such as sulphur and lead which are present in air come to earth and pollute it.
Many pesticides herbicides and insecticides also pollute the land.

WATER POLLUTION:

Sewage line should be kept away from water line and water lines should be repaired

FERTILIZERS:

There are certain bacteria, which control plant pests. Bacillus thurengensis is one of them. Which kills caterpillars, if spread on crops.

- If nodulated bacteria which fix the atmospheric nitrogen and convert into nitrate, introduced into the roots of other plants, there will be no need of fertilizers hence we can avoid pollution due to fertilizers.

MAN'S IMPACT ON ENVIRONMENT:

Man's activities on the earth are continuously alternating the environment particularly the nonrenewable resources are degrading. These activities are making difficult the survival of human race on earth.

- It has been estimated that the fossil fuel will last only for 2000 years and a day will come when there will be no fuel and yet no alternative has been developed.

- Change in the mode of transportation and emission of CO_2 and industrial gases are responsible for global warming, which could lead to floods and tornados.

- Use of insecticides, fungicide and pesticides reach in soil water and hence soil environment is also changing which will reduce the plant growth. This gradiation of environment is a serious problem and we should adopt such practices to stop this gradiation