Edition 2017

Teacher Notes Series

GREEN HALL
Resource Center

Article # 216

O Level

BIOLOGY

Subject Code 5090

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DHA PHASE 4 | DHA PHASE 1 | GULBERG
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O Level
Biology

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Syllabus 2016 – 18

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- Recording observation
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UNIT-1 CELL STRUCTURE AND ORGANIZATION

1.1 PLANT AND ANIMAL CELLS:

It is a basic unit of structure and function of all living things (Except Viruses). New cells come from division of old cells.

Preparation of a Microscopic Slide:

Preparation of an onion epidermal slide:

- Cut a piece of onion with the help of a razor.
- Remove the epidermis with the help of forceps.
- Place the epidermis in the canter of a slide.
- Pour few drops of Dye / Stain on it.
- Place a cover glass on the mounted material in such a way that the cover glass is held on the pointed tip of a needle and gradually lower it down. So the air bubbles are not trapped.
- Remove the extra stain using blotting paper.

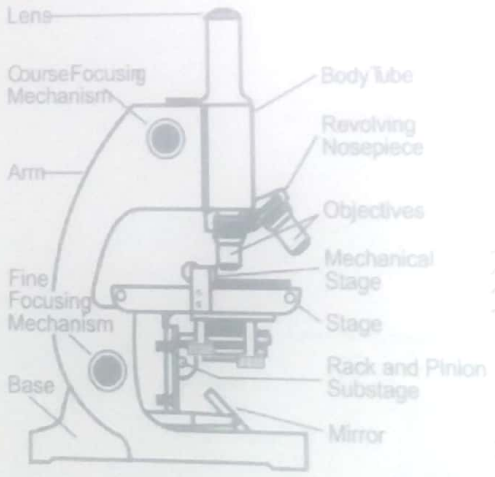
Viewing under a light Microscope:

- Place the slide on the stage.
- Turn on the lamp.
- Adjust the power of the objective
- Looking through the eye piece focus the image by moving adjustment knobs.

Recording observation:

- Take a photomicrograph.
- Draw the outline of the image seen.

Structure of Light microscope:



Label different parts

Different types of cells observed under an ordinary Microscope:

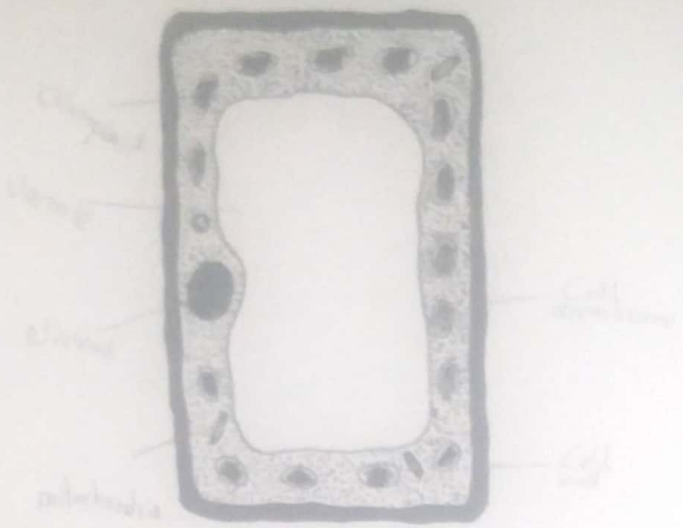
Onion Epidermis:

Animal cells:

Cheek cell:

Nerve Cells:

Mesophyll cell:



Difference between Animals and Plant cells:

- Cell wall is absent in animal cell whereas plant cells have cell wall.
- Sap vacuole is absent in animal cell whereas sap vacuole is present in plant cell.
- Chloroplast is absent in an animal cell where as it is present in a plant cell.
- Nucleus is present in the centre in an animal cell where as it is in plant cells slightly on its side.
- Size of plant cell is big whereas the size of cell is small in animals.
- Starch is reserve food in a plant cell whereas glycogen in an animal cell.

Similarity between Animal and Plant cells:

- They both contain cell membrane.
- They both have cytoplasm.
- They both have nucleus in them.

Components of Cell:

Cell wall:

It is found in plant cells. It is composed of cellulose (A carbohydrate). It is rigid dead layer. It is fully permeable layer which protects a plant cell from bursting and maintains its shape.

Cell Membrane:

It is a partially permeable membrane. Outer most boundary in animal cells. It is beneath the cell wall in a plant cell. Prevents mixing up of the contents of various cells together. Controls the inward and outward movement of substances.

Cytoplasm:

It is a jelly like substance which covers the space between cell membrane and the nuclear membrane. It is a site for chemical reactions e.g. Respiration.

Nucleus:

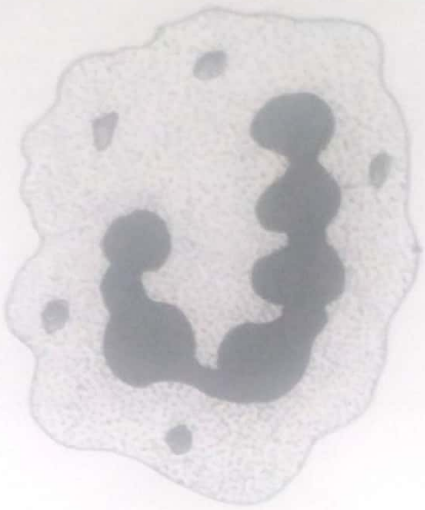
It is densely stain region in the center of an animal cell and slightly away from the center in a plant cell. It consists of a nuclear membrane which is partially permeable. It also contains chromosomes. Chromosomes carry the hereditary materials. Nucleus controls the division of cells.

Chloroplast:

It is found in mesophyll and guard cells in a plant cell. It is double membrane bound cell organelle. Non Living components in the cytoplasm are called inclusions e.g. Starch. Living components in the cytoplasm are called organelles. Chloroplast contains green pigment called chlorophyll embedded in it. Chlorophyll traps the light energy and converted into chemical energy. This chemical energy is used in formation of carbohydrates from CO_2& H_2O by photosynthesis

Magnification:

The following figure is a photomicrograph of a white blood cell.



X 900
Fig.1.1

Draw and label the white blood cell shown in figure 1.1

Measure the Width of the cell in the figure = _____mm
Measure the Width of the cell in the diagram = _____mm
Magnification =
Magnification = X_____

1.2 SPECIALIZED CELLS, TISSUES AND ORGANS:

Cells that have specific shape and perform some specific function are called specialized cells.

R.B.C:

Structural features:

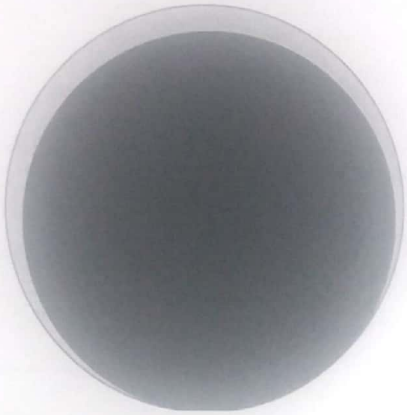
- They are tiny.
- They are flat.
- They are biconcave.
- They lack nucleus.
- They contain hemoglobin.

Adaptation of structure to function:

The advantage of being tiny is that it has large surface so more efficient exchange of oxygen. Being flat they have more surface area and exchange of gases is easy. Being flat they can pass through narrow capillaries. Lack of nucleus provides more room for hemoglobin. Hemoglobin combines reversibly with oxygen to form oxy-hemoglobin.

Lymphocytes:

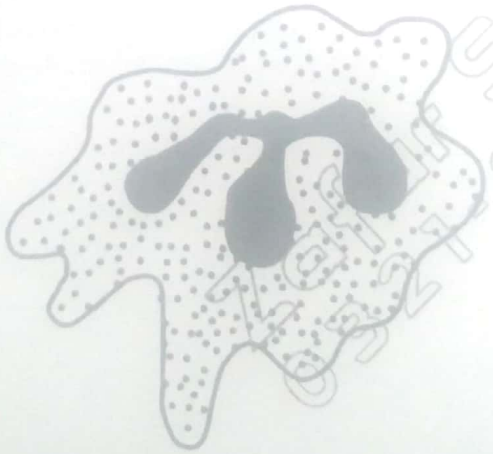
Structural features
- Spherical cell.
- Large central nucleus.
- To release anti bodies (proteins) to fight against pathogens.



Adaptation of structure to function:

The antibodies are specific in their function. They are produced in wide range against variety of pathogens. Many copies of genes are needed for the formation of wide range of antibodies. The lymphocytes have large nucleus to contain many copies of genes.

Phagocytes:



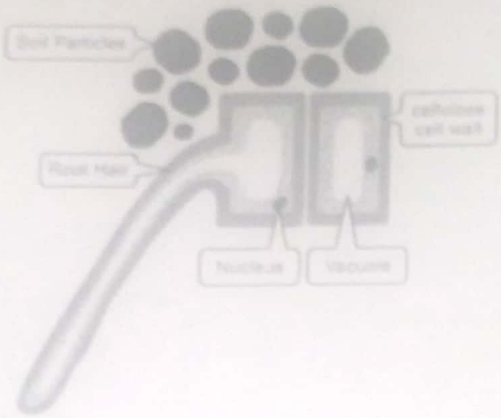
Structural features:

- Irregular shape.
- Lobed nucleus.

Adaptation of structure to function:

Phagocytes can squeeze out of the blood capillaries through narrow pores.

Root hairs:



Structural features:

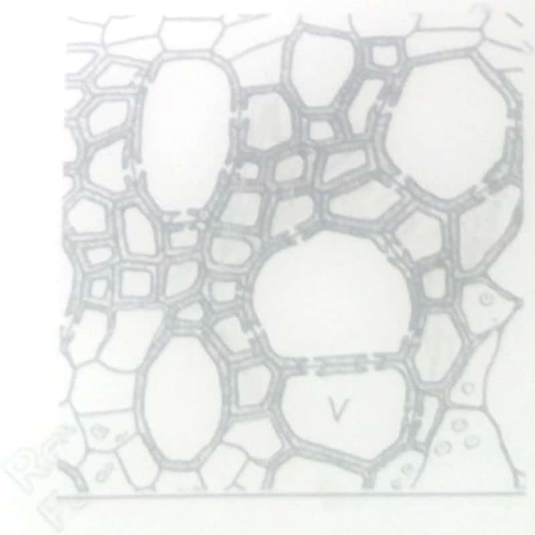
- Elongated.
- Contain cell membrane.
- Cell wall present.
- Cytoplasm present.

Adaptation of structure to function:

Being elongated increases surface area to volume ratio for absorption of water and mineral ions. Cell membrane controls the movement of substances into and out of cell. It maintains concentration gradient between inside and outside. As water moves into the cells it exerts hydrostatic pressure on the cell. Cell wall prevents cell from bursting. Respiration in cell cytoplasm releases energy from sugars which is used for active uptake of mineral ions.

Xylem vessels:

Surface View



Cross Sectional View

Structural features:

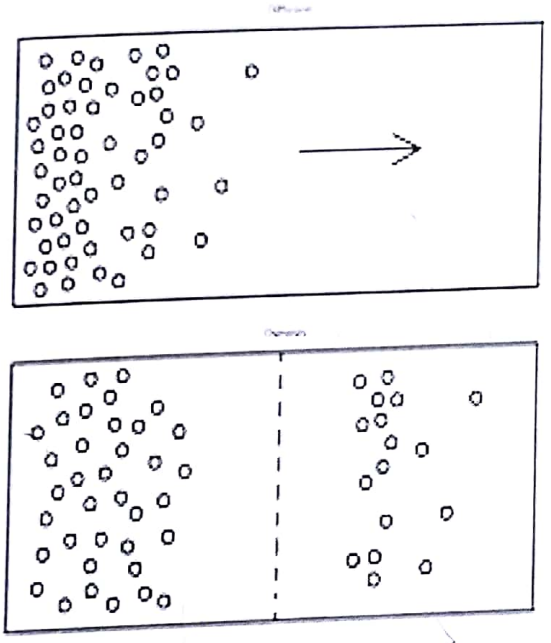
- Cylindrical cells.
- Hollow.
- No cross walls.
- Lack cytoplasm and lack nucleus.
- Lignified cell walls.

Adaptation of structure to function:

Being cylindrical they are joined end to end to extend from roots to leaves. Lack of nucleus and cytoplasm reduces resistance offered to flow of water and minerals. Lignified walls provide strength which provides mechanical support to the plant.

UNIT 2

Diffusion and Osmosis



O Level Biology

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2.1 Diffusion
- Diffusion gradient
- Importance of diffusion

2.2 Osmosis
- Osmosis
- Water potential
- Behaviour of animal cells in solution different concentration
- Behaviour of plant cells in solutions different concentrations

2.3 Active Transport
- Surface area to volume ratio
- Volume:

UNIT-2 DIFFUSION AND OSMOSIS

Transport of Material across the cell:

- Passive Transport.
- Active Transport.

Passive Transport:

It is the transport of substances without the use of energy down the diffusion gradient. The two processes are diffusion and osmosis.

2.1 DIFFUSION:

- The movement of any substance.
- Down the diffusion gradient.
- Without the use of energy.
- With or without partially permeable membrane.

Diffusion gradient:

- The difference in the concentration of molecules of a substance at two regions.

Importance of diffusion:

- Gases exchange between the alveoli and blood capillaries. The exchange of gases between the leaves and the atmosphere.

2.2 OSMOSIS:

- Net movement of (solvent) water.
- Down the diffusion gradient.
- (down the water potential gradient)
- Without the use of energy.
- Through the partially permeable membrane.

Osmosis:

The movement of water molecules from a region of higher water potential to Lower water potential through a partially permeable membrane.

Water potential:

It is the tendency of water molecules to move. Pure water has max. water potential.
Osmosis is the movement of water molecules from a dilute solution to a concentrated solution through partially permeable membrane. If we heat the partially permeable membrane will denature and become fully permeable membrane.

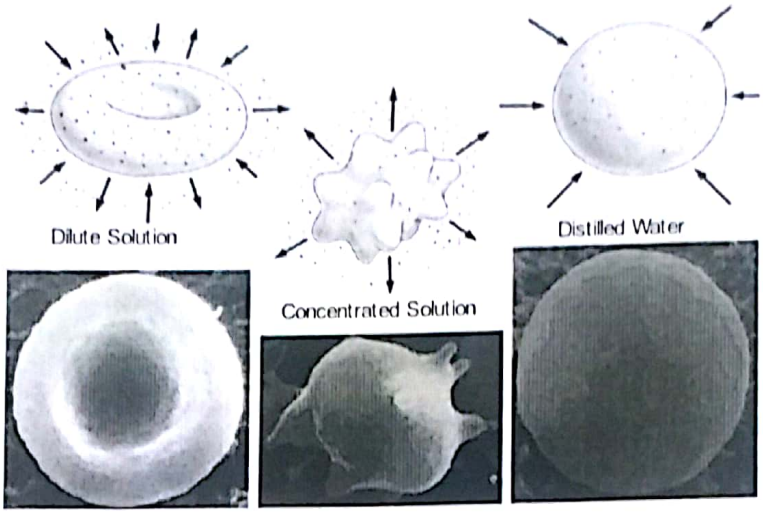
Behaviour of animal cells in solution of different concentration:

Q1. Describe an experiment to investigate the effect of solutions of different concentrations on the animal cells:

- Take three glass slides.
- Place a small amount of material taken from inner lining of cheeks in the centre of each slide.
- Label them A, B, C.
- View each slide under ordinary microscope and draw few cells from each slide.
- Place solutions of different concentration accordingly on each slide.
- Two drops of distilled water.
- Two drops of 10% sugar solution.

- Two drops of 30% sugar solution.
- Wait for fifteen minutes.
- Observe changes in cells on each slide under a light microscope.
- Repeat the experiment and take mean changes.

Q2. Describe the effect of solutions of different concentrations on the animal cells:



In Distilled water:

Animal cells enlarge in size and burst. RBC's disappear.

In dilute solution:
No change

In concentrated solution:
Animal cells shrink and become crenated

Q3. Explain the effect of solutions of different concentrations on the animal cells In Distilled water:

water potential outside the animal cells is higher, water moves into the cells down the water potential gradient by osmosis so animal cell increase in size
animal cells lack cell wall. more water uptake increases hydrostatic pressure in them which causes animal cells to burst.

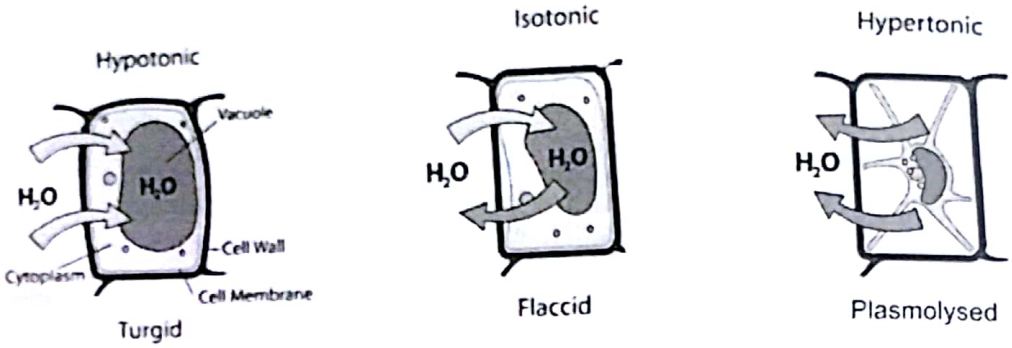
In dilute solution:
water potential outside and inside the cell is same so no net movement of water into or out of the cell.

In concentrated solution:
water potential outside the cell is lower than inside so water comes out of the cells down the water potential gradient by osmosis cytoplasm shrinks, cell decreases in size and become crenated.

Behaviour of plant cells in solutions of different concentrations:

The same experiment is repeated with the plant cells. Now the observations at the end of the experiment are as below.

Osmosis in a Plant Cell



In distilled water:

Water potential outside the cell is higher than inside the cell.
Water moves into the cells by osmosis.
Hydrostatic pressure on the cell walls increases.
Cell wall exerts pressure on the cytoplasm called turgor pressure.
The cell becomes turgid.
Cell wall prevents cell from bursting.

In dilute solution:

No change in the shape and size of plant cells in dilute solution as the cytoplasm of plant cells contain dilute solution of salts and sugar. The water potential inside and outside the solution is the same in dilute solution so no net movement of water into or out of the cell.

In concentrated solution:

Water potential outside the cell is lower than inside so water moves out of the cell. Cytoplasm shrinks and decreases in size. Sap vacuole also decreases in size.. The cell membrane detaches from cell wall. The cell is called plasmolysed and the process is called plasmolysis. The turgor pressure decreases and the cell become flaccid.

2.3 ACTIVE TRANSPORT:

Movement of any substance against the diffusion gradient with the use of energy through partially permeable membrane e.g. Ions uptake by root hair cells, uptake of glucose from the Ileum.

Surface area to volume ratio:

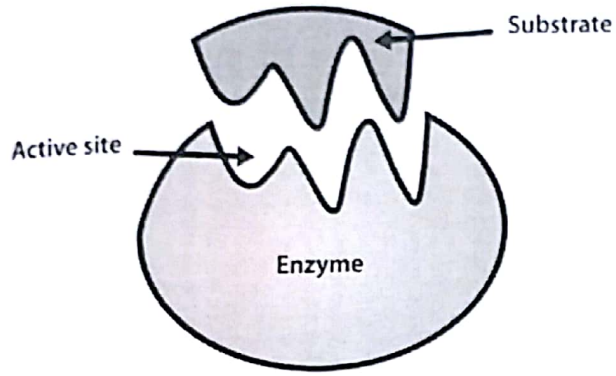
Smaller is an object greater is its surface area to volume ratio. Living things need to maintain the temperature of the body. Organisms living in cold climatic conditions have larger body size to reduce their surface area/Volume ratio to reduce the heat loss. SA is an area in contact with the surrounding environment. More is surface area more will be exchange of the substances.

Volume:

Space occupied by the mass. It is the place where substance are used or produced.

UNIT 3

Enzyme



O Level
Biology

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3.1 Enzyme Action
- Substrate
- Rate of enzyme action

3.2 Factors affecting the Rate of An enzyme Action
- Explain the effect of temperature on enzyme activity
- Experimental design
- Describe an experiment to investigate the effect of pH on the rate of an enzyme action.
- Describe an experiment to investigate the effect of Temperature on the rate of an enzyme action

UNIT 3 ENZYME

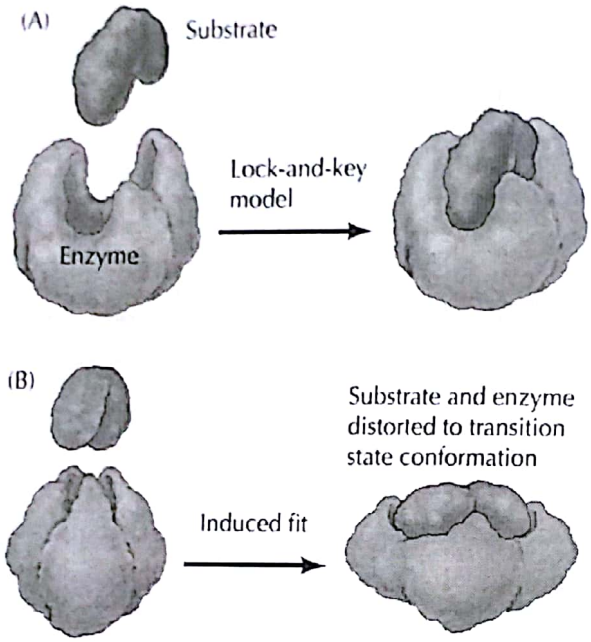
Enzymes:

A substance that speeds up the rate of a chemical reaction without being changed at the end of a reaction. enzymes are proteins in nature. They are bio-catalyst. Being protein in nature they are very sensitive to temperature and pH. They are needed in small amounts. They do not alter the end products of chemical reaction. They are specific to a substrate e.g. Amylase converts starch to maltose. They catalyse reversible reactions.

3.1 ENZYME ACTION:

- Lock and key hypothesis.
- Induced fit model.

Enzymes are 3D shaped protein molecules. They are globular in shape and water soluble. They have a specific site called Active site. Where a substrate can fit into and makes a short lived ES complex (enzyme substrate complex) and readily converts a substrate into products.



Substrate:

A substance onto which an enzyme acts. The substrate is converted into products which are released from the active site and enzyme is freed unaltered for reuse. The shape of active site or substrate should be the complementary to the shape of the active site. The substrate fits into the Active sites of specific enzyme like the key opens only one lock. The enzyme is lock and the substrate is a key according to this hypothesis.

Rate of enzyme action:

OR

3.2 FACTORS AFFECTING THE RATE OF AN ENZYME ACTION:

- Temperature.
- pH.
- Substrate concentration.
- Enzyme concentration.

Q: Explain the effect of temperature on enzyme activity.

An increase in temperature increases the kinetic energy of the molecules so increases the rate of collisions between enzyme and substrate.
At 40°C the rate of an enzyme action increases because enzyme works best at an optimum temperature i.e., 40°C. Any further increase above 40°C denatures the enzyme which changes the shape of the active sites. So substrate can no longer fit itself into an active site and does not make enzyme-substrate complex(ES-Complex). It decreases the rate of an enzyme action.

Experimental design:

CORMS
C = Controlled Exp.
O = Organism same
R = Repeat
M = Measurement
S = same condition

Describe an experiment to investigate the effect of pH on the rate of an enzyme action.

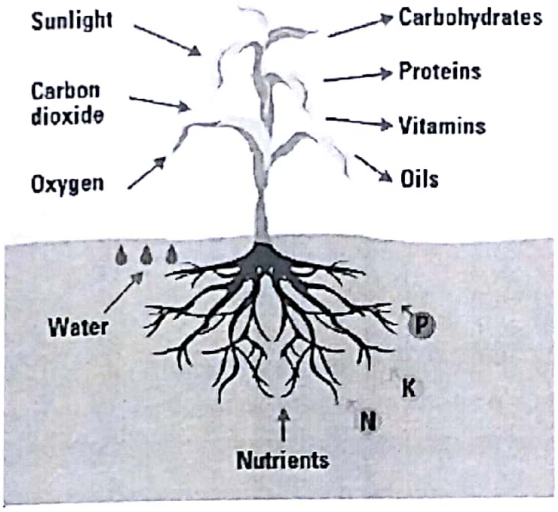
Take two test tubes label them A and B. Add same volume of enzyme (catalase) and substrate (H_2O_2) in each test tube. Add two drops of acid in tube A and add two drops of alkali in tube B. Maintain the temperature same for both. Record the time taken for O_2 bubble to be produced with the help of a stop watch. Or record the volume of oxygen produced in 5 minutes. Repeat the Experiment.

Describe an experiment to investigate the effect of Temperature on the rate of an enzyme action.

Take two test tubes label them A and B. Add same volume of enzyme (catalase) and substrate (H_2O_2) in each test tube. Place tube A in an ice cold water and place tube B in water at room temperature. Maintain the pH same for both. Record the time taken for O_2 bubble to be produced with the help of a stop watch. Or record the volume of oxygen produced in 5 minutes. Repeat the Experiment.

UNIT 4

Plant Nutrition



O Level Biology

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Syllabus 2016 – 18

4.1 Photosynthesis

- Definition
- Process of photosynthesis:
- Factors Affecting the Rate of Photosynthesis:
- Describe an experiment to investigate the effect of temperature on the rate of photosynthesis
- Factors affecting the rate of Photosynthesis
- Describe the effect of light on the rate of Photosynthesis

4.2 Structure of dicot leaf

- Dicot
- Monocot
- Cross section of a dicot leaf viewed under ordinary microscope

4.3 MINERAL NUTRITION

- Describe an experiment to investigate the effect of nitrate ions on the growth of a plant

UNIT-4 PLANT NUTRITION

4.1 PHOTOSYNTHESIS:

Definition:

A process of formation of carbohydrates by the green parts of plants from carbon dioxide and water by using light energy.

Chemical equation:

$$CO2 + H2O \xrightarrow{\text{Light}} C6H12O6 + O2$$

Word equation:

Carbon dioxide + water ----------> glucose + oxygen

Process of photosynthesis:

Light dependent stage:

- Light is absorbed by the chlorophyll.
- Chlorophyll becomes unstable and release electron.
- To fill the deficiency of electrons, water molecules split into oxygen and protons $(H^+)^-$. This is called Photolysis.

$$12\ H_2O \xrightarrow{\text{Light}} 6O_2 + 24\ H$$

Conversion of light energy to chemical energy.

The electrons travel along the electron carriers and makes ATP.

Light Independent Stage:

H^+ ions are used to fix the CO_2 to make sugar in the dark stage.

$$12\ H_2O + 6\ CO_2 \rightarrow 6\ O_2 + C_6H_{12}O_6 + 6H_2O.$$

Factors Affecting the Rate of Photosynthesis:

Temperature:

Photosynthesis is an enzyme controlled process. Temperature affects the rate of enzyme action. Consequently the rate of photosynthesis is affected by the change in temperature. It can be represented by a graph.

Describe an experiment to investigate the effect of temperature on the rate of photosynthesis:

Experiment:

- Take three beakers half-filled with water.
- Place a water weed of same species in each beaker.
- Invert a funnel on each water weed.
- A test tube is inverted on the neck of each funnel.
- Place the three beakers at different temp.
- Keep all other conditions constant.
- Record the number of bubbles of oxygen evolved in the unit time measured by stop watch.

- Repeat the experiment and take an average.
- Figure photosynthesis glass.

Record the Result:

Result may be presented / recorded in a table or a graph.

Factors affecting the rate of Photosynthesis:

1. Temperature
2. Light
3. Surface area of leaves
4. Chloroplast
5. CO_2
6. Water

Light:

Light affects the rate of Photosynthesis in two ways.

1. Wave length of light.
2. Intensity of light.

Wavelength of light:

The white light has the combination of lights of various colours that range from 400-700nm wavelength. They are prompted as VIBGOYR.

All various colours of light are not equally absorbed by the plants. Blue and Red are absorbed the most and green is absorbed the least. The rate of Photosynthesis is the most at Blue and red and least in green light.

As the green wavelength of light is not absorbed by the plant leaves so they look green.

Describe the effect of light on the rate of Photosynthesis:

Intensity of light also affects the rate of photosynthesis. If the rate of photosynthesis is plotted against light intensity it would be as follow. At low light intensity the rate of photosynthesis depends upon the change in light. Where as at high light intensity the rate of photosynthesis remains constant, even with the change in light.

Limiting factor:

Process controlled by many factors have its rate determined by a factor which is shortest in supply and is called a limiting factor.

Design an experiment to investigate the effect of light intensity on the rate of photosynthesis:

Take three beakers containing water. Place three aquatic plants in it of the same species. A funnel is inverted on the weed and on the funnel a test tube is inverted. Other conditions should be constant. Place the three beakers in three different light intensities. Then count the bubble produced per minute. Repeat the experiment at each light intensity and take an average.

Experiment:

Describe an experiment to investigate that light is needed for photosynthesis.

Step 1:

Destarch a potted plant by putting in the dark for two to three days. In the dark photosynthesis is not taking place so the new starch is not being produced. The starch already present is converted into

Use it

glucose and used during respiration or is converted to other substances or stored in other parts of the plants.

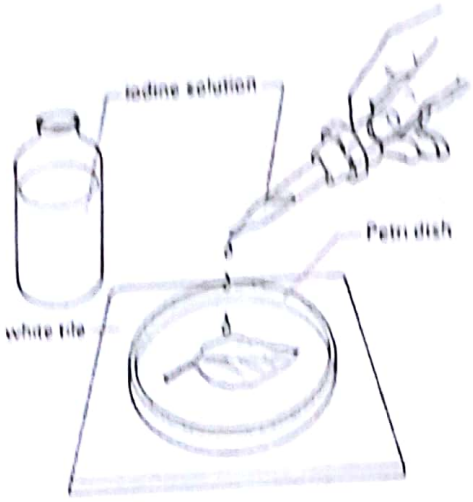
Step 2:

Set a controlled experiment

Cover both surfaces of half part of a leaf with black card paper. And expose the plant to light for two to three hours.

Step 3:

Test for starch



- **Boil in water**
  - Removes wax.
  - Fixation (denature the enzyme and ceases the metabolism).
  - Membrane become fully permeable.

- **Boil in alcohol**
  - To extract the chlorophyll.

- **Precautions**
  - Use water bath.

- **Observation**
  - Leaf becomes colourless.
  - Brittles.
  - Curls.
  - Alcohol becomes green.

- **Place in warm water a minute or two**
  - Extra alcohol washed away.
  - It turns soft.
  - Spread the leaf on glazed tile, and pour few drops of iodine onto it.

- **Observation:**
  - Parts exposed to light → Blue Black.
  - Parts not exposed to light → Brown.

Conclusion:

The parts exposed to the light have starch synthesized in them, so the photosynthesis has occurred in the parts exposed to the light only. The parts covered do not have starch synthesized in them. So photosynthesis has not occurred in them.

Describe an experiment to investigate that CO_2 is needed for photosynthesis:
Take two potted plants. Destarch them by putting them in dark for two to three days. Both are covered with polyethene bags. In one potted plant place a substrate which absorbs carbon dioxide and in the other which releases carbon dioxide. After two hours take leaf from both plants and test them for the presence of starch. The one which was not given CO_2 will show negative test and the one which has given CO_2 will show positive test. This will show that plant needs CO_2.

Describe an experiment to investigate that chloroplast is needed for photosynthesis:
Take a potted plant which contains variegated leaves. Place it in the sunlight. Keep all other conditions constant. After few hours pluck a leaf from the plant and make an outline of the leaf and label its green and non-green parts. Test it for the presence of starch. The part which contains chlorophyll will show positive test. The part which does not contain chloroplast will show negative test. This shows that chlorophyll is needed for photosynthesis.

4.2 STRUCTURE OF DICOT LEAF:

Dicot:

Dicot means a plant which contains seeds that have two seed leaves or seeds that can be split into two halves.

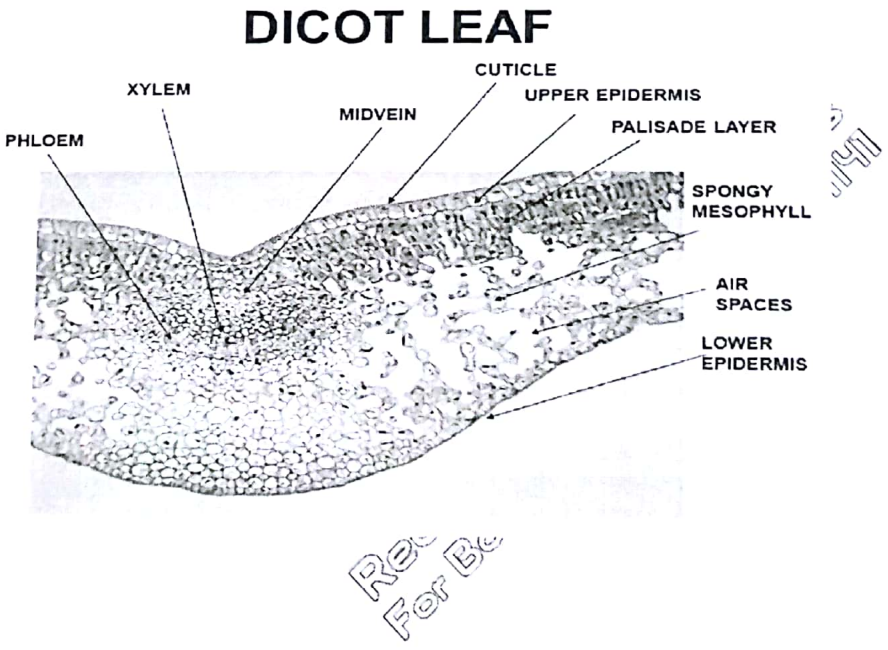
Monocot:

Plants that have seeds which cannot be easily halved into two parts.

The other differences include:

The monocot leaves are long and narrow and have parallel veins. Where as dicot leaves are broader and have net veins.

Cross section of a dicot leaf viewed under ordinary microscope:



How structure of a leaf is adapted to its function:

1- Cuticle:
- Waxy.
- Transparent.
- Water impermeable so prevent water loss.
- Allows light to pass through.

2- Upper epidermis:
- Transparent
- No intercellular spaces.
- It prevents the water loss.

3- Palisade mesophyll:
- Immediately below the upper epidermis.
- Cells longitudinally placed.
- No intercellular spaces.
- Contain chloroplast.
- Contain large central sap vacuole.
- It receives more light.
- To distribute light evenly or less interception to the light.
- More cells are compactly packed.
- Photosynthesizing cell organelle.
- Large vacuole pushes the chloroplast towards the outer region so they can absorb more light.

4- Spongy mesophyll:
- It has intercellular spaces.
- The wall are moist.
- Help in gaseous exchange .

5- Guard cells:
- They have unequal thickness of the cell wall (Inner side is thicker than the outer side)
- Contain chloroplast.
- It can regulate the opening of stomata. They open during daytime and closed during night time.
- Gaseous exchange.
- Prevent excessive loss of water.

4.3 MINERAL NUTRITION:

Nitrate ions; needed for synthesis of amino acids.
Deficiency causes stunted growth.
Magnesium ions; needed for synthesis of chlorophyll.
Deficiency causes yellowing of leaves.

Describe an experiment to investigate the effect of nitrate ions on the growth of a plant:

Take two plants. In one plant nitrates are provided and in the other nitrate ions are absent. All other conditions are kept constant. After few weeks measure the height of both plants. The plant which is given nitrates will grow normally but the plant which is not given nitrate ions grows shorter.

UNIT 5

Animal Nutrition

O Level Biology

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Syllabus 2016 – 18

5.1 Nutrients
- Food

5.2 Diet
- Balanced diet
- Drugs
- Can this test be used to determine the quantity of reducing sugar
- Test for non-reducing sugars
- Test for Starch
- Protein
- Kwashioskore
- Chemical Element
- Ethanol / Emulsion test
- Vitamin C (Ascorbic Acid)
- Vitamin D
- Water
- Iron

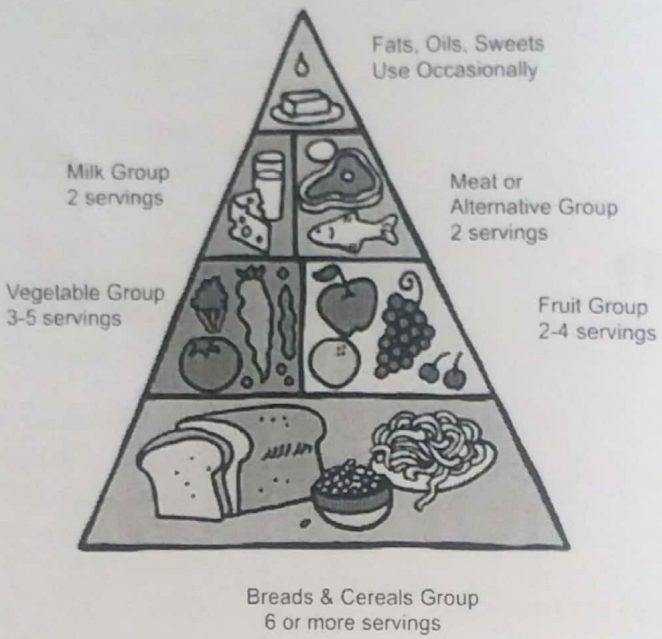
5.3 world food supplies

5.4 Digestion In Humans
- Functions
- Processes in the oral cavity
- Swallowing
- Oesophagus
- Location
- Ileum
- How it increase its surface area
- How the diffusion rate is effected
- Colon

UNIT-5 ANIMAL NUTRITION

Nutrition:

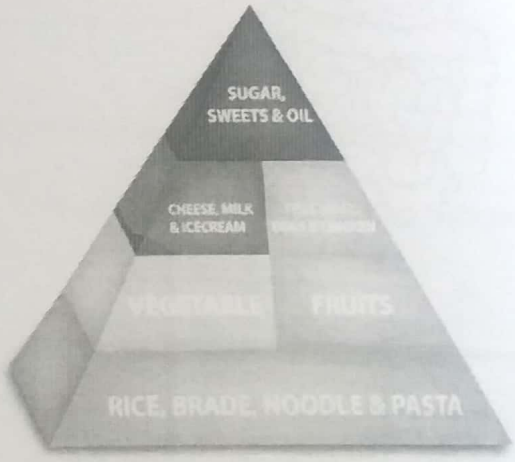
The study of relationship between nutrients, there sources and uses in the body.



5.1 NUTRIENTS:

Any component of food which provides;

- Energy.
- Raw materials for growth.
- Materials for normal working of body.



Food:

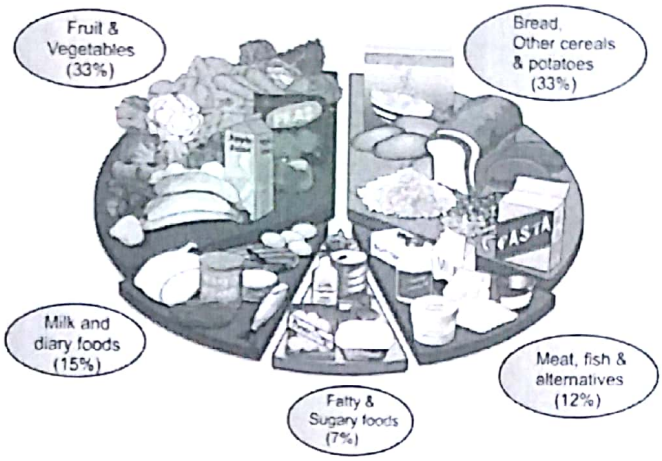
Any thing we eat or drink and provide us nutrients.

5.2 DIET:

The daily intake of food is called diet.

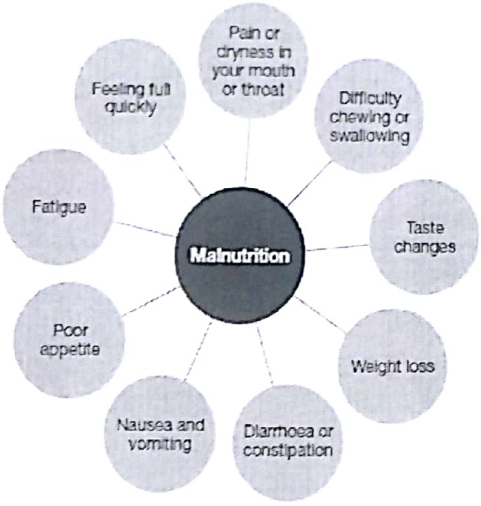
Balanced diet:

A diet which provides right proportion of nutrients according to the requirement of the body.



Malnutrition:

A diet that does not provide the right proportion of nutrients according to the requirement of body.



Under nutrition:

A diet which provides nutrients less than required by the body. It results into the nutritional deficiency diseases.

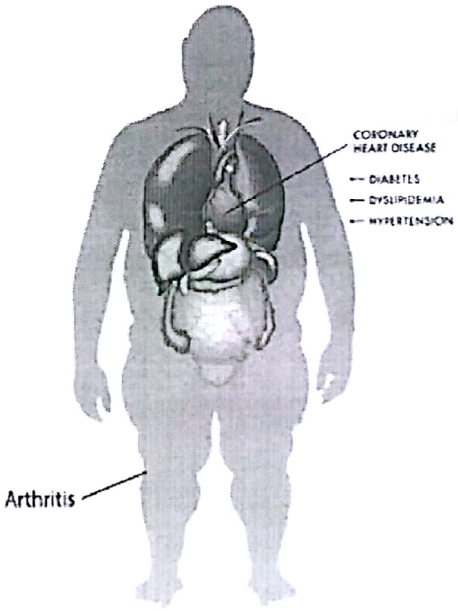
Over Nutrition:

A diet which provides energy more than it is required by the body. Over nutrition results into obesity.

Obesity:

An increase of body mass above 20% more of the normal body mass.
5 feet = 100 lbs.
5.5 feet = 120 lbs.

Obesity



Causes of obesity:

Lazy life style, drugs alcohol, fat rich diet, genetic predisposition.

Effects of obesity:

Cardio vascular diseases, diabetes, arthritis.

Effects of obesity:

1-Cardio vascular diseases:

- More work load.
- Causes narrowing of blood vessels.
- More resistance to the flow of blood.
- Blood clot formed in blood vessels.

2-Diabetes:

- An increased body mass would require insulin released. The insufficient release of insulin results into diabetes.

3 -Arthritis:

Definition: Inflammation and painful joints are known as arthritis.
More weight increases the friction between joints which results in arthritis.

Factors affecting balanced diet:

Infancy → 6 Months
Childhood → Adolescence
Adult hood → Man and woman
Old age Death
Age:

The Early Age	Old Age
1.Physically more active.	Physically less active
2. Growth takes place which needs more energy.	No growth.

Occupation:
- Sedentary lifestyle = 1200 J
- Light work = 1600 J
- Heavy work = 3000 J

Body mass:
More will be the body mass more will be nutrients required.

Climate:
More energy needed in cold climate.

Sex:
Male has a larger body frame so need more energy.

Pregnancy:
More iron is needed for formation of haemoglobin.
More proteins needed for formation of muscles.
More calcium needed for the formation of bone and teeth.
More vitamins for normal growth.

Components of Food:

1. **Organic (carbon and hydrogen)**
- Carbohydrates.
- Proteins.
- Fats.
- Vitamins .
- Fibbers.
2. **Inorganic (water and minerals)**

Carbohydrates:

An organic molecule that has hydrogen to oxygen ratio same as for water. It is made of carbon, hydrogen, oxygen.

Sources:

Plant sources:
Vegetable and Fruits.
Animal sources:
Milk.

Uses:

- Instant source of energy.
- Reserve food materials.
- Plant → Starch.
- Human→ Glycogen.
- Structural material.
- Plants have cell wall made of cellulose.
- Cell membrane have carbohydrate with fats.
- Lubricant.
- Present in saliva.
- Component of DNA / RNA.
- Helps in cross pollination. Nectar attracts insects .

Deficiency of glucose leads to:

- Laziness.
- Unwillingness to work.

Examples:

- Monosaccharides: Glucose, Fructose and ribose.
- Disaccharides: Sucrose, maltose, lactose.
- Polysaccharides: Starch, Glycogen, Cellulose.
- Monosaccharides are not hydrolysed disaccharides and hydrolysed to two simple sugars polysaccharides are hydrolysed to many sugar units.
- Monosaccharides are sweet in taste.
- Disaccharides are less sweet in taste.
- Polysaccharides are tasteless.
- Monosaccharides are soluble in cold water.
- Disaccharides are soluble in hot water.
- Polysaccharides are insoluble.

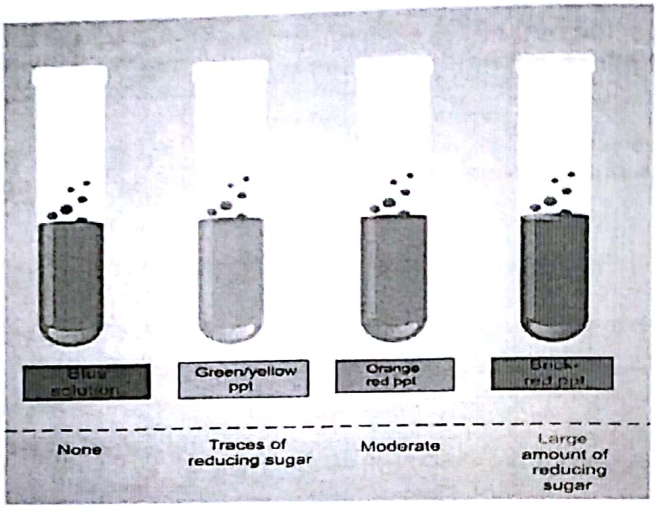
Monosaccharides	Disaccharides	Polysaccharides
Not hydrolysed	Hydrolysed to two simple sugars	Hydrolysed to many sugar unit
Sweet	Less sweet	Tasteless
Soluble in cold water	Soluble in hot water	Insoluble

Test for carbohydrates:

- Starch.
- Reducing sugar.
- Non-reducing sugar.

Reducing Sugar:

A sugar that loses electron or that gives electron to metallic ions upon heating with them.
Cu^{2+} is soluble in water and is blue in colour.
Cu^{+} is insoluble in water and is red in colour.
Cu^{+2} + Sugar Heat Cu^{+1}



Method:

- Take 2 cm of sample solution in a test tube.
- Add same volume of bendicts solution.
- Heat on a water bath.

Observation:

Colour change
Blue → Green → Yellow → Orange → Brown → Brick Red.

Conclusion:
The change in colour shows the presence of reducing sugar.

Use of benedicts test to determine the quantity of reducing sugar in a solution:

Prepare glucose solutions of different concentrations. I.e. 0 %, 0.1 % and 1.0 %
Test each solution with benedicts solution. Record the colour change as standard colours

- 0 % blue.
- % yellow.
- % brick red.

Test the solution with unknown concentration with the Benedict's solution. Compare the colour change with the standard colours to estimate the concentration of reducing sugars in unknown sugar solution.

Basis of the test:

- Reducing sugar upon heating with Cu^{2+} gives an electron to it to convert to Cu^{+1}.
- As it reduces metabolic ioins so is called a reducing sugar.

- Cu^{2+} is soluble in water and gives blue colour, However as it is converted to Cu^{+1} it gives red colour and is insoluble in water.
- The different colours represent the amount of Cu^{2+} ions reduced to Cu^{+1}.

Test for non-reducing sugars:

Carried in two steps.

Step 1:

As for reducing sugar.

- Take 2 cm of sample solution in a test tube.
- Add same volume of bendicts solution.
- Heat on a water bath.

Observation:
Blue colour.
Conclusion:
Reducing sugar absent.

Step 2:

- Take 2 cm of sample provide.
- Add few drops of dilute acid and boil – why.
- Sucrose + Dilute acid Boil Fructose + Glucose.
- Hydrolysis.
- Add benedicts reagent.

Observation:
Colour changes from blue to brick red.

Conclusion:
Non-reducing sugar present.

Justify:
Upon hydrolysis the non-reducing sugar is converted to reducing sugar which gives positive test for reducing sugar in step 2. So we conclude that non-reducing sugar is present.

Test for Starch:

Coloured sample: Petal, leaf, Remove the colour first.

Colourless sample:

- Intact part of a plant (Peel it or crush)
- Take sample solution in a test tube.
- Add iodine solution.
- If starch is present the colour changes from brown to blue black.

Protein:

Chemical Element:

Carbon, Hydrogen, Oxygen, Nitrogen (Rarely sulphur).

Sources:

- Plant Sources.

- Beans, Pulses and Grams.
- Animal sources.
- Egg, Milk.

Uses:
- Provides raw material for growth.
- Provide energy.

Used for:

Function	Name of protein
Hormones	Insulin
Defence	Anti-bodies
Transport → O_2	Haemoglobin
Pigment	Melanin
Movement	Actin / Myosin (Both make muscles)
Cell division	Tubulin

Deficiency disorder:

Kwashioskore:

Swollen abdomen:
Less digestive enzymes so food decays in alimentary canal. Decomposition releases gases which causes flatulence and abdomen to swell.

Loss of weight:
Muscle wasting.

Hair loss or reddening of hair:
Hairs are made from keratin protein. Deficiency of protein weakens the hair. Melanin is a protein which gives black colour to hair. Deficiency of melanin causes hair colour change to red.

Reduced resistance to diseases:
Antibodies provide resistance to infections. Lack of protein results in less antibodies formation which reduces resistance to infections.

Excess Symptoms:

If in excess broker down in liver and released out as urea.

Test for proteins

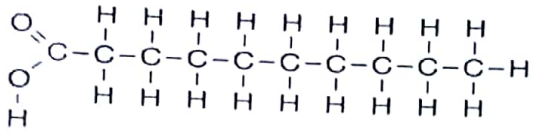
Test name:
- Biuret test.
-

Method:
- Take sample in test tube.
- Add alkali.
- Add $CuSO_4$.

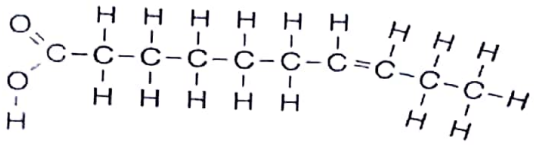
Observation:
Initial colour blue changes to purple / Violet / Lilac.

Fats:

Saturated



Unsaturated



Chemical Element:

Carbon, hydrogen and oxygen.

Sources:

Plant Sources:

- Oil palm seeds.
- Cotton seeds.
- Mustard seeds.

Animal sources:

- Milk.
- Cod liver oil.

Uses:

- Reserve food material.
- Provides energy.
- Insulation beneath skin.
- Blubber for aquatic animals.
- Sources of fat soluble vitamins.
- Component of structure eg, cell membrane and cuticle..

Deficiency:

- Deficiency of fat soluble vitamins.
- Excess stored in body.
- Beneath skin.
- Around organs.

Tests for fats:

Grease Spot Test:

Pour small amount of sample on an opaque paper. If fat is present it turns the paper to translucent.

Ethanol / Emulsion test:

- Take 2 cm of sample in a test tube.
- Add same volume of ethanol.
- Add 1 cm of cold water.
- Shake gently.

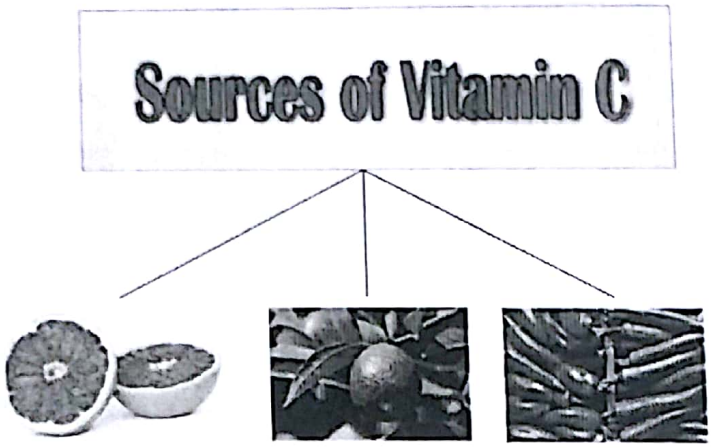
Observation:

White cloudy emulsion.

Why:

Because the fats do not dissolve in water, which forms a cloudy suspension.

Vitamin C (Ascorbic Acid):



Sources:

- Citrus fruit.
- Unripe fruits.
- Pepper etc.

Uses:

- Iron absorption.
- Formation of connective tissue.
- (Collagen) → Biological glue.

Deficiency:

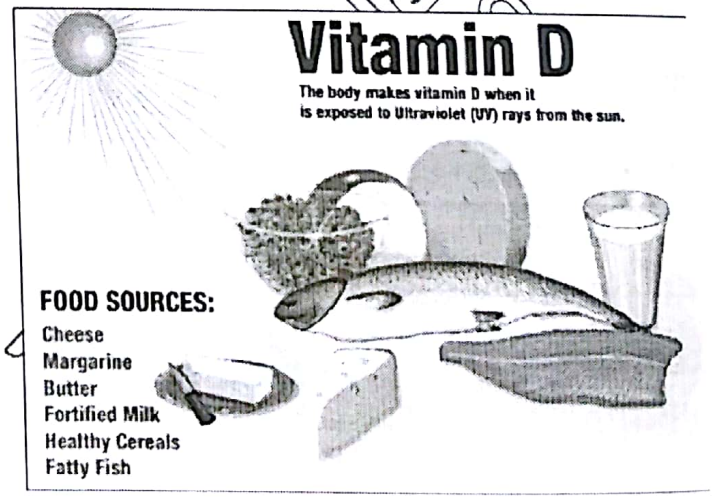
- Bleeding gums. (Scurvy)
- Bad Breath.
- Low resistance to diseases.
- Anaemia (Reduction of haemoglobin).

Excess:

Water soluble so, if in excess test through urination.

Vitamin D:

- Fatty foods.
- Fried foods.
- Cod liver oil.
- UV. Radiations convert a precursor in skin to vitamin D.



Uses:

- Absorption of calcium from the intestine.
- Formation of bones and teeth.

Deficiency:

- Rickets. (Poor teeth and bone formation)
- Osteomalacia (Old people).

Excess:

Softening of bones.

Calcium sources:

- Milk.
- Egg.
- Milk products.

Uses:

- Muscular contraction.
- Osmotic Balance.
- Formation of bones / teeth.
- Nerve conduction.

Deficiency:

- Rickets.
- Osteomalacia.

Excess:

Kidney stones, Gall bladder stones.

Water:

Gain:

- Drinking.
- Eating.
- Metabolic water.

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

Loss:

- Sweating.
- Urination Normal.
- Exhalation
- Diarrhoea, Vomiting, Bleeding, Tears, Menstruation, etc.

Uses:

- Transport of material.
- Maintaining Turgor.
- Reactant for photosynthesis.
- Used during hydrolysis (Breaking down of complex substances).
- Lubrication.
- Cooling.

Deficiency:

Dehydration, Drying of mouth, drying of Cornea, Thickening of blood, Heart stroke, Heat stroke.

Treatment:

ORT (Oral rehydration therapy) or intravenous injection of fluids.

Iron:

Sources:

- Bread, flour
- Broad leaved vegetables like spinach.
- Red meat.
- Egg.
- Liver.

Uses:

Used for haemoglobin formation.

Deficiency:

Anaemia.

Dietary guidelines:

The meals with iron should be taken with lemon / orange. Why? (Increased the absorption of iron)

Fibre:

Chemically composed of cellulose.

Sources:

- Cereals.
- Vegetable.
- Fruits.
- Mycoprotein.

Uses:

- Prevents from constipation.
- Retains water.
- Provides bulk to the food.

Movement of food by peristalsis through the alimentary canals. As this lubricated, softened food, containing fibber stays for shorter time in the alimentary canal, so prevents from constipation. Constipation is a state of difficulty in egestion.

5.3 WORLD FOOD SUPPLIES:

Problems that contribute to famines include

- Unequal distribution of food.
- Droughts.
- Flooding.
- Increased population.

5.4 DIGESTION IN HUMANS:

Digestive system consists of two parts.

- Alimentary canal.
- Associated glands.

Functions:

Digestive system performs the following functions.

1-Ingestion:

Intake of food through mouth.

2-Digestion:

- Break down of food.
- Physical.
- Chemical.

3-Absorption:

Uptake of products of digestion from alimentary canal into blood/body.

4-Assimilation:

Use of products of digestion after they have been absorbed.

Egestion:
Removal of undigested and unabsorbed food substances out of the alimentary canal.

Alimentary canal:
A long tubular structure which extends from mouth to anus. Along its length it is modified into various organs to perform various function.

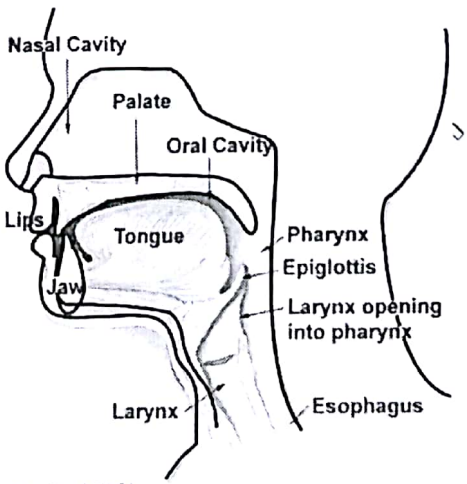
Parts:
Alimentary canal is distinguished into following parts.
- Oral cavity.
- Stomach.
- Oesophagus.
- Intestine → Small intestine.
- Large intestine.

Bolus:
Bolus is a mass of food which is partially digested, lubricated and softened.

Oral cavity:

Processes in the oral cavity:

- Ingestion → By mouth.
- Digestion → By amylase.
- Lubrication → By mucus.
- Selection of food → Tongue.
- Detection of harder particles → Teeth.
- Swallowing → Tongue.

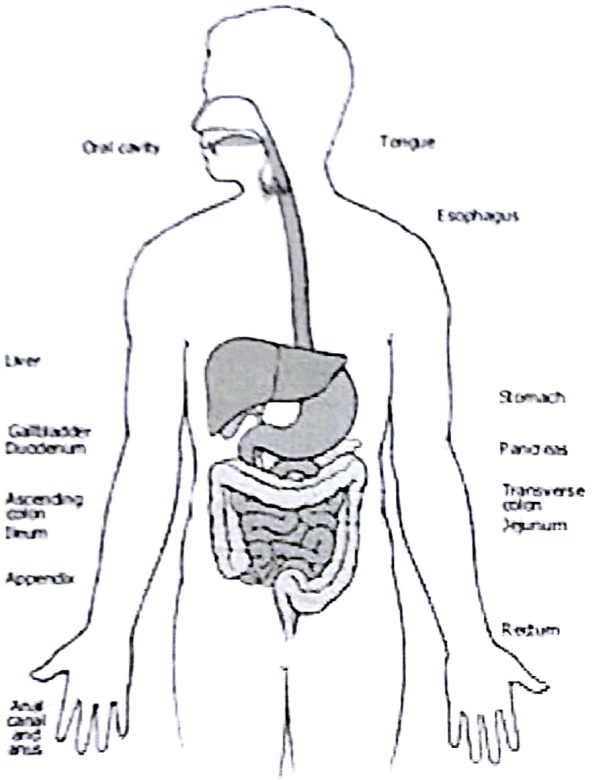


Swallowing:

Pushing food back into esophagus.
- Tongue moves upward and backward and pushes the food.
- It pushes the uvula to back which saves the nasal cavity.
- The trachea is pulled up.
- Epiglottis closes the glottis and prevents the food from going into trachea.

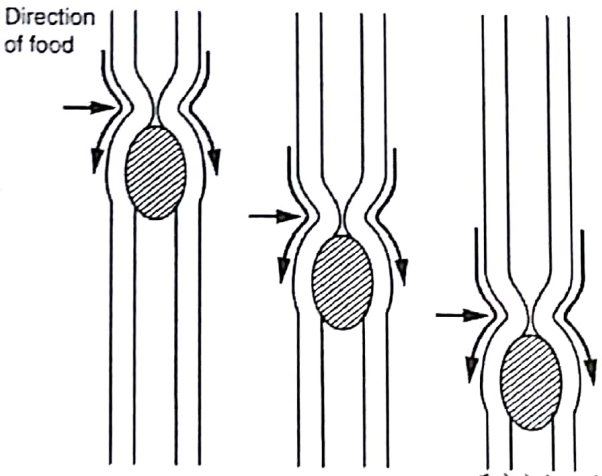
Oesophagus:

- A long muscular tube.
- Extends from pharynx down through the neck and chest region to the abdomen and open into the stomach.



Function:

Transports food from pharynx to the stomach by peristalsis.



Circular muscle contracted behind the bolus

Oral Cavity:

- Jaws → the lower jaw moves up and down to bring ingestion.
- Teeth
- Salivary glands.
- Tongue.

- Cheeks.
- Palate.

Teeth:

- Mechanical digestion.
- Detection of solid particles.

Salivary glands:

- Saliva
- Mucus → Softens and lubricates the food.
- Amylase → converts the starch to maltose.

Tongue:

- Rolls food or mixes the saliva and food.
- Selection of food.
- Swallowing.

Cheeks:

Prevents food slipping out of the mouth.

Palate:

- Hard palate.
- Partitions the nasal cavity.

Mouth:

- Ingestion.

Oesophagus:

A long tubular structure that extends down from the pharynx through neck/chest and leads to stomach.

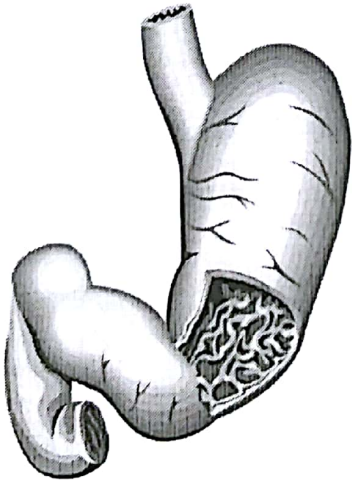
Function:

Peristalsis.

Peristalsis:

Movement of food substances in a tubular organ by muscular contraction and relaxation.
A ring of muscular contraction behind the food travels forward like a wave pushing the food from behind.

Stomach:



Location:

Structure:

Thick muscular, glandular, sac like structure. It secretes gastric juice that contains mucus, HCL and pepsinogen.

HCL:

- Kills micro organisms.
- Converts pepsinogen to pepsin.

Mucus:

- Softens and lubricates food.
- Protects lining of the stomach.

Functions:

- Storage of food.
- Physical digestion.
- Chemical digestion.

Duodenum:

C-shaped tubular structure that extends from sphincter down to the ileum.

Fluid it receives:

- Chyme/Acidic food from stomach.
- From gall bladder (bile) through bile duct.
- From pancreas (Pancreatic juice) through pancreatic duct Pancreatic juice contains hydrogen carbonate and enzymes. Hydrogen carbonate neutralizes chime.
- When bile duct and pancreatic duct joins it forms hepato pancreatic duct.

5.5 CHEMICAL DIGESTION:

- Oral cavity salivary amylase starch to maltose.
- Oesophagus no digestion.
- Stomach gastric juice pepsin converts proteins to peptides.

Duodenum

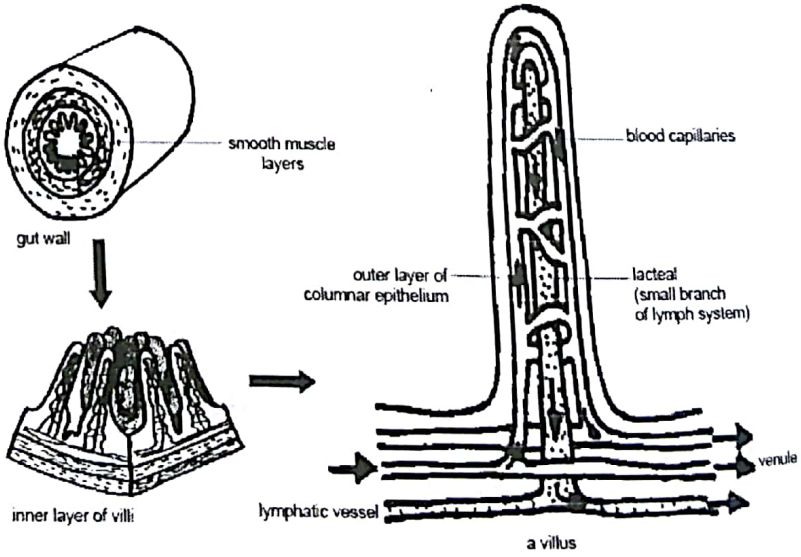
- Amylase converts starch to maltose.
- Trypsin converts proteins to dipeptides.
- Lipase converts fats to fatty acids and glycerol.

Ileum

- Erepsin converts dipeptides to amino acids.
- Maltase converts maltose to glucose.

Ileum:

The last part of the small intestine. Its main function is to absorb products of digestion, so it has greater surface area to volume ratio.



How it increase its surface area:

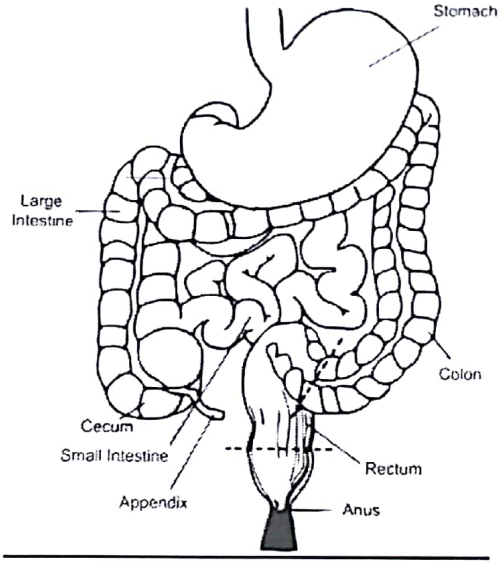
- Long.
- Folding.
- Villus.

5.6 ABSORPTION AND ASSIMILATION:

How the diffusion rate is affected:

- The surface area.
- Thin membrane.
- Partially permeable membrane.
- Continuous flow of materials.

Colon:



Function:

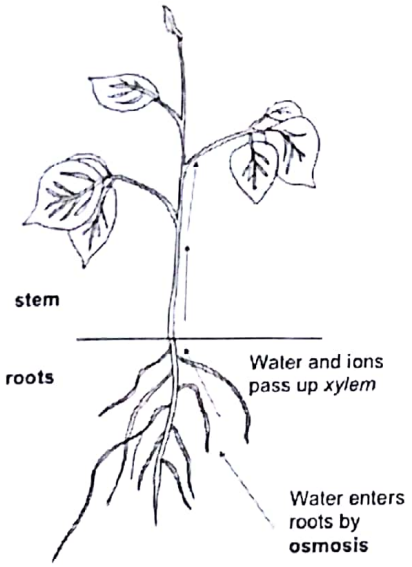
- Absorption of water and minerals salts.
- Formation of vitamin k and vitamin B12 by bacteria in colon.

Rectum:

- Storage / Faeces formation.

UNIT 6

Transport in flowering Plants



O Level Biology

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Syllabus 2016 – 18

6.1 Water and ion uptake

- Entry of water/minerals into the roots

6.2 Transpiration and Translocation

- Describe an experiment to investigate that water is transported up through a plant by transpiration pull
- Photometer
- Factors affecting the rate of Transpiration

UNIT-6 TRANSPORT IN FLOWERING PLANTS

The food synthesized in the leaves is transported down to the roots whereas the water absorbed from the soil through roots is transported to leaves where it is used during photosynthesis. Dicot plants have specialized tissues called vascular bundle for the transport of these materials.

Vascular bundle:

Consists of xylem and phloem.

Xylem:

Location
- Leaf = Upper side.
- Stem → Inner side of vascular bundle.
- Root → Central star shaped structure.

Structure:

Tubular, narrow structures, they lack cytoplasm and nuclei. They are joined end to end to make a continuous tube extending from roots to the leave. Xylem is a dead tissue which consists of dead wall made of cellulose and deposited by lignin.

Functions:

- Transport.
- Support.

How the structure of xylem is adapted to carry out its function:

Tubular
Joined end to end to extend from roots to leaves.

Narrow lumen
Transport of water by capillarity.

No nucleus / Cytoplasm
No resistance offered to flow of water and dissolved minerals.

No end plates / Attached end to end
No cross walls as mechanical strength is provided by lignin.
Lignin deposited.
Strengthens the walls which provide mechanical support to plant.

Types of xylem:

Annular.
Spiral.
Pitted.
Reticulate.

Structure of phloem:

Phloem consists of sieve tube elements and companion cells.

Sieve cells:

- Cylindrical cell.
- Cellulose cell wall.

- Perforated end plates.
- Lack nucleus sap vacuole.

Companion cells:

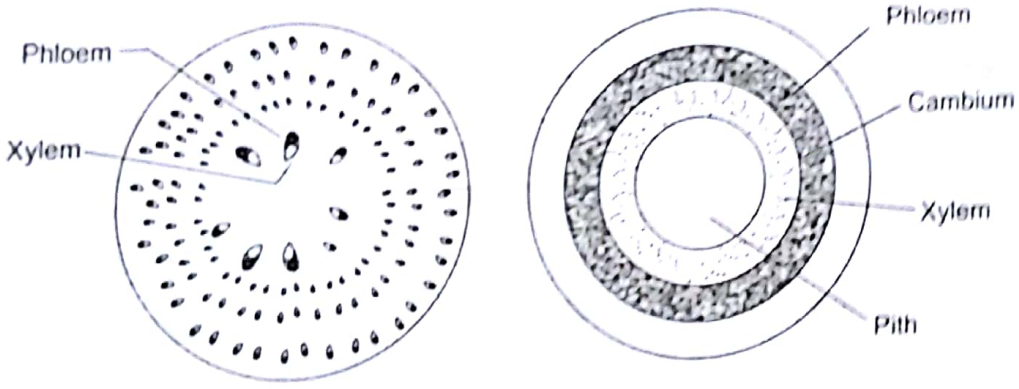
Companion cells have typical plant cell structure.

Function of phloem:

- Transport of sucrose.
- Neither glucose nor starch.
- Transport of amino acids.
- These substances are transported dissolved in water.

Structure of phloem related to its function:

- Lack of nucleus, so no obstruction to the flow of substance.
- Perforated end plates allow substance to be transported through the phloem.
- Cross walls prevent them from being collapsed.
- Being living they provide energy needed for transport of materials.



Xylem and Phloem

Differences between xylem and phloem:

Xylem	Phloem
1. Xylem is present on the inner side.	Phloem is present on the outer side.
2. Xylem has lignin walls.	Phloem doesn't have lignin walls.
3. Function of xylem is to transport water & mineral salts.	Function of phloem is to transport sucrose and am acids.
4. Xylem does not need energy to transport.	Phloem needs energy to transport.
5. Xylem does not have cytoplasm.	Phloem has cytoplasm.
6. Xylem walls are thick.	Phloem walls are thin.
7. Xylem has wider diameter	Phloem has a narrow diameter.

Justify why insects feed on Phloem:

- Because phloem contain nutrients like sucrose needed by the insects.
- Phloem is on outer side so nearer to the outer boundary.
- Phloem has thin walls so it is easier to penetrate their proboscis into the phloem.

Describe an experiment to investigate that water/minerals are transported through the xylem:

Take a cut shoot of a plant. Place the cut end of the shoot in a beaker half filled with a dye. Leave this apparatus undisturbed in light for few hours. Cut thin sections of the shoot. View them under an ordinary microscope. The xylem is darkly or densely stained than the other parts.

Describe an experiment to investigate that sucrose and amino acids, products of photosynthesis are transported through phloem:

- Spray an insecticide on the aphids sitting on plant shoots.
- It paralysis the aphids.
- Cut their heads leaving their proboscii in the shoots.
- Collect the fluid which oozes out of shoots the proboscii .
- Test the fluid for Starch, proteins, fats, reducing and non reducing sugars.
- Cut thin sections of shoots and observe them under light microscopes.

Observation
Ends of most of the proboscis are found in phloem.

Conclusion
The insects were feeding on the phloem sap which contains reducing sugars and amino acids.
Ends of some proboscis were not found in phloem as the insects were trying to access the phloem when paralysed.

6.1 WATER AND ION UPTAKE:

Entry of water/minerals into the roots:

The roots have tiny; numerous hairs like structure called root hairs. These increase the surface area for uptake of mineral ions and water.

How structure is related to its function:

- Elongated, narrow cells which increases surface area for absorption.
- Cytoplasm where metabolic processes produce energy needed for active transport.
- Partially permeable membrane helps to maintain diffusion gradient and ensures water uptake.
- Cell wall prevents deformation or bursting of cells due to the hydrostatic pressure.

Function:

Root hair cells are embedded in the soil are surrounded by soil particles. The spaces between the soil particles contain minerals dissolved in water. If the water potential outside these cells is higher, then water enters into them through osmosis. However the minerals are taken up by active transport and the energy needed is provided by respiration of glucose. The uptake of minerals lowers down the water potential inside the cells, so water enters into them down the water potential gradient through osmosis.

Upward transport of water (Dissolve Minerals)

Three forces involved.
- Root pressure.
- Transportation pull.
- Capillarity.

Root pressure:

As the water enters into the cells of the root, it increase its turgor pressure. Collectively the turgor pressure of all root cells is called root pressure.

Examples:
Guttation6.2 Transpiration and Translocation:
The loss of water from the aerial part of the plant is called transpiration. This loss of water produces a force of pull called transpiration pull, which draws water upward as a continuous column called transpiration stream. Because of the cohesive forces there is no break in the travelling of water.

Describe an experiment to investigate that water is transported up through a plant by transpiration pull:

Take two plants. From one remove the leave and from other remove the roots. Attach a capillary tube. A coloured water is contained in capillary tube. Then put both apparatuses in light. Keep other conditions constant. After 2 to 3 hours check the level of water in capillary tube.

Transpiration:

Loss of water from aerial parts through stomata.

Rate of transpiration:

Rate = volume of water lost/time taken.
OR
Rate = volume of water taken up/time taken.

Potometer:

A long narrow graduated capillary tube wider at one end and narrower at the other end.

Use:

- Cut a shoot of a plant under water.
- With a sharp knife.
- In a slanting position.
- It is then fixed in a rubber bung on the cut end which is then fixed into the wider end of the tube in a trough of water.
- Remove the wider end out of the water and make air tight by using wax.
- This apparatus is set on s stand as shown below.
- Tap the narrow end with the index finger to produce an air bubble.

This apparatus is set in condition to investigate the effect of same factors on the rate of transpiration. It can be measured by recording the time taken for 10cm distance travelled by the air bubble. Repeat the experiment to take an average and apply the formula.

Rate = ^r2.d/t

Why the plant shoot is cut under water, with a sharp knife diagonally:

- To prevent air locking.
- To increase surface area.
- For accurate cutting or will damage the cells.

Why the apparatus should be air tight:

If there will be no air tight then the water will move back from the tube.

Describe an experiment to investigate the effect of humidity on transpiration:

Take two plant shoots of same plant. Place cut end of each shoot in a measuring cylinder containing water. Pour some amount of oil on it to prevent evaporation. Then put one in high humidity area and the other in low one. One plant covered with polythene which will increase the humidity.

Keep all other conditions constant e.g. CO_2 etc. After 2 to 3 hours check the water level in both measuring cylinder. Repeat the experiment and take an average.

Factors affecting the rate of Transpiration:

1- Humidity:

More is humidity surrounding a leaf less steeper would be the diffusion gradient, so less water diffuses out of the leaves through stomata.

2- Wind:

At lower wind velocity the rate of transpiration increases with the increase of wind velocity. The blowing wind carries away the moisture (humidity) from the surrounding of a leaf making diffusion gradient steeper which leads to more water loss through diffusion. At stronger wind velocities the water is evaporated from guard cells. They become flaccid and close the stomata which reduces the rate of Transpiration.

4- Light and Temperature:

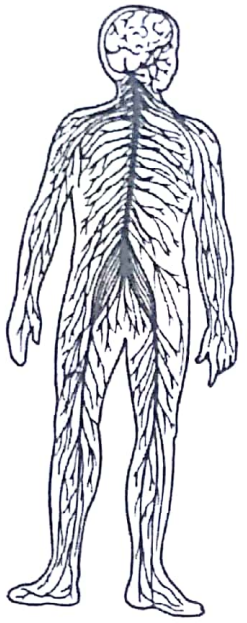
More light more stomata open. More water loss. At very high light intensity maximum stomata open so the rate of loss of water becomes maximum.

5- S.A:

More surface area more stomata higher the rate of Transpiration.

UNIT 7

Transport in Humans



O Level Biology

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Syllabus 2016 – 18

7.1 Blood circulatory system

- Blood vessels
- Comparison between blood vessels
- Major Blood Vessels
- Supply of nutrients and oxygen to the heart muscles
- Working of heart
- Blood cells
- Functions of blood
- Blood cells
- Blood Clotting
- Exchange of materials at capillaries / Tissue fluid formation

UNIT-7 TRANSPORT IN HUMANS

- Movement of substances.
- Two systems.
- Lymphatic system.
- Blood circulatory system or closed circulatory system.

7.1 BLOOD CIRCULATORY SYSTEM:

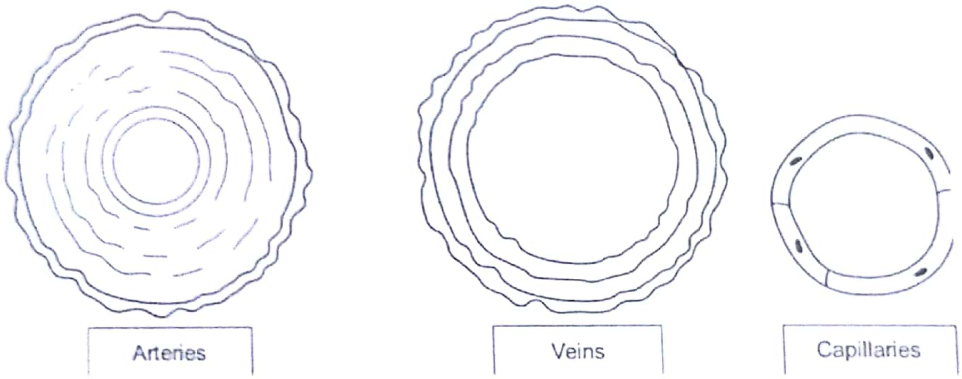
Consists of;

- Blood vessels.
- Heart.
- Blood.

Blood vessels:

Tubular structures that extends through out the body.

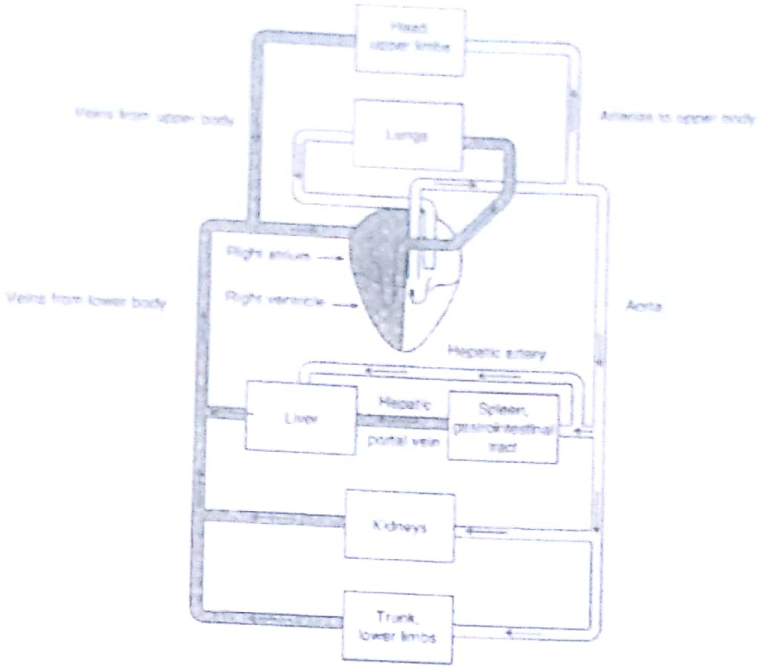
Three main types:



Comparison between blood vessels:

	Artery	Vein	Capillary
1- Diameter	Narrower	Wider	Microscopic
2- Wall thickness	Thick	Thin	Single cell thick
3- Lumen	Narrow	Wide	RBC,s can pass in single row
4- Elasticity	Elastic	Inelastic	No elastic fibbers
5- Valves	Absent	Present	Absent
6- Direction of blood flow	Away from heart	Towards heart	From an artery end to vein end.
7- Composition	More O_2 Less CO_2 Except P.A	Less O_2 More CO_2 Except P.V	More O_2 towards and artery end
8- Pressure	Higher	Lower	Gradually decrease from an artery to vein

Major Blood Vessels:



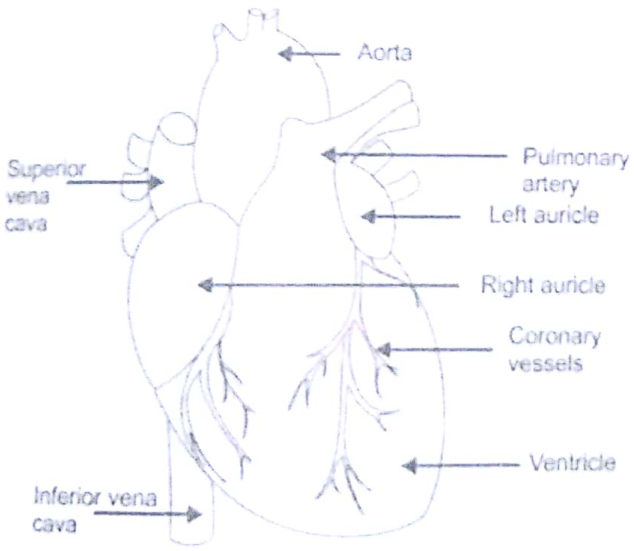
Blood pressure decrease in capillaries because plasma comes out from the capillaries from the pores out from the capillaries from the pores present in it. Which lowers the volume which leads to decrease in pressure.

Heart:

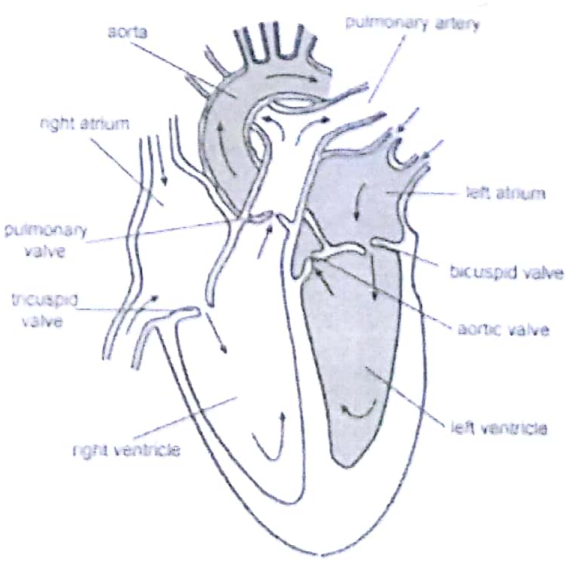
A muscular pumping organ located in the chest cavity slightly on its left flanked by the lungs on both sides.

Structure:

It is conical shaped organ with the pointed apex towards the diaphragm. It is associated with the blood vessels. Heart is enclosed in a tough fibrous membrane called pericardium. It prevents heart from over distension and damage due to friction.



Surface View of Human Heart



Vertical Section of Human Heart

Supply of nutrients and oxygen to the heart muscles:

Coronary Artery:

Supply nutrients and oxygen to the heart muscles.

Internal structure of the heart:

Heart consists of 4 Chambers

Valves:

- Cuspid valve.
- Semilunar valves.

Cardiac muscles:

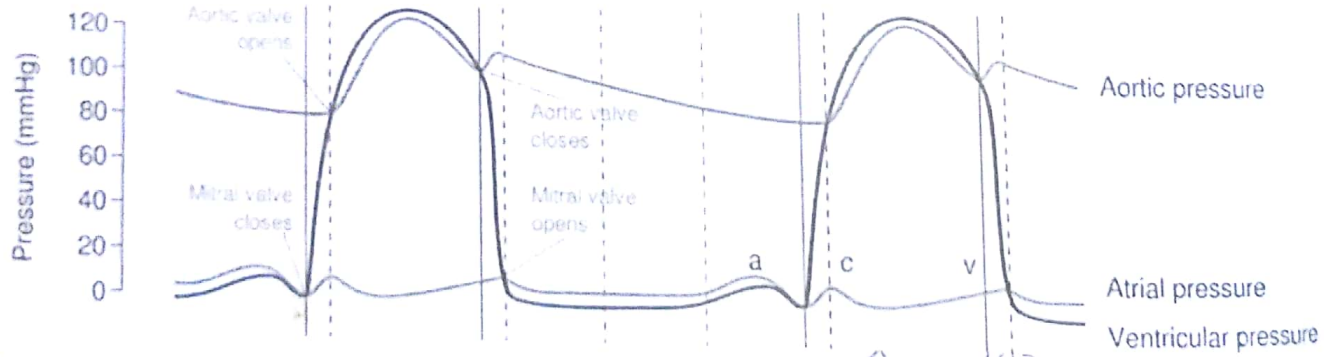
Make the walls of the heart respire only aerobically. So they don't tire throughout life.

Double circulation:

As the blood enter or leaves the heart twice so the circulatory system is called double circulatory system.

Working of heart:

	Ventricular systole	Ventricular diastole
1- Ventricular muscles	Contract	Relax
2- Vol of ventricles	Decrease	Increase
3- Pressure	Increase	Decrease
4- Valves semilunar and cuspid	Semilunar valves open and cuspid closed	Semilunar closed and cuspid open
5- Direction of blood flow	L.V ventricle to aorta / R.V to P.A	Atria to ventricle
6- Pressure in aorta	120 mm Hg	80 mm Hg



Blood:

A liquid connective tissue found circulating in the blood vessels. It consists of two parts:

- Plasma.
- Blood cells.

Functions of blood

Transport:

- Oxygen.
- Nutrients.
- Wastes → CO2, Urea, Ammonia ions.
- Hormones.
- Heat distribution.

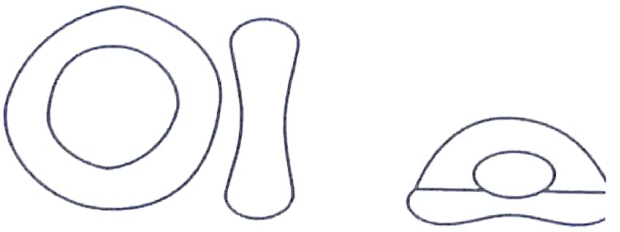
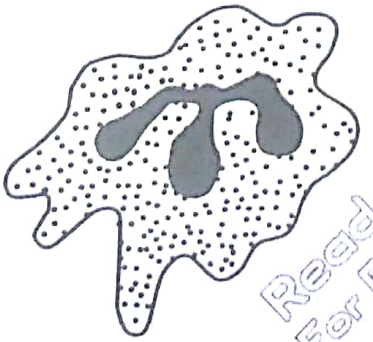
Defense:

- Blood clotting → Prevents entry of pathogens.
- Phagocytes engulf antigen (Pathogen).
- Lymphocytes release antibodies to fight against pathogens.

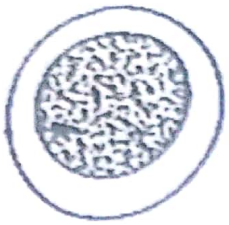
Components of plasma:

- Water → 95%.
- Dissolved substances.
- Salts.
- Nutrients = Glucose, Amino acids.
- Hormones.
- Fibrinogen.
- Suspended substances.
- Albumin protein.

Blood cells:

Type	Structure	Function-How structure is related function
1 RBC's	 Front and side view of a red blood cell. Red blood cell cut in half. Flat, Biconcave, Lack nucleus, Haemoglobin	Transport oxygen
2 WBC's phagocytes	 Irregular shape, Constantly changing shape, Lobed nucleus	Engulf Foreign particles

Pseudopodia



3- Lymphocytes

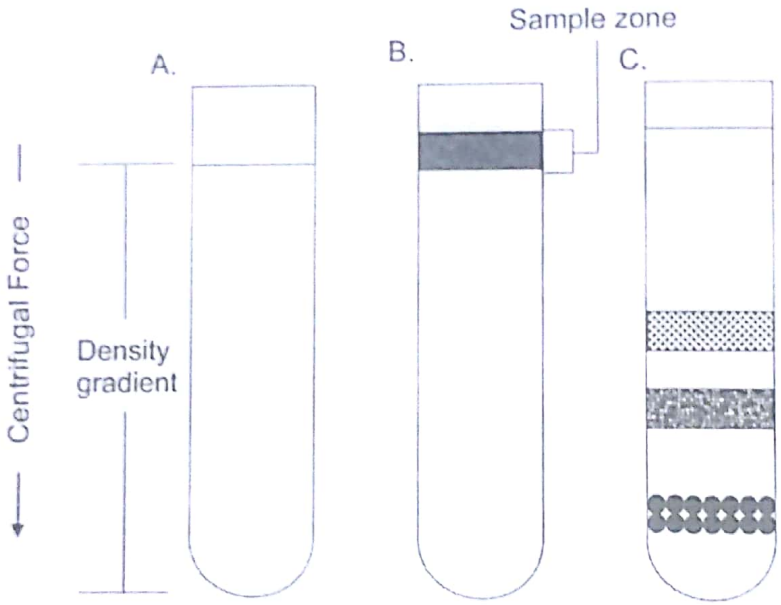
Release antibodies

Large spherical nucleus

4- Platelets

Play role in blood clotting

Cell fragments



Blood Clotting:

Platelets:

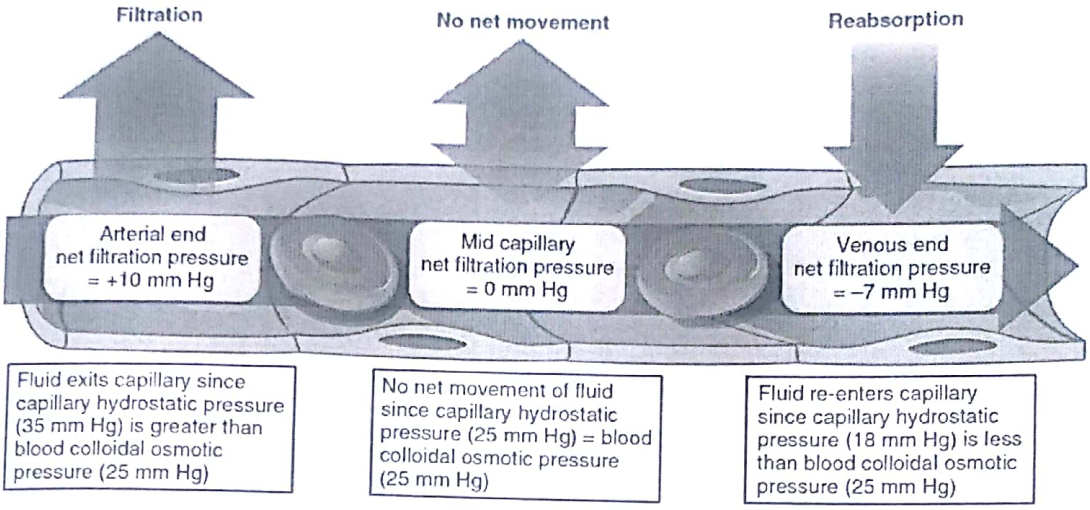
Exposed / Damage.
Thrombokinase (Converts).
↓
Thrombin (Soluble) Fibrinogen — Thrombin — Prothrombine (Inactive enzyme) — Fibrin (Fibers)

Fibrin:

Importance of blood clotting:

- Prevents loss of fluids.
- Prevents entry of pathogen into the body.

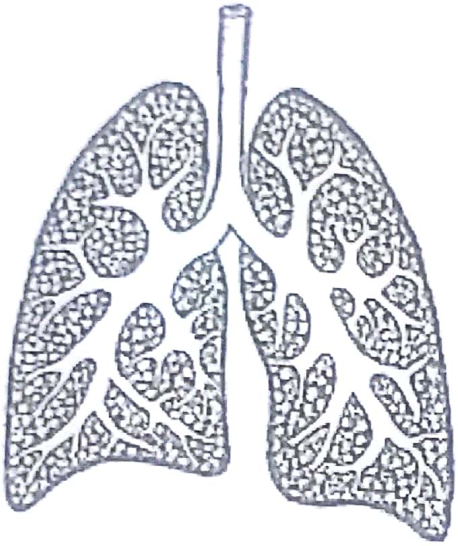
Exchange of materials at capillaries / Tissue fluid formation



Some fluid will go back in lymph vessels and go back to lymphatic system.

UNIT 8

Respiration



O Level
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Syllabus 2016 – 18

8.1 **Aerobic Respiration**

8.2 **Anaerobic Respiration**
- Alcoholic fermentation
- Acidic fermentation
- Differences between aerobic and an aerobic respiration

8.3 **Human gas exchange**
- Air passage
- Ciliated epithelium
- Breathing
- Gas Exchange
- Effect of exercise on the breathing

UNIT 8 RESPIRATION

Definition:

Oxidation of carbohydrates to release energy.

What is energy:

Its uses living organisms use energy in the form of ATP (Adenosine Triphosphate) which is obtained from carbohydrates, fats or proteins obtained by animals where as plants absorbs light energy which is converted into ATP during photosynthesis.

Uses:

- Maintenance of body temperature (Not in cold blooded)
- Muscle contraction
- Protein synthesis
- Cell division
- Conduction of nerve impulses.
- Other uses include energy needed for glowing in fire flies and electric shock produced by electric cell.

Types of Respiration:

8.1 AEROBIC RESPIRATION:

Break down of glucose to CO_2 and H_2O to release more energy in the presence of oxygen.

Aerobic Respiration

$$\underset{\text{Sugar}}{C_6H_{12}O_6} + \underset{\text{Oxygen}}{6O_2} \longrightarrow \text{energy} + \underset{\text{Carbon dioxide}}{6CO_2} + \underset{\text{Water}}{6H_2O}$$

8.2 ANAEROBIC RESPIRATION:

Break down of glucose to pyruvate and then to alcohol or lactic acid to release energy is called anaerobic respiration. It is also known as fermentation.

Alcoholic fermentation:

Glucose Yeast Alcohol + CO_2 + Energy

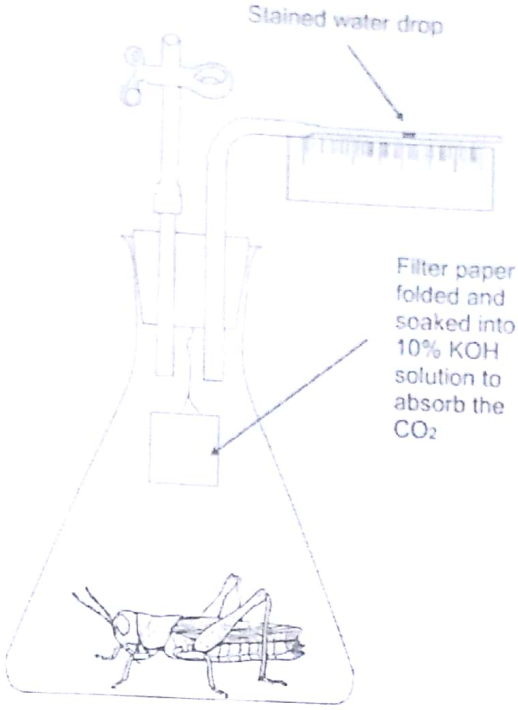
Acidic fermentation:

Glucose Lactic acid

Differences between aerobic and an aerobic respiration:

Aerobic Respiration	Anaerobic Respiration
1- in mitochondrion	In cytoplasm
2- More energy produced	Less energy released
3- Water and carbon dioxide produced	Lactic acid or alcohol and CO_2 produced.
4- In presence of oxygen	In the absence of oxygen.

Describe an experiment to show CO_2 is released during respiration:
Describe an experiment to investigate that O_2 is used up during respiration:



Describe an experiment to show CO_2 is released during respiration:
Take respiring organisms in a test tube.
Attach a bent tube into a rubber bung and fix into the mouth of the test tube.
Take some volume of lime water in another test tube.
Place the free end of the bent tube into the lime water in other test tube.
Wait for half an hour and record the change in colour of the lime water.
Take same mass of respiring Organism of the same kind and kill it by boiling in water.
Place these dead Organisms in another test tube.
Fix a bent tube into it as done with the other test tube.
Place the free end of the bent tube into the lime water.
Record the colour change

Observations:
Lime water turns milky for live organisms.
Lime water remains clear for dead organisms.

Conclusion:
Carbon dioxide released by respiring organisms turns lime water cloudy.

Describe an experiment to investigate that heat is released during respiration:
Take to vacuum flasks.
Place same mass of organisms of same species in each.
In one organisms are killed by boiling before placing them in vacuum flask.
Place a thermometer in each flask.
Record the initial temperature.
After half an hour record the temperature change in each.
Repeat the experiment.

Observations:
More rise in temperature of vacuum flasks which contains live organisms

Describe an experiment to investigate that yeast respires anaerobically.
Take some yeast and sugar solution in a test tube
Place a layer of oil on its surface
Attach a bent tube with this test tube
Place the other end of the bent tube into a yest tube containing lime water
Record the colour change of lime water
Repeat the experiment after now after placing boiled yeast suspension

Observations
The lime water turns milky in a test tube attach with the test tube contains live yeast suspension. The other remains clear

8.3 HUMAN GAS EXCHANGE

Exchange of gases between the lungs and the atmosphere two processes.
- Inhalation
- Exhalation

Air passage:

Nasal canal:

Is the anterior most part which opens through external nostrils to the outside.
It has:
- Turbulent pathway.
- Hairs lining the nasal canal filter the air and trap larger particles.
- Moisture (keeps the hairs moist)

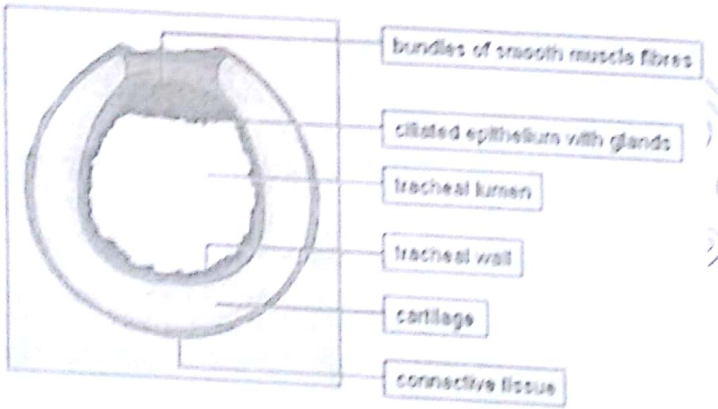
Pharynx:

Is a muscular chamber, the nasal canal opens into it through internal nostrils. It the floor of the pharynx, it has
- Opening of food pipe
- Opening of wind pipe.

Wind pipe (Trachea):

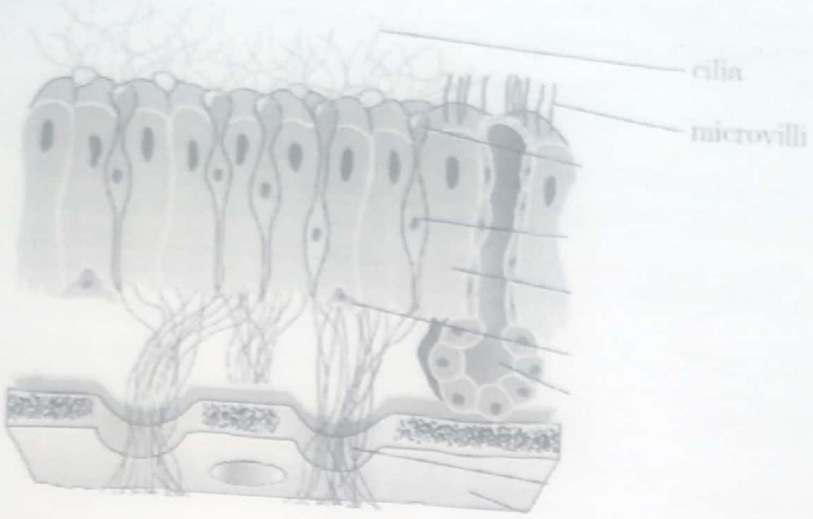
It is a long tubular organ which extends down through the neck on ventral side of the oesophagus. The opening on the trachea is called glottis and is guarded by ephiglottis. On its lower end trachea branches into two bronchi.

Cross section of trachea:



- Trachea contains C-Shaped cartilage Rings along its entire length.
- They keep it open all the time.
- Prevent it from kinking.

Ciliated epithelium:



Ciliated epithelium contains two types of cells.

1- Ciliated cells:

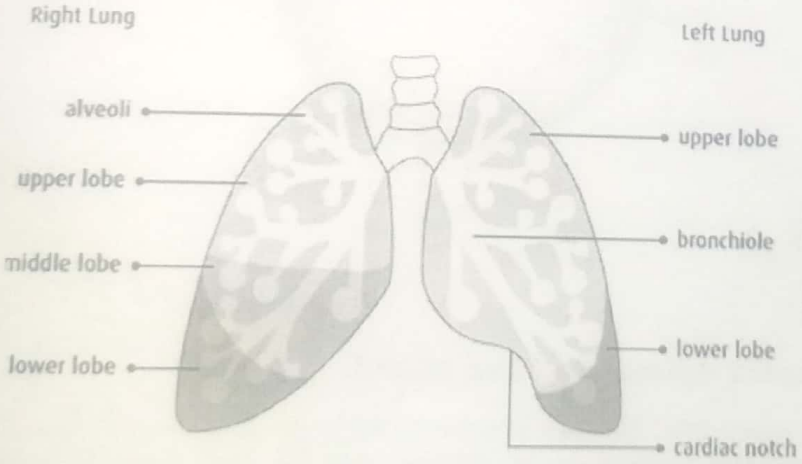
Have cilia in them that sweep the mucus up the trachea.

2- Mucus producing cells:

Mucus makes a trail on the inner linning of the trachea and traps dust and pathogens.

Bronchi:
They have narrower diameter than trachea and do not contain C-Shaped cartilage. They further divide into bronchioles which finally open into cluster of grapes like membrane bound air sacs called alucoli. Each bronchous opens into a lung.

Lung:
Two lungs enclosed in pleural membrane. They are located in the chest cavity. They contain numerous microscopic structure for gas exchange called alveoli.



Breathing:

Inhalation and Exhalation:

When we inhale, external coastal muscles contract and when we exhale external inter coastal muscles relax.Inhalation is an active process and exhalation is passive process.

Inhalation:

During inhalation ribs move upward and outward. When we inhale the diaphragm contracts (It flatten) which increase the volume of the chest cavity. The lungs expand which decreases the pressure in lungs, so air rushes into lungs.

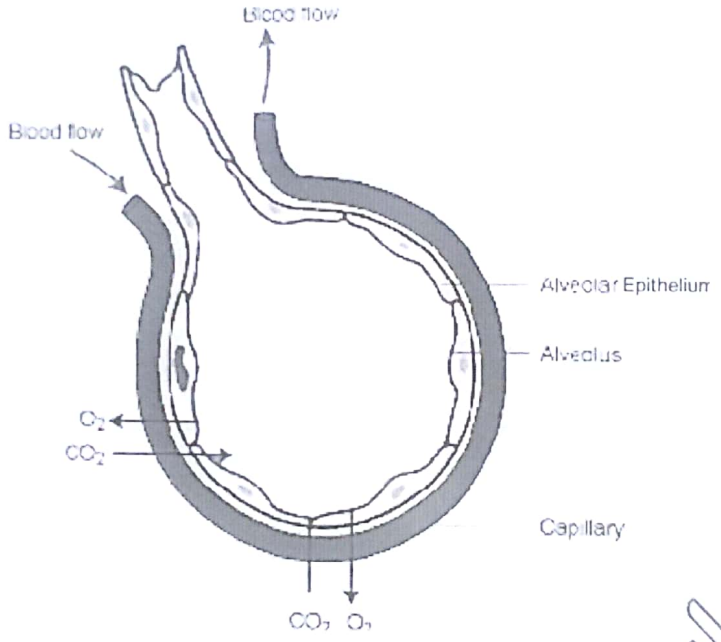
Exhalation:

External inter costal muscles relaxe, the volume of chest cavity decrease and the pressure inside increases which expels air out of the lungs. The diaphragm relaxes.

	Inhalation	Exhalation
1- External inter costal Muscles.	Contract	Relax
2- Ribs.	Swing upwards and outwards	Return to orginal position
3- Diaphragm.	Contract and flattens	Relaxes and arches upwards
4- Volume of chest cavity.	Increased	Decreased
5- Lungs.		
6- Pressure inside the lungs.		
7- Air moves.	Sucked in the lungs	Forced out of the lungs

Alveolus:

Tiny microscopic membrane bound SAC for gas exchange between the lungs and the blood. describe how its structure is adapted to its function.



Gas Exchange

Between the alveolar space and the blood.

The oxygen from the alveolar SAC diffuses into the moist layer. It increases the concentration of oxygen. On this side of the alveolar epithelium. It diffuses through the alveolar epithelium into the blood capillaries. Blood continuous circulation maintaining the lower concentration of O_2 in the blood capillaries, So oxygen continues to diffuses into the blood capillaries. Oxygen combines with haemoglobin in the RBC's to make oxyhemoglobin. This oxygenated blood is transported out of the lungs through P.V. It carries blood to the left side of heart. Which pumps it to the body. In the body the blood capillaries pass closer to the respiring tissues. The respiring cells use O_2 and maintain the lower concentration of O_2 in the tissues. The oxygen disassociates from oxyhemoglobin and diffuses out to the

respiring tissue. During this process CO_2 is evolved. When its concentration increases in cells it will diffuses out and dissolves in plasma and then transported to alveolar SAC from where it is expelled out.

Lung capacity:

The total volume of air that can be held by both the lungs.

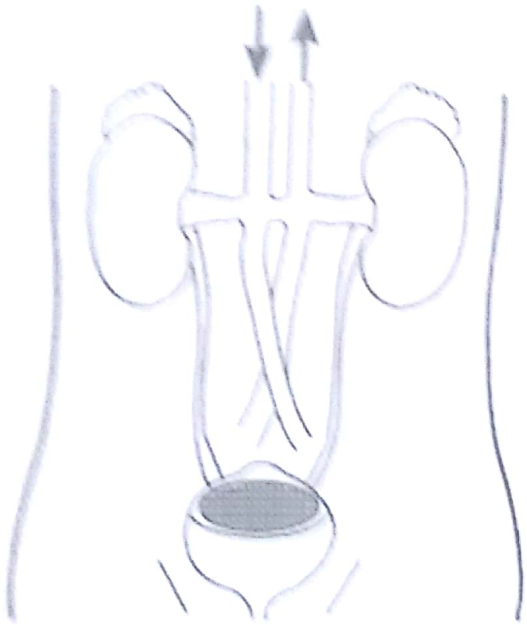
Effect of exercise on the breathing:

- The breathing will become rapid.
- Breathing depth will increase.

It increases absorption of oxygen and removal of Carbondioxide and heat from the body.

UNIT 9

Excretion



Syllabus 2016 – 18

9.1 structure and function of kidneys
- L.S of a kidney
- C.S
- Functions of kidneys

9.2 kidney Dialysis
- Haemodialysis
- Significance of lacking urea in dialysis fluid
- Peritoneal dialysis
- Advantages/Disadvantages of each
- Advantages of peritoneum dialysis

O Level
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UNIT-9 EXCRETION

Removal of metabolic waste out of the body.

Metabolic wastes:

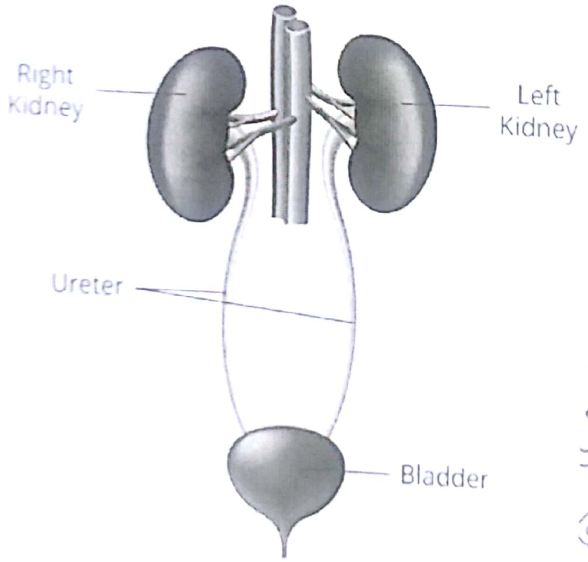
Waste substances produced during biochemical reactions in the cells.

Waste	Process	Part	Excretory organs
1- CO_2	Respiration	All cells	Lungs
2- Urea	Deamination	Liver	Kidneys, Skin
3- Amonia	Deamination	Liver	Kidneys, Skin
4- Excess (salts) water	Food/Drinks Rspiration		Kidneys, Skin, Lungs
5- Uric acid	Breakdown of DNA	Liver	Kidneys

Excretion through Urinary system:

Urinary system consists of the following parts.
- Pair of kidneys.
- Pair of ureters.
- Bladder.
- Urethra.

The urinary system is associated with the Blood vessels:



9.1 STRUCTURE AND FUNCTION OF KIDNEYS

A pair of bean shaped organs enclosed in peritoneum held in the abdominal cavity attached with the dorsal body wall.

Functions of kidneys:

- Excretion.
- Osmoregulation.
- Maintenance of PH of Blood.

Working of the urinary system or urine formation:

Blood enters into kidneys through renal artery. A network of microscopic tubules called nephrons causes ultra filtration of blood. The plasma squeezes out from the blood into the nephrons where needed substances are reabsorbed and the remainder is passed out of them as urine out of the kidneys through ureters. Urinary bladder stores it for sometime as it is filled up the relaxation of the sphincter muscles opens the urethra to remove urine out of the body.

Composition of

- Blood.
- Plasma.
- Urine.

Secretion:

Relese of useful substances into the body.

Egestion:

Removal of solid wastes of the alimentary canal.

9.2 Kidney dialysis:

Removal of selective substances by using partially permeable membrane through diffusion.

Haemodialysis:

Removal of urea from the blood by suing dialyzing membrane.

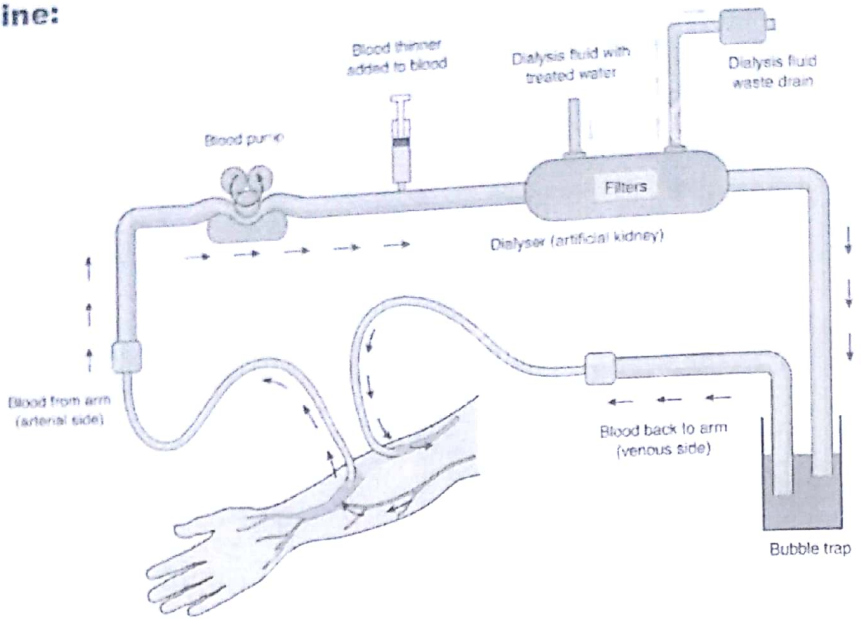
When:

- Kidney failure.
- Kidney infections.
- Kidney transplant.

Types:

- Kidney machine / Dialysis machine.
- Peritoneal dialysis.

Kidney machine:



Working:

A dialysis tube (Partially permeable membrane) attached with one end to an artery and the other to a vein is embedded to dialysis fluid.

Dialysis fluid:

Contains the substances in the same ratio as they are in plasma except urea.

Significance of lacking urea in dialysis fluid:

When there will be no urea in dialysis fluid, the diffusion gradient between blood and dialysis fluid will become steeper.

Problem with the design:

How to maintain?

- Temperature.
- Blood pressure.
- Continuous flow of blood .
- Steeper concentration gradient.
- Prevent blood From clotting.
- Contamination.

Peritoneal dialysis:

Peritoneum:

A partially permeable membrane that surrounds Kidney / Gut and inner lining of the body cavity.

Advantages / Disadvantages of each:

Disadvantages of Kidney machine:

- Kidney machine restricts the mobility of an individual.
- It is very expensive.
- Risk of infections diseases.
- A trained person is needed.

Advantages of peritoneum dialysis:

Disadvantages:

- Pathogen can conveniently enter.
- Prove fatal.

UNIT 10

Homeostasis

O Level
Biology

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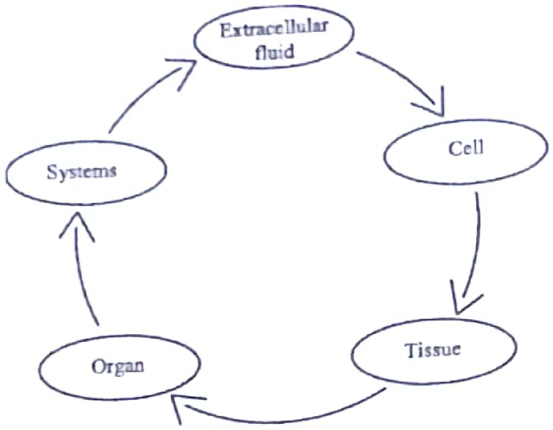
Syllabus 2016 – 18

10.1 structure and function of the Skin
- Structure

UNIT-10 HOMEOSTASIS

Maintenance of the internal environment fairly stable.



External environment is constantly changing, Does it effect internal environment.

Importance of homeostasis:

More survival chances of organisms as it.

- Enable organisms to occupy diverse places.
- Stay active in all seasons.
- Continue metabolism at an optimum level.

Process:

Negative feedback is a main process involved in homeostasis.

Negative feed back:

A series of events in response to a deviation from a normal condition to bring the change back to the normal.

Examples:

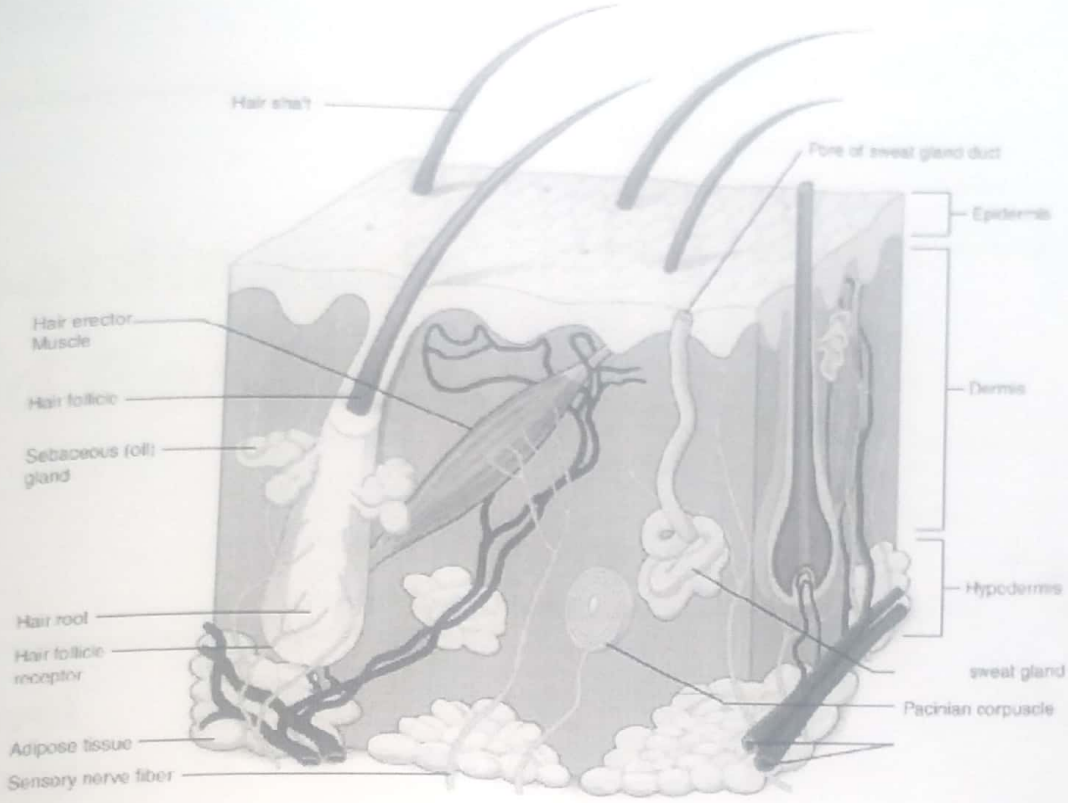
- Thermoregulation.
- Blood glucose regulation.
- Osmoregulation.

10.1 STRUCTURE AND FUNCTION OF THE SKIN:

The largest organ that covers the entire body. It performs many functions.

- Prevents entry of pathogen into the body.
- Loss of body fluids.
- Maintains body temperature.
- Excretion of excess water, salts, urea.

Structure:



Cornified:

Flat, dead, keratinize cells:
Dead layer acts as a barrier against the pathogens and the living tissue.

Granular layer:
It receives new cells from the lower side and replaces the worm off cells at the top.

Malphighian:

Mitosis takes place and new cells are formed:

- Thermoregulation
- In hot climate
- Sweating increases
- Metabolic rate slows
- Hair flatten on the skin
- Muscles relax

Vasodilation:
Blood vessels dilates and more blood flows to the skin carrying more heat. So the skin temperature rises and it is lost to the surrounding

- Radiation.
- Conduction.
- Connection.

UNIT 11

Coordination and Response

O Level
Biology

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Syllabus 2016 – 18

11.1 **Nervous system**
- Working of nervous system

11.2 **Different stimuli and receptors**
- Stimulus

11.3 **Reflex action**
- There are two types
- Eye
- Apparatus for accommodation
- Focusing
- Harmonal Co-ordination

11.4 **Harmone**
- Target site

UNIT-11 COORDINATION AND RESPONSE

Coordination:

Precisely ordered working of various systems of the body together.

Lack of coordination:

Chaos in body function which reduces survival chances.

Co-ordination systems:

Two co-ordination systems.
- Nervous system.
- Harmonal system.

11.1 NERVOUS SYSTEM:

Consists of :
- CNS (Central nervous system).
- PNS (Peripheral nervous system).

Working of nervous system:

Stimulus:

Change in the environment which could bring a change in the body.

Receptor:

A tissue / organ which can detect a stimulus.

Sensory nerves:

Nerve cells which carry message from receptor to CNS.

Motor nerves:

Carry message from CNS to effectors.

Effector:

Is an organ which responds to a stimulus. Eg,
- Muscles.
- Glands.

Response:

A change in the body in accordance to a stimulus.

11.2 DIFFERENT STIMULI AND RECEPTORS:

- Light → Retina.
- Pressure → Skin.
- Chemicals → Tongue / Nostrils.
- Pain → Skin.
- Sound → Ears.

Stimulus:

Brain:

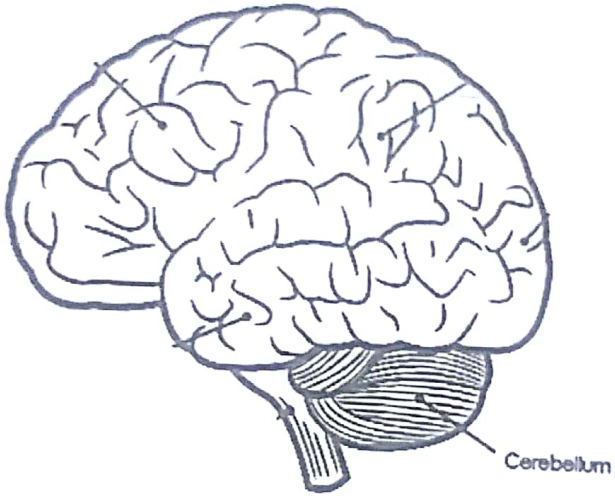
Most intricate complex organ enclosed and protected in the skull.

It can be divided into :

Fore brain:
Cerebrum (Top of the skull) controls.
Speech:
conscious altitude.
Intelligence, Decision making.
Hypothalamus:
Homestasis, Hunger, Thirst, Hot, Cold.
Mid brain → Reflexes of head region.

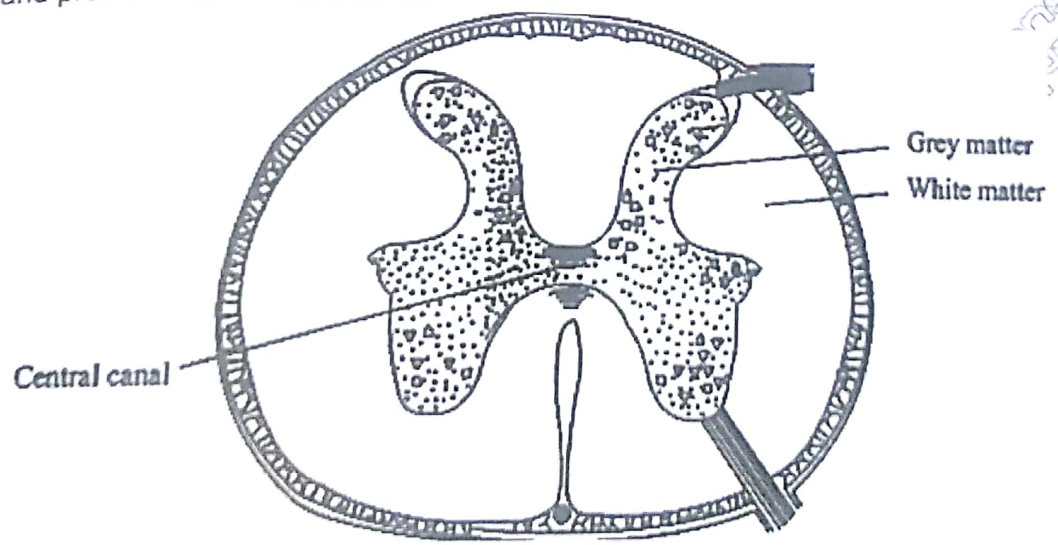
Hind brain:

Cereblum:
It co-ordinates the muscles and balance.
Medulla:
Controls Vital function berating, heart beat and peristalsis.



Spinal cord:

Enclosed and protected in the back bone.



Cross Section of Spinal Cord:

Functions:

- Control the reflexes of the lower part of body below neck.
- Carries impulses to the brain from the body.
- Carries impulses to the body from the brain.

11.3 REFLEX ACTION:

A spontaneous, sudden change in the body in response to a stimulus. It does not involve conscious control.

There are two types:

- Conditional reflexes.
- Simple reflexes.
- Simple reflexes may be.
- Cranial reflexes → Controlled by brain.
- Spinal reflexes are controlled by Spinal cord.

Withdrawal of hand:

- Touch a hot object.
- Receptors in the skin fire off impulses which are carried to the spinal cord.
- Relay neurons in the spinal cord pass information to motor neurones.
- Motor neurones carry motor impulses to an effector / Biceps.
- Biceps contracts and the hand is pulled back.

Reflex arc:

A route followed by a nerve impulse during a reflex action is called reflex arc. A simple reflex is a spontaneous reaction.

Sneezing:

Inner lining of nose is receptor and inter costal muscles are effecter.

Importance:

Expels out any thing present.

Blinking:

Retin (Receptor), Muscles in eyelids (Effectors).

Importance:

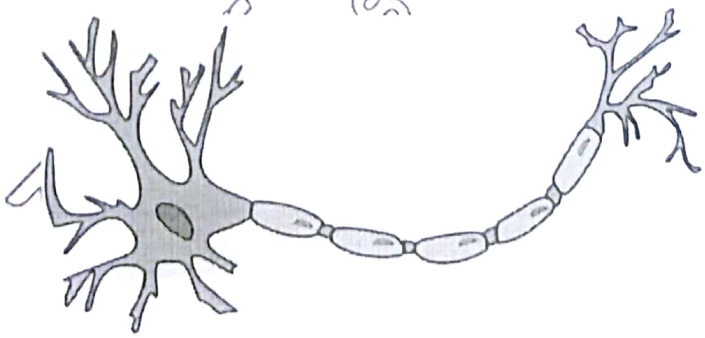
Prevents anything entering in eyes and prevent eyes from drying.

Nerve cells / Nevrone:

- Sensory neurone / Receptor neurone.
- Relay / Intermediate.otor / Effector neurone.

Structure:

A neurone consists of two parts.
- A cell body → Provides energy.
- A long fiber.
- Axon → Carry impulses away from cell body.
- Dendron → Carry impulses towards cell body.



Nerve impulse:

Nerve impulse travels along the nerve cell in a series of changes of potential difference on inside and outside the cell. The potential difference is maintained by an insulating layer called myelin sheath where as a nevrone joined end to end. To another allows the electrical impulse to be converted into chemical impulse to travel through the gap present in between them called synapse.

How structure of a nevrone is adapted to its function:

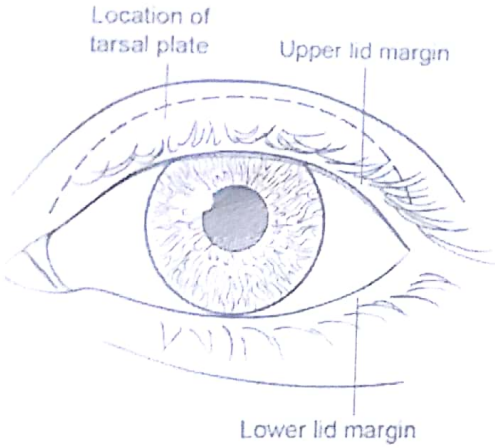
- Long → It can extend from one part to another part of body. (Receptor to effector).
- Mylein sheath → It provides insulation and speeds up the conduction of nerve impulses.
- Branching → Can make connections to various nevrones.
- Cell body → Provides energy for active transport synthesizes the nervotransmeter. Synthesizes enzymes for metabolic processes.

Eye:

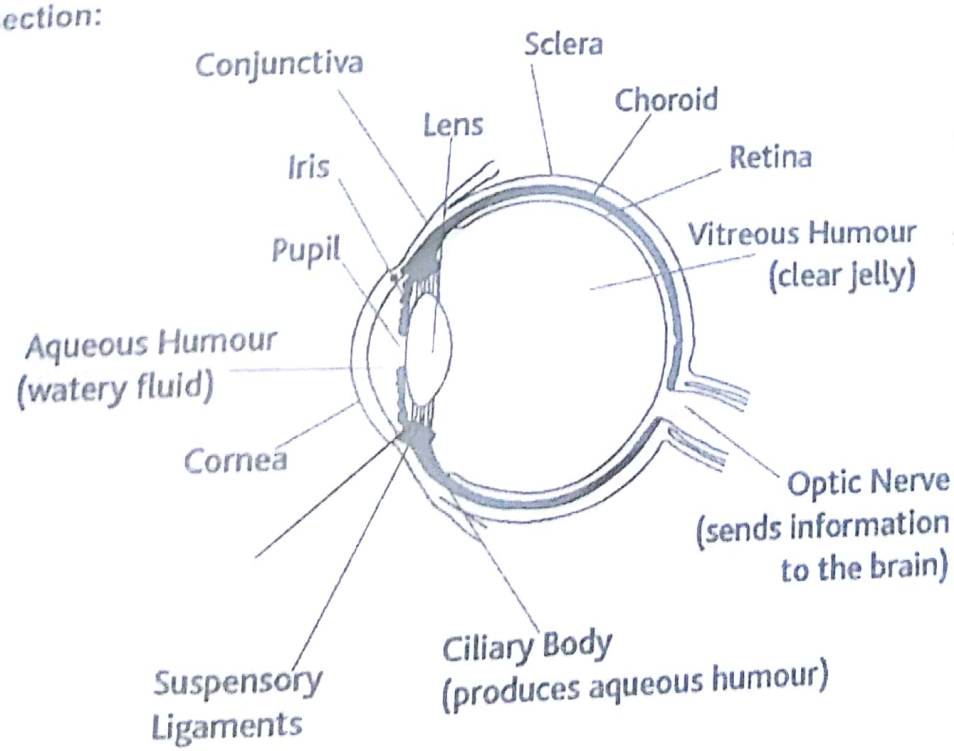
A pair of eyes located on the ventral side of the skull. Each present at the base on either side of the nose. Being present on the anterior most part of the body, they keep us aware of the dangers coming ahead.

Structure:

Front view



Longitudinal section:



Structure of an eye:

- **Eye Socket:**
  A hole in the skull where eye ball is held.

- **Muscles:**
  Which hold / move the eye ball.

- **Eye lids:**
  Protect the eye ball.

- **Eye ball:**
  Consist of three layers.

Sclera:
An outer most fibrous, white layer which enclosed the contents of the eye ball. In front of eye ball it is transparent and is called cornea.

- **Choroid:**
  Choroid → Middle layer:
  Heavily pigmented prevents internal reflection.
  Vascularised provides nutrition.

- **Retina:**
  Inner most layer which is sensitive to light. It contains two types of cells.

(i) **Rods:**
- Sensitive to dim light.
- Black and white image.
- Most concentrated towards the edges.
- Cones
- Sensitive to bright light.

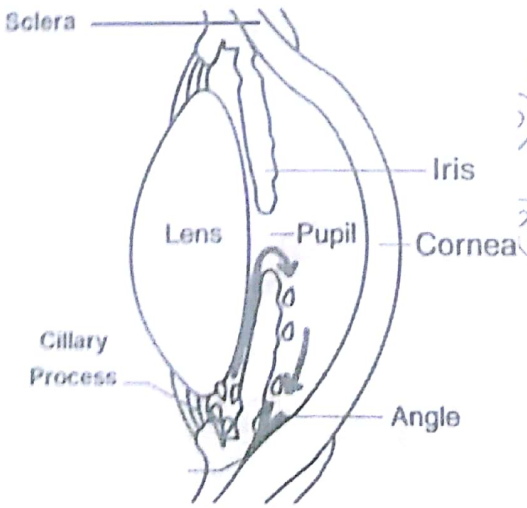
(ii) **Colour:**
- Most concentrated in the centre → Fovea.

The image formed stimulates the rods or cones from where the message is carried to the visual centre of brain through optic nerve. There is a cavity in the centre of the eye ball. It is filled with a liquid transparent substance.

It is partitioned into two regions:
- Vitreous humur (From lens to retina).
- Aquoushumur (From cornea → Lens).

The partition in vitreous and humerus cavity is made by an apparatus for accommodation which is covered on front side with iris.

Apparatus for accommodation:



It appears like cart wheel. The lens is surrounded by ciliary muscles which hold the lens with the help of suspensory ligaments which appear like spokes in a cart wheel.

Lens:

Is transparent structure made of strechible material. It can stretch and recoil so can become thick or thin to focus the image onto retina. The process is called focusing or accommodation.

Suspensory ligaments:

Are inelastic fibers which help lens to stretch and make less convex.

Ciliary Muscles:

Contract and relax to bring changes in the thickness of the lens.

Experiment to investigate a blind spot:

- Close your left eye with the left hand.
- Focus right eye on the cross, you will see both cross and dot.
- Move your head up and down slowly. Don't allow your gaze wander.
- At a point you will see the cross but not the dot.
- Measure the distance from eye to the paper.

Vision = Ability to see

Monocular vision:

In animals like lizards both eyes see a different image.

Binocular vision: Sterioscopic vision:

Both of the eyes see the same image at different angle.

Visual field:

An area in front of each eye where we can see an object.

Blind zone:

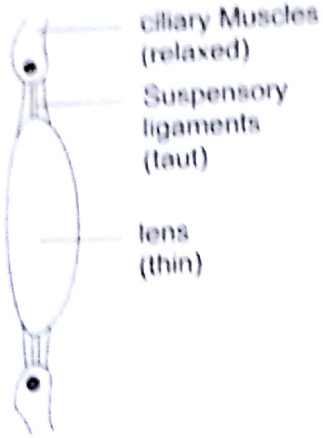
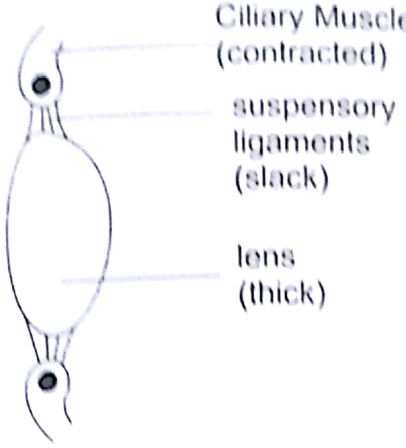
An area behind the eyes where an object placed cannot be seen.
Both eyes see slight different aspect of an object the image from both of the eyes is super imposed to provide stereoscopic vision.

Advantages of stereoscopic vision:

We can judge image;

- 3D.
- Size of an object.
- Distance.

Focusing table:

Distant	Near
	
• The light rays from a distant object are parallel to principal axis.	The light rays from a nearer object are diverging.
• 70% of bending of light rays is done by the cornea.	Main bending is not done by cornea.
• The ciliary muscles are relaxed.	Ciliary muscles contract.
• Suspensory ligaments are pulled tavt.	Suspensory ligament slacken.
• Lens is made thin.	Lenses become thick to bend the diverging rays the retina.

Focusing:

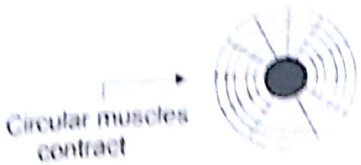
Accommodation:

Change in the distance stimulates ciliary muscles to change the thickness of lens to focus on to a moving object. This is called accommodation.

- An insect sitting on your nose is flown away with your right hand. Describe and explain the changes in nervous and muscular system in flying this insect away. (12 Marks)
- A person is reading a book in a room. He looks at a bird flying away through the window. Describe and explain the changes in eye. (12 Marks).

Pupil reflex:

A change in the light intensity acts as a stimulus. The receptor cells in the retina detect this change and fire off nerve impulses. These impulses reach to the mid brain through the optic nerves. The mid brain sends motor impulses to the iris muscles to adjust the diameter of the pupil to regulate the light.

Bright	Dim
If the intense light enters into the eyes it can damage retina. To avoid damage less light is allowed to enter into eyes.	In dim light less light enters into the eyes. To make a clearer image more light is allowed to enter into the eyes
→ How?  → Circular muscles → Contract → Radial muscles → Relax → Pupil → Narrow	→ How?  → Circular muscles → Relax → Radial muscles → Contract → Pupil → Wider

Harmonal Co-ordination:

Adrenaline:

An emergency harmone released during condition of fear, flight to fly away. It is released by adrenal gland present at proximal end of each kidney. The harmone is released in the blood and transported to the target site. Where it shows its effects. The effects of harmone are normally long lived, but in this some effects are short lived.

Effects of adrenaline:

- Vaso dilation in the muscles.
- Vaso constriction.
- Skin.
- Alimentary canal.
- Glycogen → Glucose.
- Breathing rate.
- Heart beat.
- Pupil dilation.
- Harmone is broke down in liver and is released during urination.

11.4 HARMONE:

A chemical substance regulatory in function released from endocrine glands into the blood stream.

Target site:

A site where a harmone acts is called target site.

UNIT 12

Support, Movement and Locomotion

Syllabus 2016 – 18

12.1 **bones**
- Pectoral girdle
- Two types

12.2 **Joint**
- Two types

12.3 **Antagonistic Muscles**
- Teeth

O Level
Biology

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UNIT-12 SUPPORT, MOVEMENT AND LOCOMOTION

Skeletal System:

It consists of three main types of tissues:
- Cartilage →Cusioning.
- Bones.
- Muscles.

Skeletal system provides the following functions:
- Protection.
- Support.
- Muscle attachment.
- Movement.
- Storage of calcium.
- Blood cells formation.

Types:

There are two main types of skeleton.
- Exo skeleton → in insects.
- Endo skeleton → in humans.

Skeleton of humans:

It is divided into three parts:

1- Axial skeleton:
- Skull.
- Back bone.
- Ribs.

2- Appendicular skeleton:
- Limbs.

3- Girdles:
- Pelvic girdle (Hip girdle)
- Pectoral girdle (Shoulder girdle)

Skull:

The most anterior part of the body. It encloses and protects the brain. It also holds and protects the main sense organ.

Back bone:

It makes the central axis of the body. It keeps us upright and holds the weight of body. It is made of 33 irregular bones stacked one above the other.

Ribs:

Encloses and protect the heart, lungs and major blood vessels. They also move to bring inhalation and exhalation.

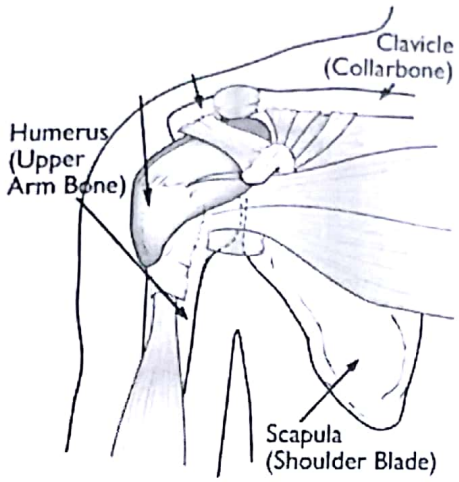
12.1 BONES:

Pectoral girdle:

(Shoulder girdle).

Consist of:

Shoulder bone:



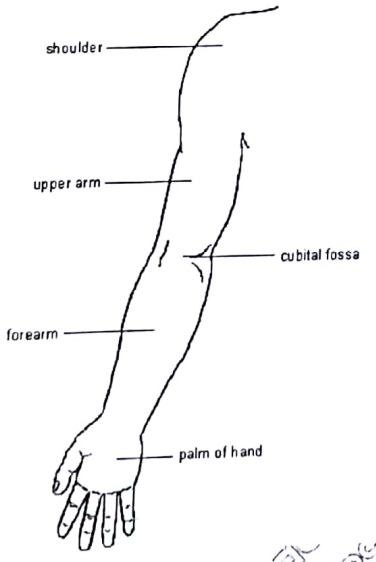
A triangular, flat bone with a shallow cavity on narrower end. It joints the arm to the axial skeleton.

The collar bone:

It prevents the shoulder from bending inward.

Arm:

- Upper arm.
- Lower arm.



Ulna and radius:

Longer than radius.
Thicker than radius.
Has cavity where part of humorous fitted to make hinge joint.
Ulna has an extended bone.

Humerus:

A long bone with a rounded head called epiphysis and a long central shaft called endophysis.

Shallow cavity:

Lose attachment of the shoulder bone with the back side of ribs. (Allow free movement of hands)

12.2 JOINT:

Place where two or more bones meet together.

Two types:

- Ball.
- Socket.

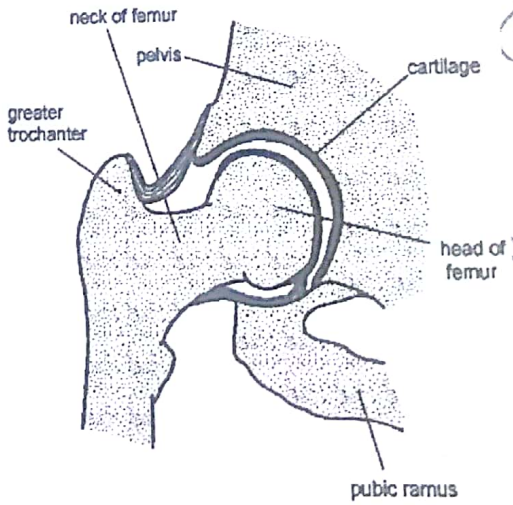
Location:

High joint / Shoulder joint.

Degree of movement:

Shoulder joint has wide degree of movement → 360° in all planes.

Structure of ball and socket joint:



12.3 ANTAGONISTIC MUSCLES:

Muscles contract and pull the bones. They can never push the bones back. When the muscles contract they shorten in length. To move a bone at a joint muscles contract. Muscles are arranged in pairs called Antagonistic pairs as one contracts the other relaxes.

Movement at an elbow joint.
Muscles present in upper arm towards the bending of the elbow are flexor. Flexor contract and bend the arm at elbow joint. At the same time the muscles on other side of the upper arm relax. These are extensor muscles. To straighten the arm extensors contract, they shorten in length and pull the arm straight where as the flexor relax. Muscles are attached at their both ends to the bones.
At one end they are attached with movable bone and at the other end they are attached with immovable bone. A muscle is attached to a bone with Tendons. Tendons being inelastic transmit the force of pull to the bone upon contraction. Ligament are elastic tissue which join a bone to another bone. Being elastic they hold the bones together preventing them from slipping.

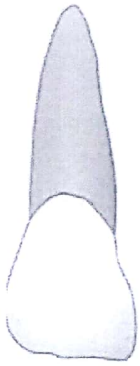
Teeth:

Two sets of teeth in humans.

- Milk teeth (Deciduous), First tooth come at the age of 7-9 months. First tooth fall at the age of 7-8 years. These teeth do not have roots and are replaced by permanent teeth.

- **Permanent teeth:**
  First tooth replaces the milk tooth at the age of 7-8 years.

Four types of permanent teeth:



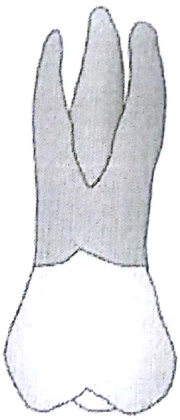
Incisors→ 8 in No:
The front four teeth on each jaw.

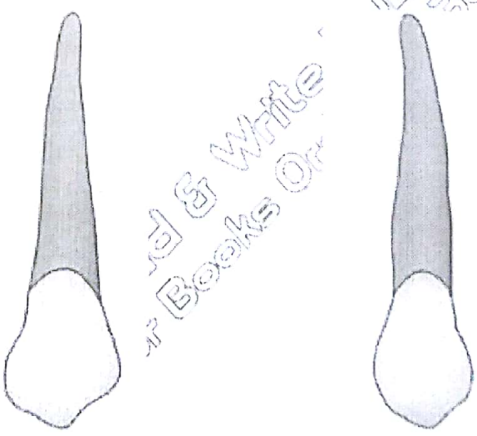
Structure
It is used for biting and cutting the food.

Canines → 4 in No:
One sharp / pointed tooth on either side of both of the jaws next to the incisors.
Meant for cracking nuts.

Premolars → 8 in No :
Two premolars next to incisors on either side of both the jaws. On the lower jaw they have two roots whereas on the upper jaw a single root. The crown has cusps which increase surfaces that come in contact for grinding.

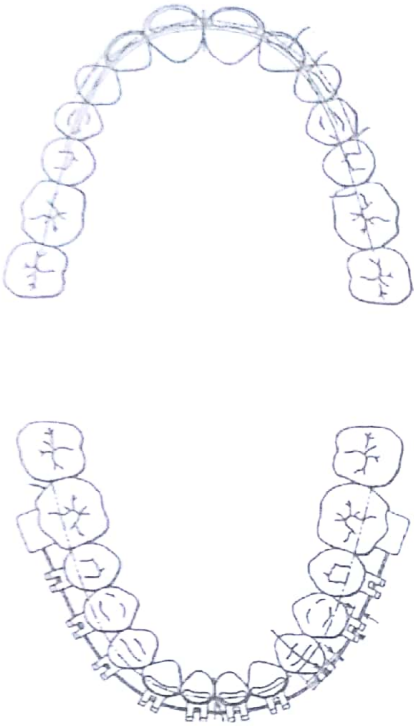
Molars:
3 molars next to premolars on both sides of each jaw.





Dental plan:

Ultra structure:



Causes of Dental decay

- Intake of sugary foods.
- Oral unhygienic.
- Food bacteria and mucus deposited on teeth as plaque.
- Bacteria break down sugars to make acids.
- Acids decrease the pH of mouth.
- It corrodes the surface of teeth.
- The minerals deposit in the plaque.
- Plaque is hardened to tartar which is not removed by simple Brushing.
- Tartar roughens the surface of teeth.
- More food deposits. More break down of food anaerobically lowering pH further.
- It keeps on eroding the enamel.
- Enamel is a harder tissue. It takes longer to be eroded however once it is eroded denting is exposed which makes a tooth sensitive hot an cold.
- Erosion of denting exposes pulp which makes the tooth painful.

Prevention of Dental diseases:

- Brushing regularly.
- Dental floss.
- Visits to dentists.
- Cut down sugar intake.
- Uses of fluoridated / alkaline tooth pastes.
- Scaling.
- Use of fluoridated water.
- Dental discloses.
- Dietary fibers.

UNIT 13

The Use and Abuse of Drugs

Syllabus 2016 – 18

13.1 Antibiotics
- Examples

13.2 Heroin
- Effects

13.3 Effects of Alcohol

13.4 Effects of tobacco smoke
- Active smoking
- Passive smoking

O Level
Biology

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UNIT-13 THE USE AND ABUSE OF DRUGS

Drugs:

An externally administered substance that alters the metabolism
Three types of drugs:

- Medical drugs, Aspirin
- Socially acceptable drugs tobacco (Now becoming unacceptable), Alcohol (Not in Muslim society).
- Socially unacceptable perion.

1- **Stimulants:**
Drugs which reduce the reaction time nicotine.

2- **Depressants:**
Increase the reaction time.

3- **Narcotics:**
Additive drugs.

4- **LSD:**
Ecstasy drugs.

Addiction:

A state if the drug is not taken, the body shows physical dependence.

Physical dependence:

If the drug is not taken, the body shows some signs and symptoms like muscle pain, vomiting and diarrhea etc. called withdrawal symptoms.

Drug tolerance:
A state of taking increased amount of drug every time to maintain the feelings of high. (Pleasure)

13.1 ANTIBIOTICS:

A substance extracted from micro-organisms to control bacterial infections.

Examples:

Penicillin:

It is extracted from a fungus called penicillium. It is a broad spectrum antibiotic (Acts against a wide range of bacterial infections). Many bacterial have become resistant to penicillin today so the new derivatives of penicillin are being used against bacteria.

Streptomycin:

It is obtained from a bacterium called streptomycin. It is also a broad spectrum anti biotic.

How do anti biotic work:

- They interfere the enzymes of bacteria involved in protein synthesis.
- They interfere the cell division.
- They break down the bacterial cell walls.
- Antibiotics do not work against viruses.

Flue is a viral infection:

Why the antibiotics are given to the people effected by flue.

Abuses of antibiotics:

- Overdose of antibiotic can have side effects.
- If antibiotics are taken less than the recommended dose, bacteria develop resistance against them.

Advantage of antibiotics:

Used to control bacterial infections and they have reduced the risk of death due to bacterial infections.

13.2 HEROIN:

Strongly depressant drug.

Effects:

Medical:

- It reduces hunger, so malnutrition occurs.
- Sharing needles can spread infections like aids, hepatitis. Ignores the hygiene.

Social:

It is an expensive drug and user develops tolerance against it. The addict person ignores family and job, so may have limited sources of income, they can involve in stealing, theft and becomes violent and can commit to murder.

Effects on nervous system:

Initially dulls the senses and produces feelings of well being. It increases the reaction time.

Withdrawl symptoms:

- Watery eyes.
- Stomach upset.
- Muscular pain.
- Vomiting diarrhea.
- Convulsions.
- Hallucination.

13.3 EFFECTS OF ALCOHOL:

Alcohol:

$CH_3 CH_2 OH$, $C_2 H_5 OH$

Reasons for starting alcohol:

- To show off.
- Influenced from advertises.
- Peer pressure.
- Easy availability.
- To overcome social inhibition.

Reason for continuing alcohol:

It is addictive.

Effects of alcohol:

- It is depressant drug and influences almost every part of body.

Effects on nervous system:

- Slows down the conduction of nerve impulses so increases reaction time.
- It effects cerebrum loss of control over speech, or a person may become unconscious.
- It effects medulla, it may cause death.

Effects on digestive system:

- Increases acidity in the stomach.
- Can lead to stomach ulcers.
- If an alcoholic is smoker too, it increases chances of oral cancer, cancer of tongue.

Effects on Reproductive system:

It reduces sperm count, so leads to male sterility (Infertile)

Effect on skin:

It causes vasodilation in the skin, A person feels warmth and removes warm clothing. In the cold weather it can lead to the heat loss, called hypothermia.

Effects on urinary system:

It reduces water potential of blood, a person feels thirsty and drinks more water, it can cause edema lower water potential can damage kidneys resulting in kidney failure.

Effects on liver:

It causes liver cirrhosis (Shrinkage of liver)
Alcohol Alcohol dehydrogenase $CO_2 + H_2O$

Effects on fetus:

- Reduced weight loss.
- (FAS) Fetal alcohol syndrome (Slow development of brain)

Withdrawn symptoms of alcohol:

- Tremors
- High pulse rate
- Sweating
- Visual hallucination
- Restlessness
- After effects / withdrawn symptoms can be treated with sedative drugs and multivitamins.

13.4 EFFECTS OF TOBACCO SMOKE:

Inhalation of tobacco smoke.

Active smoking:

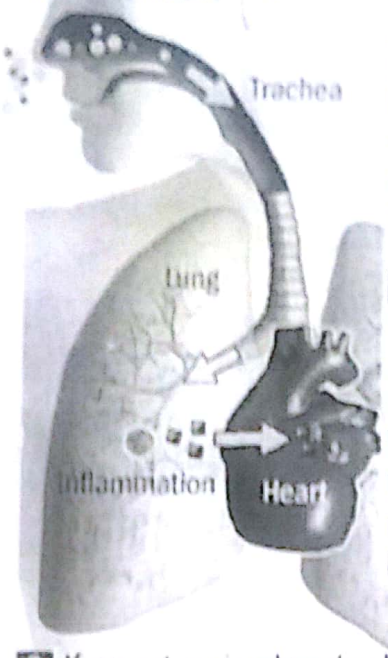
Inhaling tobacco smoke from the end of tobacco other than burning end.

Passive smoking:

Inhaling the tobacco smoke from the same burning end.

Sheer Heart Attack

Possible effects of passive smoking on the human heart



1 Particles from passive smoke arrive in the lung and cause inflammation there.

2 Hormones such as interleukin 6 (IL-6) are released in increased amounts. IL-6 causes platelets to stick together more easily in the blood.

3 If an artery is already clogged, this can lead to a blood clot forming – thereby causing a heart attack

According to a study from Scotland,

the number of heart attacks has dropped by 17 percent in the total population and by 20 percent among non-smokers

since the introduction of the smoking ban.

Component	Effect on the body
1- CO Carbon mono oxide	Combines irreversibly with the hemoglobin to make carboxy hemoglobin. It reduces oxygen carrying capacity of blood → Tires easily, Breathlessness.
2- Irritants	Stimulate the release of excessive mucus. It blocks the bronchioles and produces a state of difficult breathing called bronchitis.
3- Tar	Deposits on inner lining of alveoli and breaks the elastin. Surrounding alveoli. The alveoli stretch and the alveolar epithelium become thin. Vigorous coughing can break down the alveoli. The state is called emphysema.

Nicotine:

- Stimulant.
- Narrows blood vessels.
- Makes blood cells sticky.
- Increases heart beat rate.
- Cardiovascular diseases.

Food:

Does not alter the metabolism.

Reaction time:

The time taken to response a stimulus.

Cardio vascular diseases:

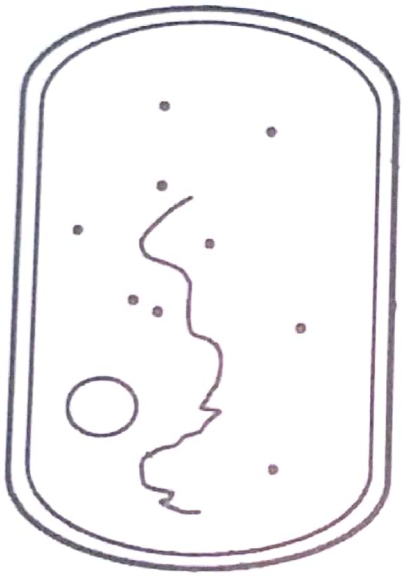
Diseases of heart or of blood vessels.

Causes:

- Fats → Deposition of fats → Atherosclerosis.
- Obesity.
- Ageing.
- Smoking.
- Lack of exercise.
- Stress.

UNIT 14

Microorganisms and Biotechnology



Syllabus 2016 – 18

14.1 **Microorganisms**
- Virus
- Bacteria
- Role of bacteria and fungi in decay

14.2 **Food Biotechnology:**
- Fermentation

14.3 **Industrial biotechnology:**
- Fermenter:
- Types of fermentation process:
- Formation of mycoprotein (S.C.P):

O Level
Biology

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UNIT-14 MICROORGANISMS AND BIOTECHNOLOGY

Micro biology:

Study of microorganisms.

14.1 MICROORGANISMS:

Tiny living things that can not be seen through the naked eyes.

- Viruses.
- Bacteria.
- Fungi (Not all).
- Protozoans (Plasmodin→ Malaria).
- Algae (Not all).

Virus:

The word virus is derived from Greek that means poisons.

Characteristics of viruses:

- A cellular (Non-cellular).
- Strictly parasites.
- On the border line of living and non-living things.

Why non-living:

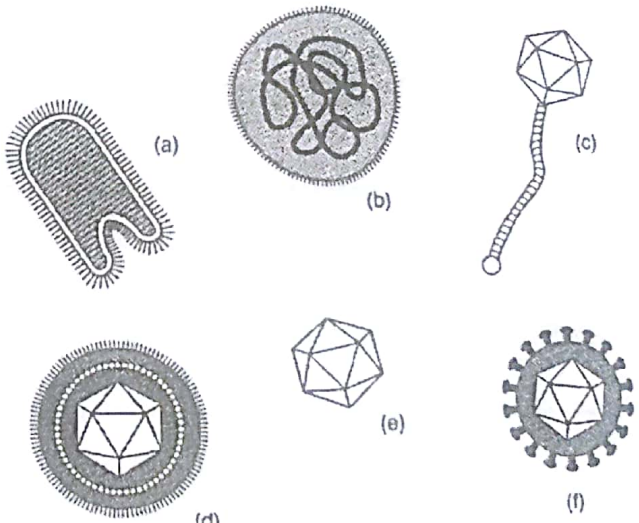
- They do not show any life activity outside the host cells.
- They have crystalline shape outside the host cell.

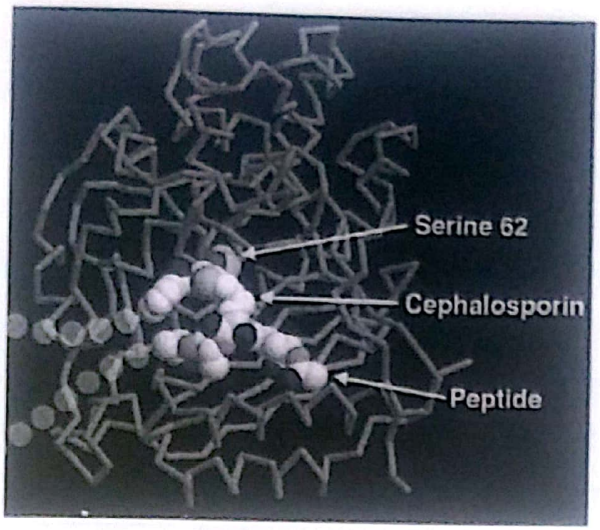
Why living:

- They contain nucleic acid.
- Multiply inside the host cell.

Structure of viruses:

- Viruses exist in various shapes.
- Rod shaped.
- Polyhedral.
- Spherical.
- Tad pole like.
- They are 10 to 100 times smaller than bacteria.
- Viruses body consist of .
- An outer coat of proteins.
- An inner care of nucleic acid.



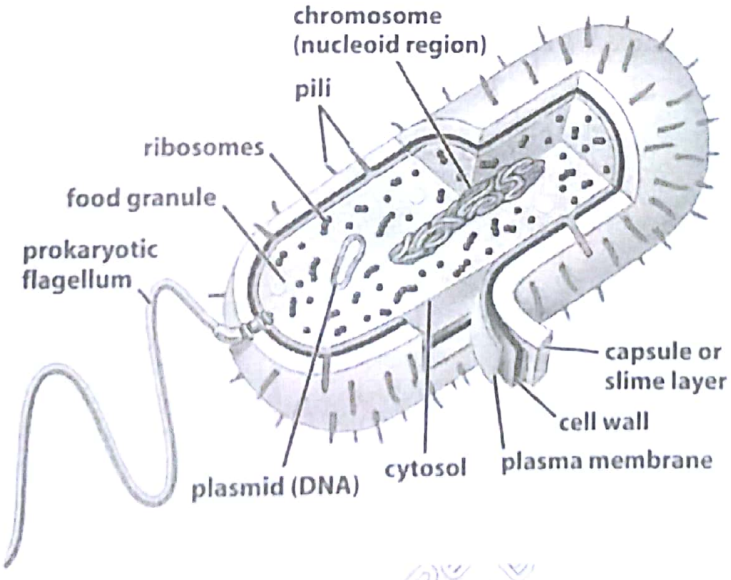


Life cycle of virus:

- A virus nears a host cell.
- Virus attaches itself with the host cell surface with the help of sticking protein.
- Virus makes a hole through the wall of the host cell.
- It injects its DNA/RNA into the host cytoplasm.
- The viral DNA can insert itself into the host DNA and multiplies with the multiplication of the host cell.
- It uses the machinery of the host cell in the cytoplasm and instructs the host cytoplasm to make new viruses. The viruses mature inside the host and cause the host cell to burst.

Bacteria:

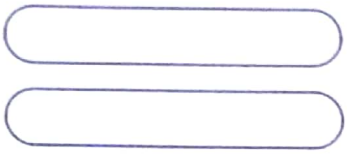
- Unicellular.
- cell wall made of murein.
- Lack double membrane bound organelles.
- A double standard circular DNA embedded in the cytoplasm. No nucleus.
- May or may not have flagella. (Locomotary organs).



Shapes:

= Spherical →Coccus→Cocci (Streptococcus).

= Rod like → Bacillus → Bacilli (Lacto Bacillus) → Yogurt making



= Comma → Vibrio →Vibrios (Vibrio cholera) → Cholera.

= Spiral →Spirillium→Spirilla (Spiro Cheete) → C

Nutrition:

- Bacteria obtain their nutrition by both.
- Autotrophic (Self sufficient in its own trophic level)
- Hetrotrophic ways. (Don't make their own food depend upon other sources.
- Parasites.
- Saprotrophis.
- Symbionts→ Rhizobium.

Respiration:

Respire aerobically and anaerobically.

Reproduction:

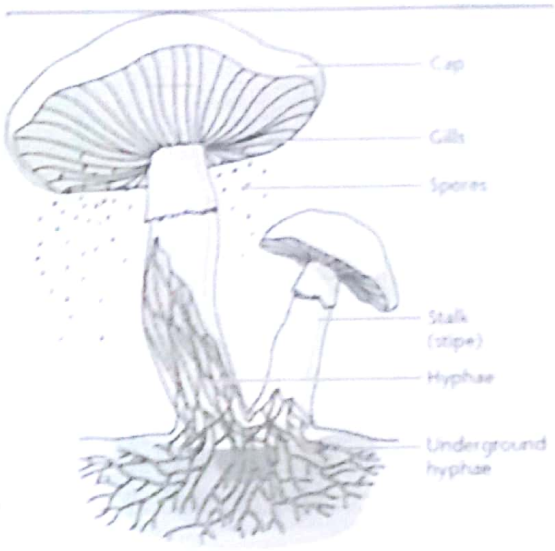
A sexual reproduction is by binary fission.

Role of bacteria and fungi in decay:

Bacteria of fungi release enzymes into their surrounding these enzymes bring about extra cellular digestion. The products of digestion are absorbed by them.

Fungi:

- May be unicellular → Yeast.
- Multi cellular → Bread mold.
- The multi cellular forms consist of thread like structures called hyphae. The hyphae are interwoven together to make the vegetative body of a fungus called mycelium.
- Each hypha consist of a cell wall made of chitin.
- One or more nucleus may be present.
- Their mode of nutrition is heterotrophic.They do not contain chlorophyll / chloroplast.



14.2 FOOD BIOTECHNOLOGY:

The implementation of biological processes for the benefit of mankind.

Fermentation:

Is a biological process which is used for the formation of many food products.

$$\text{Glucose} \rightarrow \text{Alcohol} + CO_2$$

OR

$$\text{Glucose} \rightarrow \text{Lactic acid}$$

These products of fermentation are used for:

- CO_2 for bread making.
- Alcohol for beer making.
- Lactic acid for yogurt making.

Bread making:

Involves three steps:

- Kneading.
- Fermentation.
- Baking.

Kneading:

Flour, water, salt, sugar and yeast are mixed up together thoroughly, it makes dough.

Fermentation:

Dough is placed in molds and left at warm temperature for 2-3 hours.
During this process anaerobic respiration of yeast produces CO_2 and alcohol.

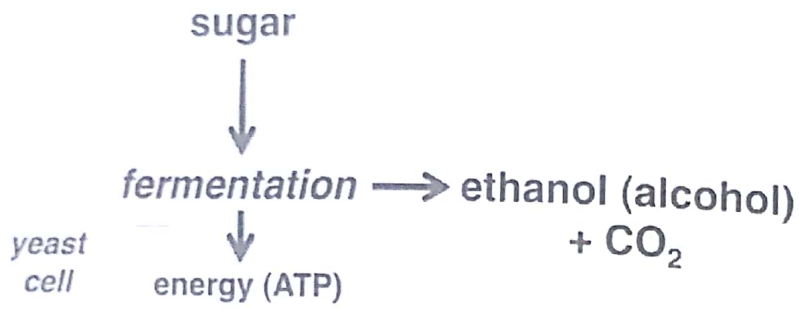
Baking:

The dough is treated at high temperature. High temperature

- Brings CO_2 to expand. As it escaped through dough it causes the dough to rise and become soft.
- High temperature also kills yeast.
- High temperature hardens the outer crust which maintains the shape of bread.

Beer making:

- Soak seeds in water. Allow them to germinate for 2-3 days.
- Roast the germinated seeds and grind them.
- Add hot water into the ground grains. It makes "wort".
- Add yeast into it which converts sugar into alcohol.



- As the yeast respires it produces CO_2. It escapes from the medium and produces foam at the top of the "wort". It creates anaerobic conditions.

Yogurt making:

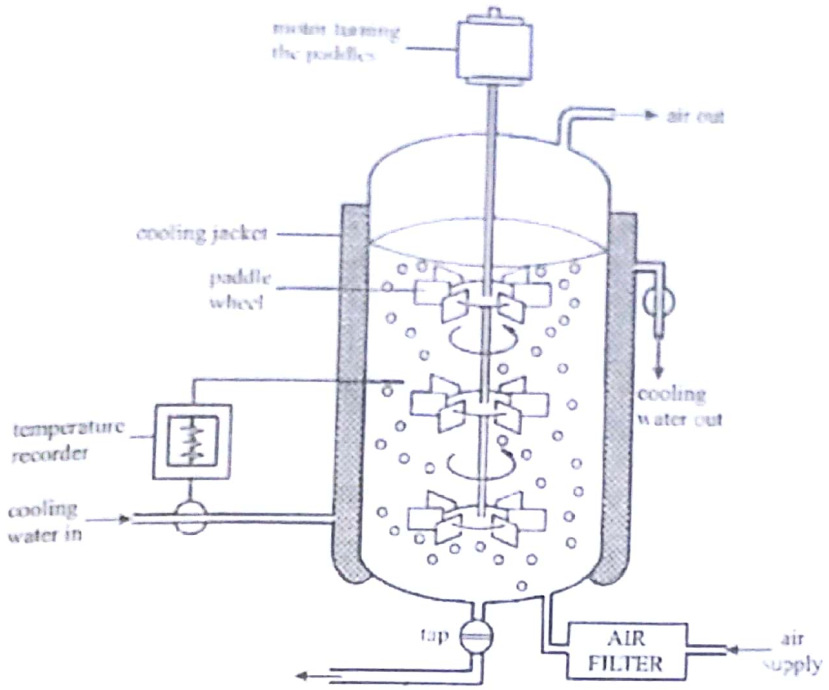
- Pasteurization Pasteurize milk (Boil milk At 60°C → 30 min).
- Let it cool to room temperature.
- Add starter culture into it starter culture involve.
- Streptococcus.
- Lacto bacillus Inoculum.
- Leave the milk to ferment overnight.
- Streptococcus is aerobic bacterium it absorbs oxygen from the milk and produces anaerobic conditions.
- Lacto bacillus convert milk sugar into lactic acid. It drops PH of milk which causes milk protein to solidify. The curdled milk is called yogurt.

14.3 INDUSTRIAL BIOTECHNOLOGY:

Fermenter:

A vat or container made up of non-corrosive material used for fermentation.

Structure:



Cooling jacket:

During fermentation heat is released which increases temperature of culture medium. The higher temperature can effect the enzyme action, Hence the growth of micro organisms. So the temperature of culture medium should be lowered down.

Impellers:

Are connected to the motor / turbine which rotates them and mixes the contents of the fermenter thoroughly.

Air sparger:

It allows air to be thoroughly passed through the contents mixing with them evenly.

Inlet:

Used for adding nutrient medium and starter culture.

Outlet:

Harvest is collected through this opening.

Biosensors:

Used to monitor changes in PH, Temperature and pressure etc.

Types of fermentation process:

Batch process:

Culture medium (Nutrients) and starter culture are added once and after the product is made the process is stopped and product removed.

Continuous process:

Nutrients are added continuously through the inlet and without stopping the process. Harvest is called periodically at the other end.

Advantages of batch process:

- The fermenter can be used for many products.
- If the contamination occurs, only the single batch is destroyed.
- Maintenance of condition is easier.

Disadvantages:

Fermenter needs to be washed and sterilized before every use:
- It wastes time.
- Expensive.

Formation of penicillin:

Phase 1:
Nutrient medium and starter culture are added into a fermenter. Favorable conditions of PH, temperature are maintained. Oxygen is supplied to allow aerobic respiration. The fungus grows maximum in aerobic conditions.

Phase 2:
After the maximum growth has achieved, the conditions are made unfavorable for growth (Oxygen supply is stopped). Under unfavorable conditions fungus releases antibiotics. The contents are removed and purified anti biotic extracted.

Formation of mycoprotein (S.C.P):

Starter culture:

A filamentous fungus fusaruim.

Continuous fermentation process:

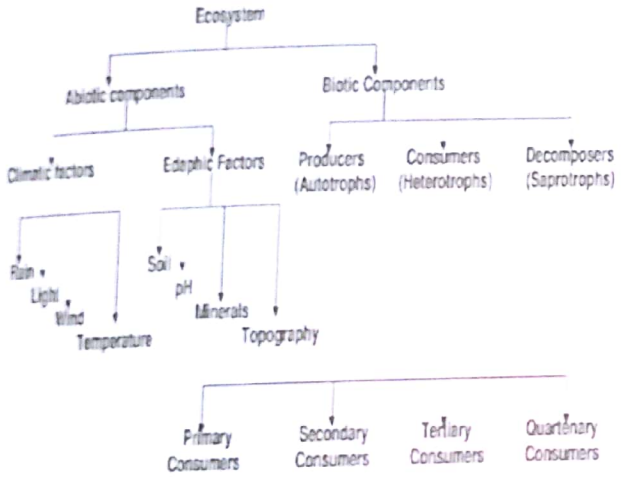
Nutrients and starter culture are added into a fermenter. Favorable conditions of pH and temperature are maintained for growth. The fungus continues to grow and is harvested periodically. At the other end, nutrients are continuously supplied to continue to run this process. The harvest collected is treated with enzymes, purified and turned into various textures. Flavors are added to make proteins edible to humans.

Advantages of mycoproteins:

- Good quality proteins.
- Contain dietary fiber.
- No fats.

UNIT 15

Relationships of Organisms with One Another and with The Environment



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15.1 Energy Flow
- Pyramids of energy

15.2 Food chain and food webs
- Food web

15.3 Carbon cycle

15.4 Nitrogen cycle
- Pyramid of energy

15.5 Parasitism
- Malaria

15.7 Pollution
- Pollutant
- Pollutants
- Effects
- Pesticides
- Fertilizers
- Green house gases

15.8 Conservation
- Importance: (Conservation of forests)

O Level Biology

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UNIT-15 RELATIONSHIPS OF ORGANISMS WITH ONE ANOTHER AND WITH THE ENVIRONMENT

Ecology:

The study of inter relationships between living organisms and their environment.

Ecosystem:

An area of particular environment where living organisms interact with each other and their environment.

Components:

Living components:

- Producers, Consumers, Decomposers.

Non-living components:

- Water, Soil, Air, Temperature etc.

Producers:

Usually green plants that photosynthesize and convert light energy into chemical energy. The chemical energy is used by the producers for growth and repair, However some chemical energy may be stored in them in form of carbohydrates, proteins etc. which is used by the animals. In an ecosystem the organisms depending on producers are called consumers.

Primary consumers:

Animals that directly depend upon plants for their food ie, Herbivorus.

Secondary consumers:

Animals that depend upon primarily consumers are called secondary consumers.

Decomposers:

Fungi and bacteria depend upon dead plants and animals and are called decomposers.

Interactions between the living things:

Living organisms interact with each other for:

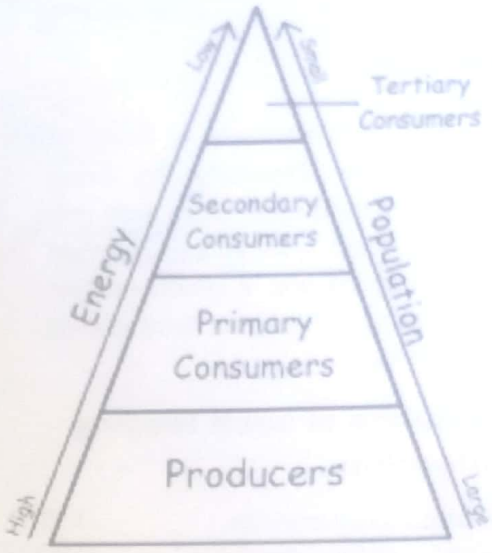
- Food
- Shelter
- Mate

15.1 ENERGY FLOW:

- The principle source of energy is sunlight.
- Sunlight is trapped by green plants and is converted into chemical energy. It is used by plants themselves.
- Primary consumers feed upon producers. The chemical energy transferred from producers to primary consumers is not all used in growth. It is lost during respiration in the form of heat which is not returned back to the food chain. Some of the energy is lost in faeces and excretion. So the flow of energy in a food chain in non-cycle.

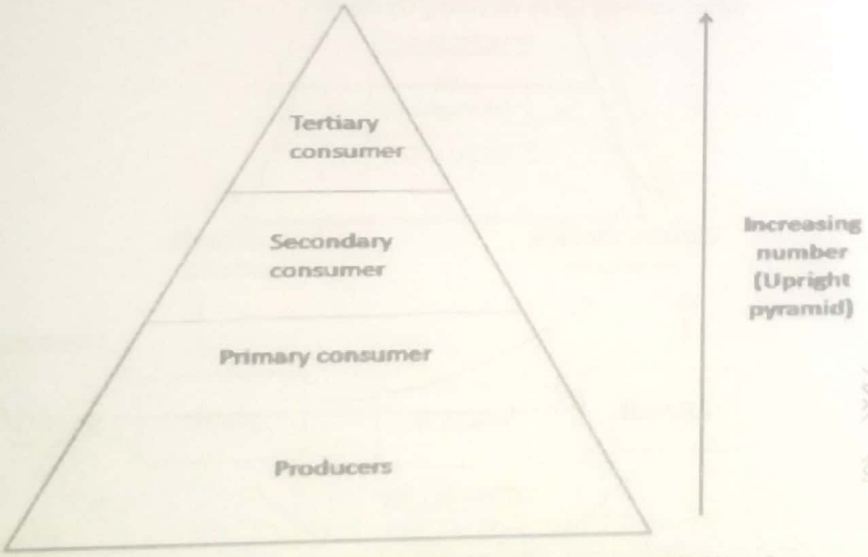
Pyramids of energy:

The amount of energy flowing through a food chain shown at each trophic level makes a pyramid like shape called pyramid of energy. The producers in a food chain receive the maximum energy. Some of the energy from the producers is lost to the surrounding in the form of heat, so the primary consumers receive energy lesser than the producers. The smallest amount of energy is obtained by the top consumers.



Pyramid of number:

If the number of organisms is counted in each trophic level and represent in the form of producers at the base and the top consumers at the top, It will make a pyramid shape and called pyramid of number. Plants will be larger in number than primary consumers and primary consumers will be more in number than secondary consumers and so on.



In pyramids of number however, the size of the organisms is a problem. As the number of organisms decrease along the food chain, the size of the organisms increases. In some cases however the size of the producers may be larger than the size of primary consumers and can support large no of organisms on it. For example, a single oak tree can support large number of insect larvae, In this case the regular pyramid of number will not be formed.

This problem is solved by making the pyramids of biomass which always make the regular pyramid.

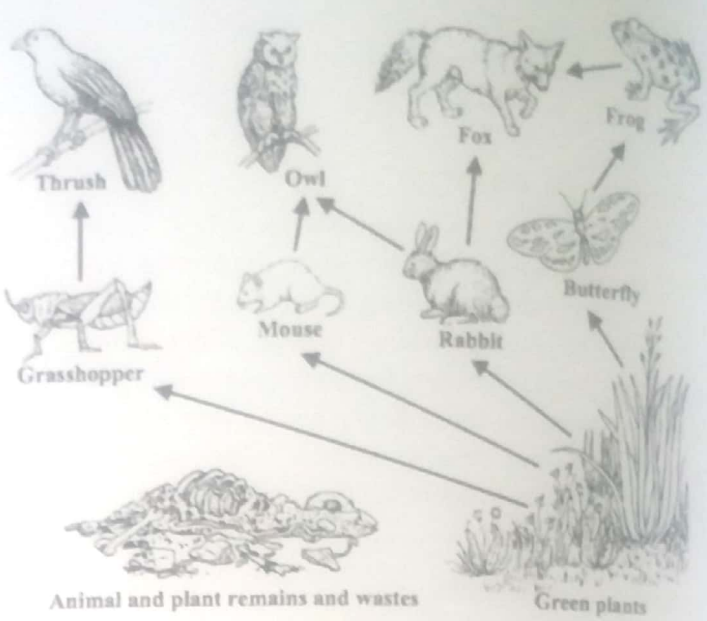
15.2 FOOD CHAIN AND FOOD WEBS:

Feeding relationship between the different organisms expressed in a linear way is called food chain.

Producer → Primary consumers
Secondary.
Consumers→ Grass →Rabbit Snake → Hawk.

Food web:

Rarely such a relationship is found in an eco system. Normally the living organisms depend upon more than one sources of food and in turn provide food to many others. It produces fine interlinks between various food chains called food web.

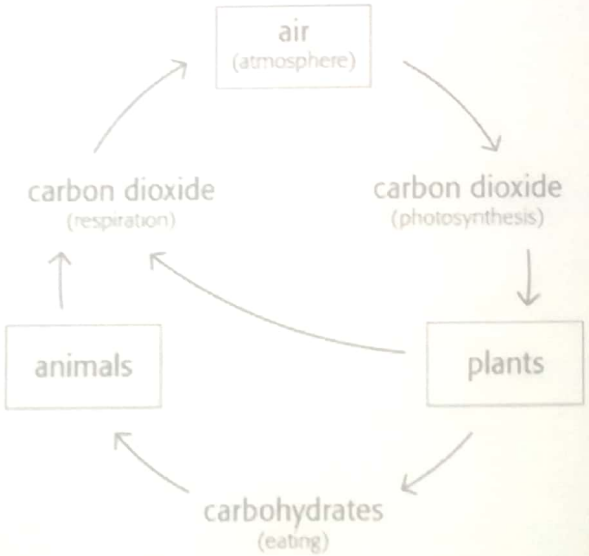


Importance of such feeding relationship:

- More energy transfer.
- Variety of food available.
- Less risk of extinction of a specie.

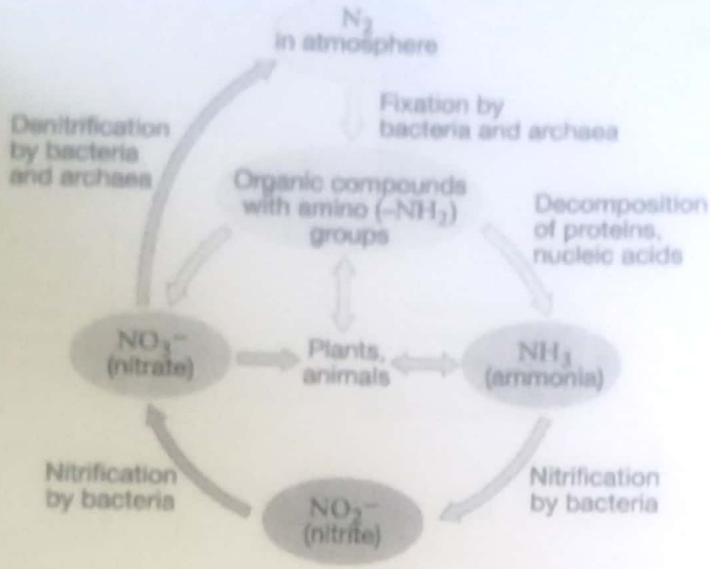
15.3 CARBON CYCLE:

Basic Carbon Cycle of Living Systems

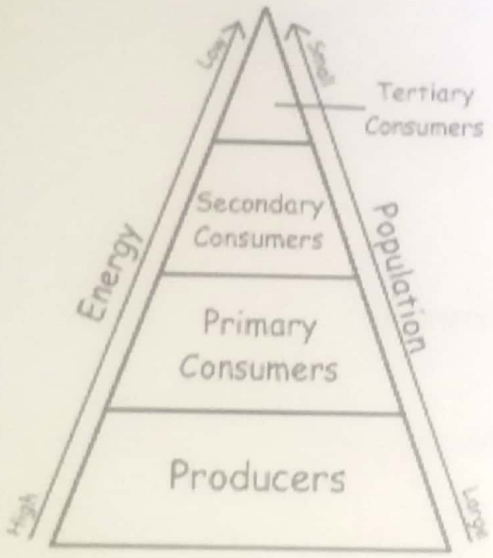


15.4 NITROGEN CYCLE:

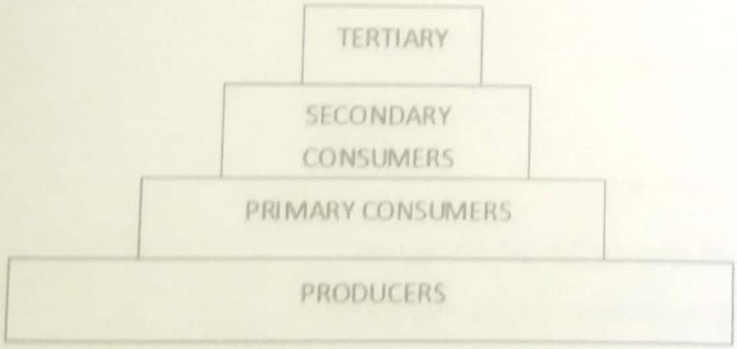
- Nitrogen fixation (Rhizobium).
- Ammonification (Ammonifying).
- Nitrification (Nitrifying) $NH_3 \rightarrow NO_3$).
- Denitrification (Denitrifying).
  $NO_3 \rightarrow N_2 + O_2$



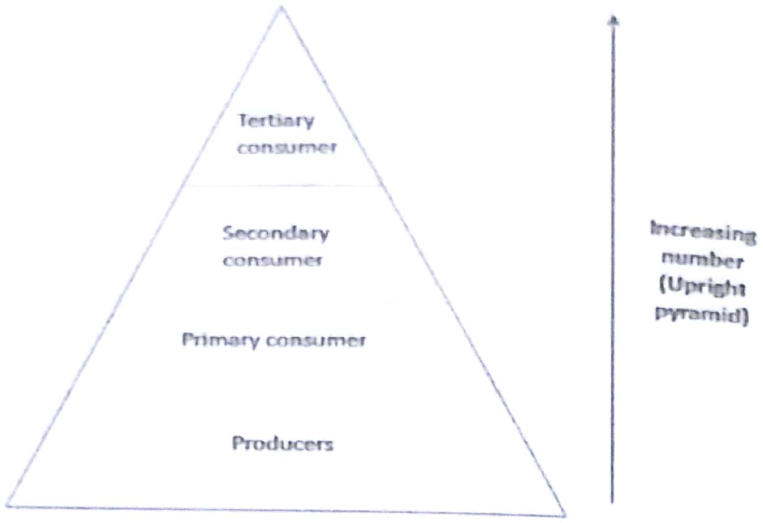
Pyramid of energy:



Pyramid of biomass:



Pyramid of Number:



15.5 PARASITISM:

Malaria:

Disease:

Malaria

Pathogen:

Plasmodium (Unicellular animal Protozoan).

Signs and symptoms:

- High fever followed by shivering.
- Profuse sweating.
- Recovering attacks.
- Vomiting / Diarhpoea.
- Tender abdomen.
- Anemia.

Transmission:

- Insect vector.
- Female anopheles mosquito.

Treatment:

Fansidar, Ovinine, Chlorquine, etc.

Control of spread of malarial pathogen:

Spread of malaria can be controlled by following ways.

Control of insect vector:

- Drain the breeding sites.
- Spray insecticides.
- Spray kerosene or water bodies.
- (Biochemical control) Use minnow fish which eats insect larvae.

Prevention of humans from mosquito bite:

- Sleeping indoor.
- Wearing long sleeves.
- Using mosquito repellants.
- Using nets while sleeping.

Killing plasmodium:

- Using of drugs like fansidar.

15.7 POLLUTION:

Addition of any harmful substance to the environment is called pollution.

Pollutant:

A substance that causes pollution is called a pollutant.

"Solution to pollution is Dilution"

Types of pollution:

- Air pollution.
- Water pollution.
- Soil pollution.

Pollutants:

Carbon monoxide:

Pollutant:
CO (Carbon monoxide).

Sources:
Incomplete combustion of fossil fuel. (Car exhaust, Industrial smoke).

Effects:
Combines irreversibly with the hemoglobin to make carboxy hemoglobin. It reduces the oxygen carrying capacity of the blood cells.

Remedy:
Combustion in availability of high level of O_2.
Catalytic converters:
Oxides of nitrogen / sulphur.

Pollutants:
Oxides of nitrogen / sulphur.

Sources:

- Combustion of organic fuels.
- Industrial smoke.

Effects:

Acid rain:

The oxide of nitrogen and sulfur dissolve in moisture and precipitate as acid rains.

Effects of acid rains:

On plants:

- Causes leaching of minerals, that reduces soil fertility and reduces plant growth.
- Tissues of plants are damaged, It reduces plant growth.
- The low PH of the soil damages the roots and reduces nutrients uptake.

On animals:

- Cause diseases of eyes, lungs and skins.
- Causes irritation.
- Low PH of water kills fish.

Remedy:

- Use of scrubber.
- Use of catalytic converters.

Pesticides:

Sources:

Agricultural wastes.

Effects:

May accumulate in higher concentration in the top consumers and become toxic.
DDT, lowered the population of coastal birds.

Remedy:

- Bio degradeable pesticites.
- Seek alternative sources of pest control. (Bio logical control).
- Pest resistant crops.

Fertilizers:

Sources:

- Human beings.
- Animals.

Effects:

- More fertilizers with the run off of water into the water bodies.
- More nutrients for plants.
- More growth of plants (Algae) formation of algae blooms, This is called evtrophication.
- Animals increases, The animals and plants respire and increases the demand for oxygen respire and increases the demand for oxygen (BOD), The animals die.
- More decaying, material more decomposers.
- They further increases BOD that makes the water unfit for survival of animals and plants.

Remedy:

- Don't apply fertilizers before rain forecast.
- Don't apply when the soil is not having a crop.
- Don't over irrigate.
- Remove the organic water from the water bodies.
- Aerate the water with oxygen.

Green house gases:

CO_2 → Combustion of fossil fuels.
Deforestation.
CFC's → Aerosols.
Cooling agent.
Methane → Decomposition.

What is green house effect?

The green house gases present in the atmosphere allow the sun rays (Light rays) to pass through and reach the earth. Light rays are high frequency rays, as they collide with any particle, they loose their energy and turn into heat rays. Which these gases do not allow to escape out of the atmosphere. They return back from atmosphere to the earth and increase the temperature of the earth called global warming.

What if, however higher temperature and more carbon dioxide?

- More Photosynthesis
- More Crop yield
- More food for animals.
- More population.

Effects of global warming:

- Weather changes.
- Decrease of annual rainfall, extreme climatic conditions.
- Increase of evaporation leading to deserts formation.
- Melting of glaciers.
- Rise of water level of rivers.
- Floods.
- Erosion of soil due to floods and strong winds.
- Erosion of top fertile soil leads to loss of fertility.
- Shortage of food.
- Famines.

15.8 CONSERVATION:

Preservation and maintenance of natural resources is called conservation.

Importance: (Conservation of forests):

- Prevents loss of species due to conservation of their natural habitants.
- Sources of food.
- Source of medicines.
- Maintains moderate climatic conditions, etc.

Conservation techniques:

- Preservation.
- Reclamation → Reforestation.
- Creation → Afforestation.

Conservation of fish lands:

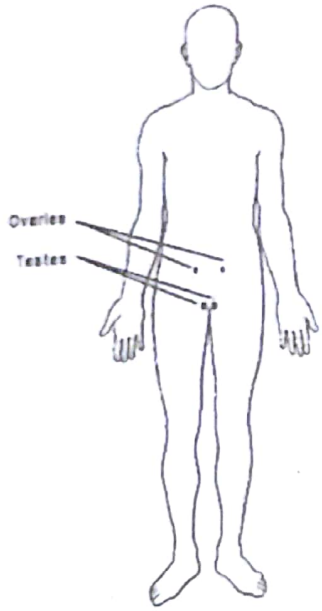
- Source of food.

Conservation of fish lands:

- Recommended mesh size of net.
- Fishing should be banned in breeding seasons.
- Licenses should be issued to the fisherman.
- Some quota system.
- Some endangered species are if caught should be returned back to the water.
- Artificial farming.
- Fish should be highly productive.
- Food should be given.
- Pesticides should be used.

UNIT 16

Development of Organisms and Continuity of Life



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16.1 Asexual reproduction
- Vegetative propagation
- Artificial vegetative propagation

16.2 Sexual reproduction in plants
- However typical flower has the following parts
- Germination of pollen grain
- Animal dispersal

16.3 Sexual reproduction in human
- Male reproductive system
- Gametes
- Menstrual cycle
- Follicle stimulating hormone
- Supply of nutrients to embryo

16.4 Sexually transmitted diseases
- AIDS: (Acquired immune deficiency syndrome)
- Syphilis

O Level Biology

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UNIT-16 DEVELOPMENT OF ORGANISMS AND CONTINUITY OF LIFE

Reproduction in plants:

Reproduction:

Formation of young ones of ones own kind is an essential character of all living things. However, this is needed for the survival of a specie.

Species:

A group of similar organisms which can reproduce freely in nature and produce fertile off springs.

Types of reproduction:

- Asexual reproduction.
- Sexual reproduction.

16.1 ASEXUAL REPRODUCTION:

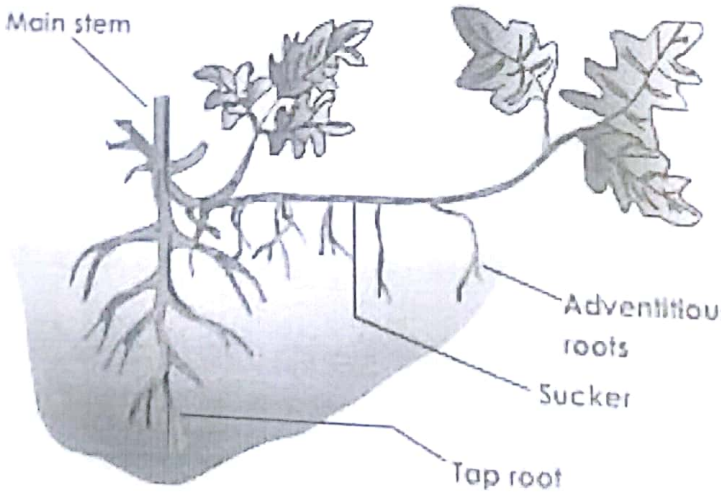
This process does not involve gamete formation and their fusion. It is a fast process. The off springs produced are genetically identical.

Types:

- Vegetative propagation.
- Natural vegetative propagation.
- Artificial vegetative propagation.
- Micro propagation.
- Spore formation.

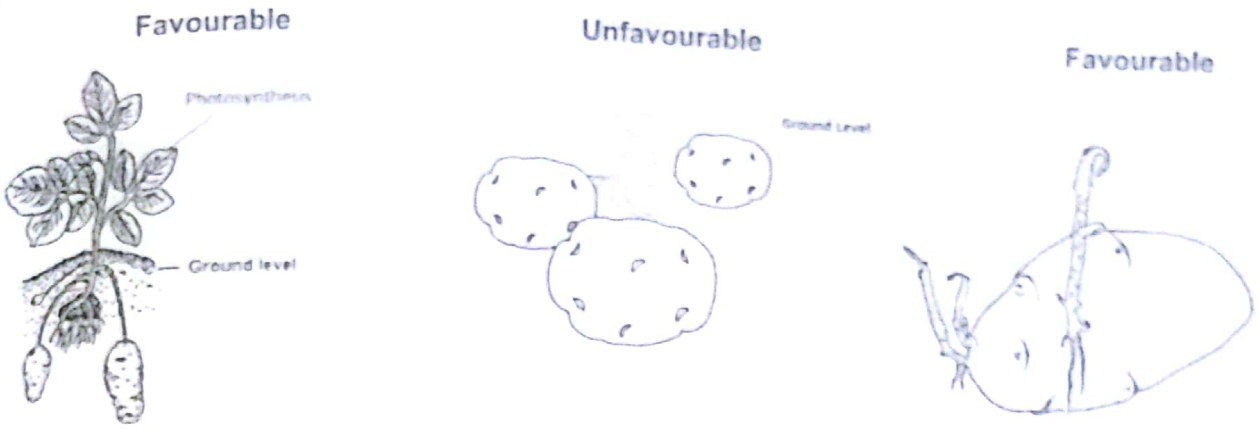
Vegetative propagation:

Formation of a new plant from vegetative part of a plant is called vegetative propagation.



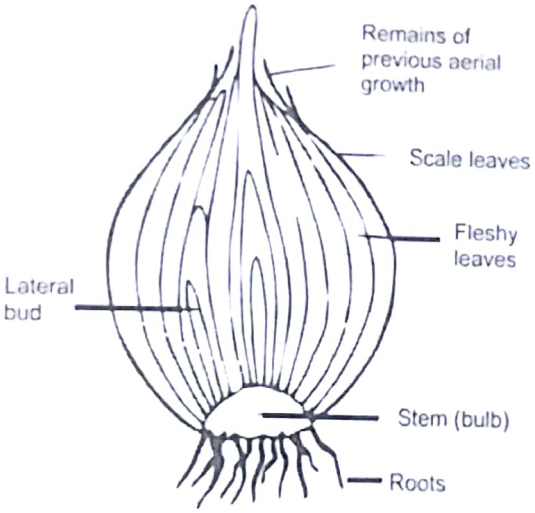
Natural:

During favourable conditions plant photosynthesis and produce carbohydrates which are stored in storage organs in same plants. Plants pass on unfavourable conditions in the form of storage organs which support to produce new plants on the arrival of favourable conditions. This is called perennation and the organs involved are called prennating organs.



Examples:

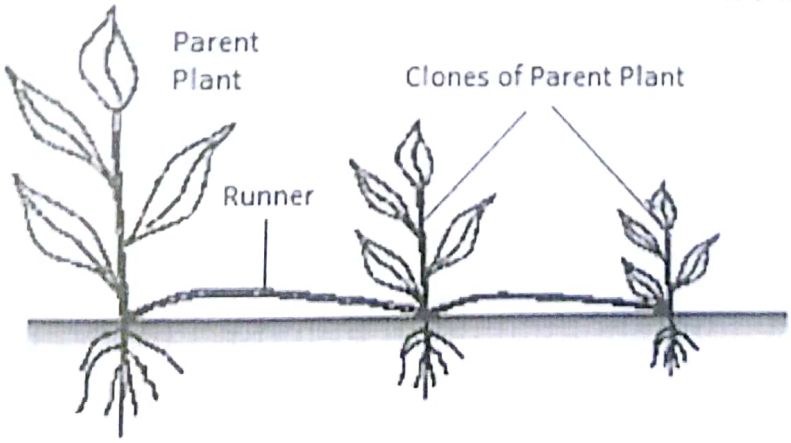
Bulb: Onion,



Onion (Allium cepa)

Runner:

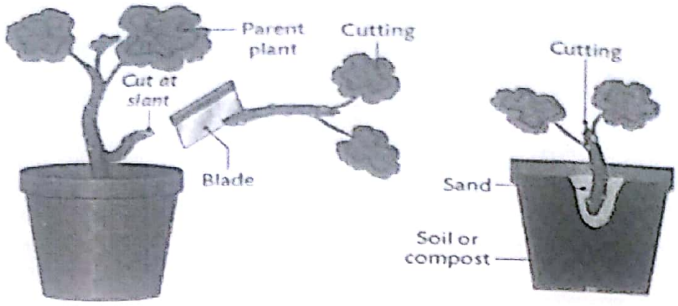
Strawberry.



Artificial vegetative propagation:

Cutting:

Examples rose, sugar cane, cut a mature shoot of a plant which has buds on it. It is then buried in the soil. Upon arrival of favorable conditions, it produces roots and shoots. The food stored in the stem is provided until plant develops its own leaves.

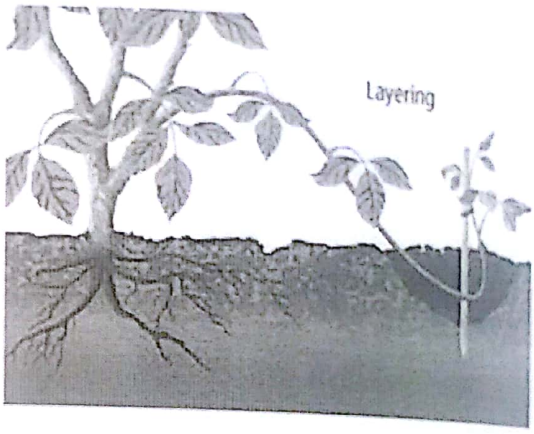


Layering:

Example:

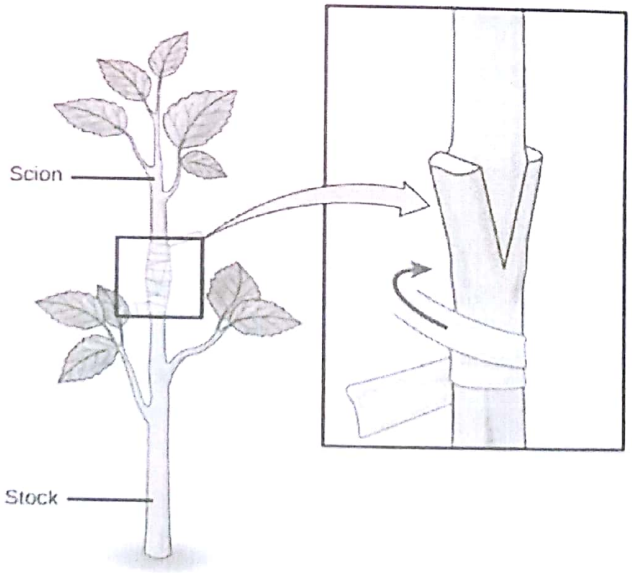
Citrus plants:

- Cut few mm thick rings slightly away from the tip of the shoot, few cm away from each other.
- Peel the bark in between these rings.
- Burry this part in the soil.
- New roots emerges from the peeled part.
- Remove this plant and plant is at another place.



Grafting Fruit trees:

Cut a shoot from a plant which has desired fruit quality, it is called scion. The stem of a plant with the root system is cut and is called stock. Scion is grafted onto the stock.



Why grafting:

Why farmers use asexual means of propagation.

Advantages of grafting to farmers:

16.2 SEXUAL REPRODUCTION IN PLANTS:

Involves the following steps:

- Gamete formation.
- Transfer of male gametes to the female gametes (Pollination).
- Fusion of male gametes to the female gametes (Fertilisation)
- Post fertilization changes. (Seed/Fruit formation)
- Dispersal of seeds/fruits.
- Germination of seed.
- Growth.

For the formation of gametes the reproductive structure present in plants are called flowers. Flowers may be present singly or in clusters called inflorescence. Flowers may differ from each other.

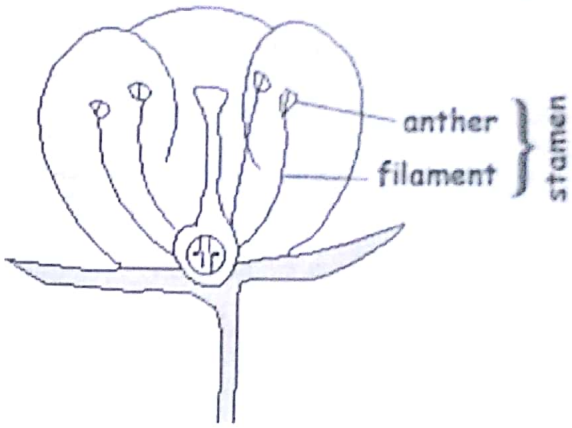
However typical flower has the following parts:

Calyx:

A collection of sepals makes the first whole of flowers called calyx. It encloses and protects other parts of a flower when it is a bud.

Corolla:

The petals of different shapes or colours may be present in different flowers. They make the second whole in a flower called corolla. Petals attract insects which bring pollination

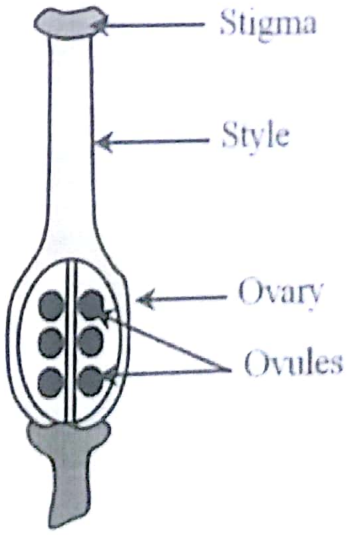


Stamens:

The male reproductive parts of a flower. Each stamen consist of two parts.

- Filament.
- Anther.

Each anther is a lobed structure which contains pollen sacs inside each pollen sac. Meiosis occurs and produces numerous, thick walled bi nucleated haploid cells called pollen grains.



Carpel:

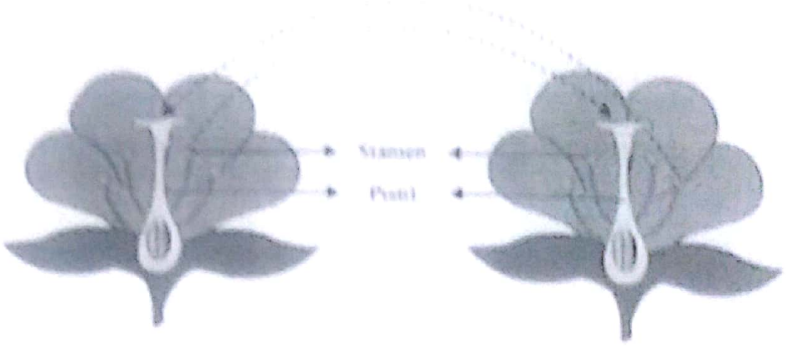
Carpel is a female reproductive part of a flower. Each carpel consists of three parts.

- Stigma.
- Style.
- Ovary.

The ovary contains one or more ovules inside it. The ovule contains haploid nucleus towards the microphyle end called egg.

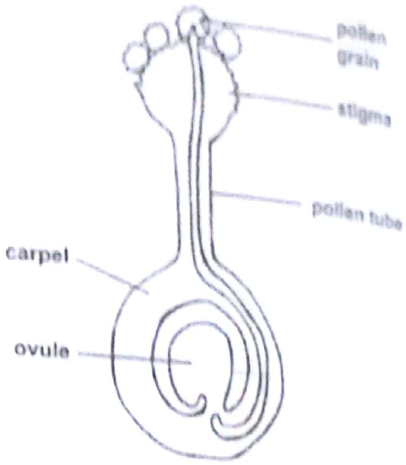
Pollination:

The pollen grains are transferred from anther of a flower to the stigma by wind or insects.



Germination of pollen grain:

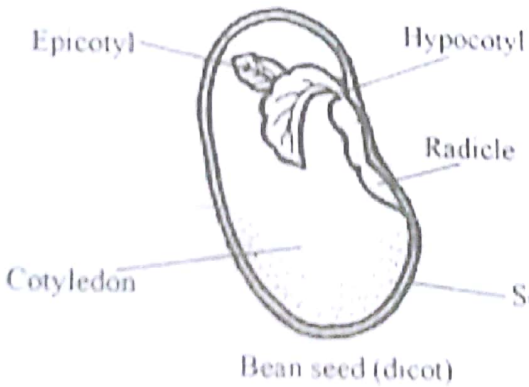
After pollination the pollens soak substances released by stigma which stimulate the pollen grain bursts. The inner one protrude as pollen tube. Both of the nuclei enter into pollen tube. The one in the tip is called tube nucleus which controls the elongation of the pollen tube. The pollen tube continues to grow down through the style to the ovary. As it enters to the embryo sac through micropyle the tip of the pollen tube and the tube nucleus disintegrates. Meanwhile the nuclei following behind called Generative, divides to make two sperms. These sperms are motile and released into embryo sac. The one fuses with egg to make zygote whereas the other fuses with definitive nucleus to make endosperm nucleus. The process is called double fertilization.



Post fertilization changes:

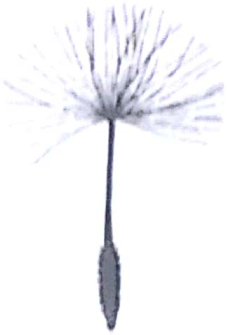
After fertilization the zygote divides to make embryo, the other changes that occur in a flower are given as follows.

Structure of a typical seed:



Bean seed (dicot)

- Ovary turns into fruit.
- Ovule → Seed
- Integument → Seed coat
- Micropyle→Micropyle
- Funicle→Funicle
- Zygote → Embryo → Plumole
- Coltylydens→ Radicle
- Patels, stamens, stigma, style, shrivel and whither off.

Example	Structure	Structure adapted to function
1- Cotton		Surface area increased
2- Dendelion		
3- Sycamore		

Animal dispersal:

- Provide food or attractive
- Hooks present on them.

1- Guava

2- Mangoes

3- Burdock cachyranthus

Hooks

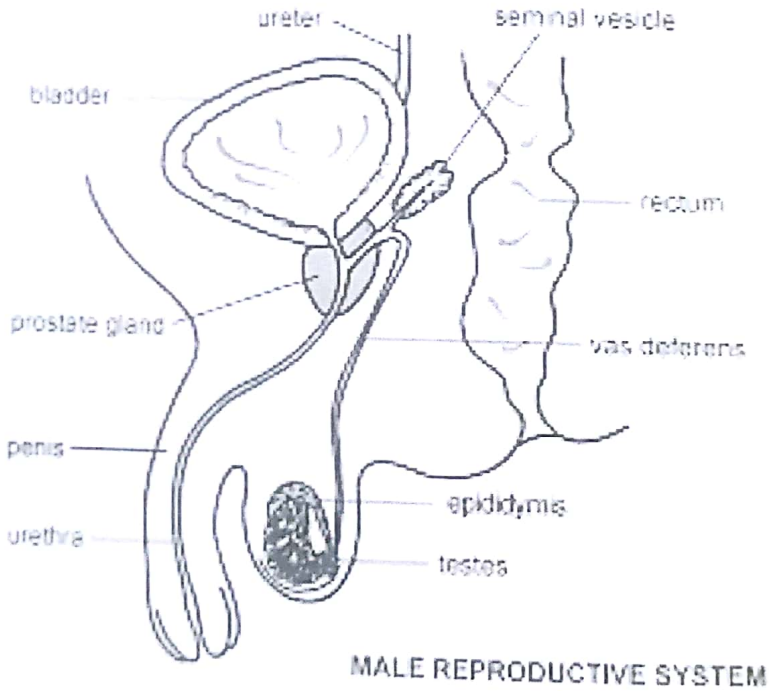
3- Fusion of male and female gameles. (Fertilization).
4- Embedding of embryo into the uterus. (Implantation).
5- Development of body from implantation to birth. The period is called gestation.
6- Birth.

For gamete formation the males and females reproductive systems are present in separate individuals.

16.3 SEXUAL REPRODUCTION IN HUMAN:

Male reproductive system:

Functions of the male reproductive system:
- Gamete formation
- Transfer of the sperms to the vagina.

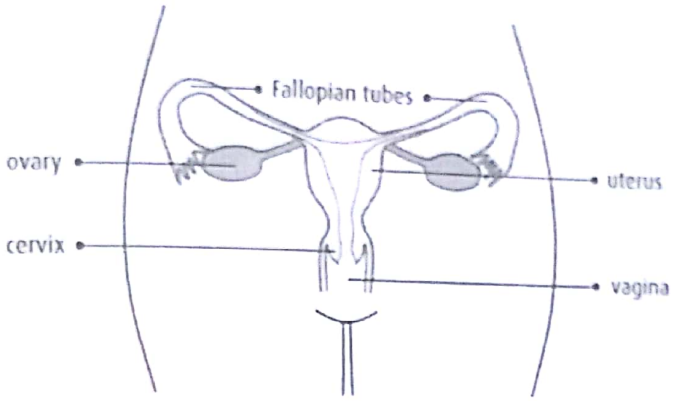


MALE REPRODUCTIVE SYSTEM

Female reproductive system:

- Functions of female reproductive system.
- Ovulation.
- receives sperms during sexual Intercourse.
- Fertilisation.
- Implantation.
- Gestation.
- Birth.
- Nursing.

Structure of female reproductive system:

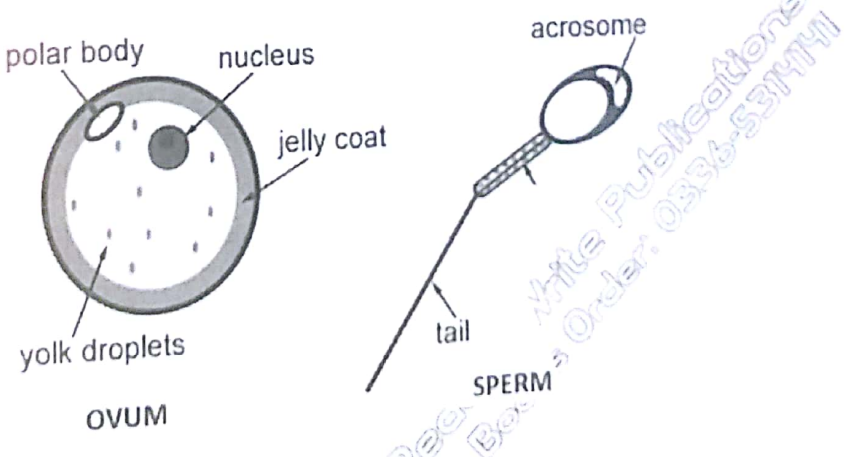


Gametes:

Male gametes called sperms are produced in the (testis) testis in large no. Their formation begins at the onset of puberty almost at the age of 11 to 13 years. Each sperm consists of three parts.

- A pointed head.
- Neck.
- Long tail.

The pointed head contains haploid nucleus.
Eggs are female gametes produced by ovary. One egg is released every month from an alternate ovary. Puberty at the age of almost 11 to 13 years till menojause.



Menstrual cycle:

In females one egg is released every month. This cycle is repeated after every 28 days. The menstrual cycle can be divided into following phases.

1- Menstruation: (1-5 days)

Changes in ovary:
The corpus luteum disintegrates and progesterone secretion reduces.

Changes in the uterus:
The uterus lining disintegrates. During this phase the
- Dead egg cells
- Disintegrated lining
- Blood
- Mucus

Are lost through the vagina as menstrual flow.

2- Preparatory phase: (6-14)

During this phase the following changes occur:
- Griffin follicle develops; which bursts and releases egg ready to be available in the fallopian tube for fertilization if the sperms are set in.
- The uterus lining thickens and becomes vascularised, so that it can conceive the embryo.

3- Ovulation:

The graffian follicle bursts and releases egg into the fallopian tube. The process is called ovulation.

4- Post Ovulation: (14-28)

During this phase if the fertilization occurs the further thickening and vascularization of the uterus occurs, so that the uterus can hold / provide the nutrients to the growing embryo.
If fertilization does not occur the
- Corpus luteum disintegrates.
- The uterus lining becomes thin.

Follicle stimulating hormone:

Stimulate primary follicle to develop into graffian follicle.

Oestrogen:

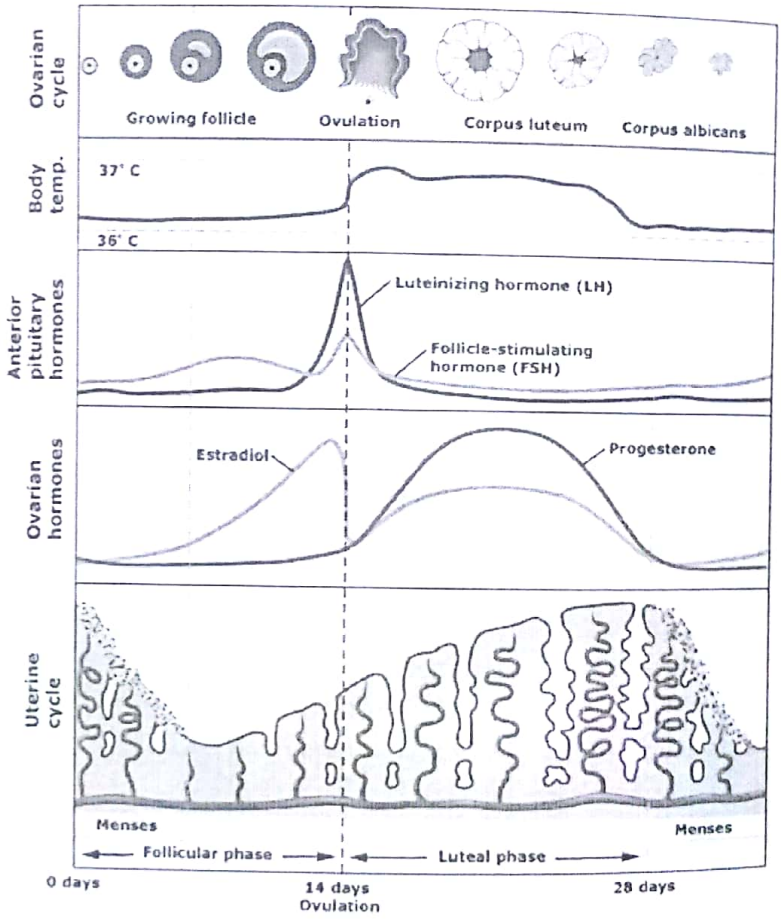
- Inhibits the release of FSH.
- It increases the thickness of uterus lining.
- Triggers the release of LH. (Levtinisingharmone)
- The secondary sexual in the females.
- Development of countours of the body.
- Development of breast.
- Development of pelvic.

L.H:

Causes ripening of primary follicle.

Progesterone:

- Inhibits FSH
- Maintain the thickness of uterus lining.
- SSC



Gestation:

A period of development of a baby from implantation till the birth.

Supply of nutrients to embryo:

Stage 1:

Embryo develops finger like protections called microvilli.
Which are embedded in the wall of the uterus.

Stage 2:

Exchange of materials takes place between mothers blood and foetal blood. The blood vessels in umbilical cord carry these material to or away from the foetus.

16.4 SEXUALLY TRANSMITTED DISEASES:

AIDS: (Acquired immune deficiency syndrome)

Pathogen:

HIV (Human immune deficiency virus) virus.

Signs and symptoms:

- Persistent fever.
- Weight loss.
- ARC (Acid related complex of disease) loss of resistance to infections.
- Rare type of pneumonia can cause death.
- Cancer of the skin Kaposi sarcoma.

Transmission:

- Sexual contact.
- Blood transfusion.
- Sharing hypodermal needles.
- Through placenta.

Prevention of spread:

- At personal level.
- Use of condom.
- Limiting to ones own sexual partners.
- At community level.
- Maximum screening of HIV positive people.
- Isolation centers.
- World wide contribution.
- Education programme.
- Surveillance programs.
- Research for antiviral drugs / vaccines.

Syphilis:

Pathogen:

Treponema (Bacterium).

UNIT-17 INHERITANCE

Genetics:

The study of inherited characters and the way they express.

17.1 VARIATION:

The living organisms differ from each other. These differences are called variations.

Importance:

- These variations may be less suited in the current environment but may increases the survival chances of species (Better adapted). If the environment changes.
- Variations provide raw materials for evolution (Formation of new species).

Cause:

- Mutations.
- Sexual reproduction.
- Gamete formation.
- Random fusion of gametes.

Mutations:

Spontaneous changes in the hereditary material which could bring the changes in phenotype.

Causes of mutation:

Mutation occurs spontaneously, but their occurrence is rare. Some factors which increase the rate of mutation are called mutagens.

Mutagens:

- Radiations.
- Chemicals, these mutagens bring.
- Error in copying genetic code.
- Damage DNA.
- Bring changes in chromosomes number.

Type of mutations:

- Harmful mutations.
  E.g. Sickle cell anaemia.
- Beneficial mutation.
  E.g. Sickle cell anaemia

Ways of mutations:

Gene mutations:

E.g. Sickle cell anemia.

Chromosomal mutations:

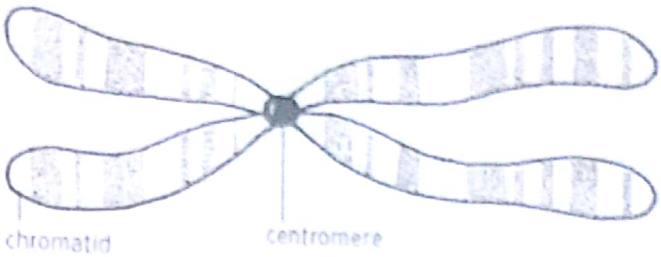
E.g. Down's syndrome.

17.2 CHROMOSOMES AND DNA:

Thread like structures found in nuclei. The number of chromosomes is specific for each specie. Eg 46 in humans.

- DNA.
- Histones / Protein.

Each chromosome consist of two parts
Body cells are called somatic cells.



Laurel Cook Lhowe

Homologous pair:

A pair of chromosomes similar in shape and size.

Heterologous pair:

A pair of dissimilar chromosomes.

Gene:

A sequence of nucleotides.
OR
A fragment of DNA molecule which controls a particular character is called a gene.

Gene locus:

A site where a gene is found on a chromosome.

Allele:

The different forms of a gene that control the alternate character e.g.

- Blue.
- Green.
- Brown.

Genotype:

The genetic make upof an individuals.

- **Homozygous:**

If both have similar allele it is called homozygous.

- **Heterozygous:**

If both allele are not of same kind.

Phenotype:

The expression of a gene is called phenotype.

17.3 MONOHYBRID INHERITANCE:

Inherited characters:

Characters that are transmitted from parents to the off springs.

Method of inheritance:

- Complete dominance.
- Co-dominance.
- Incomplete dominance.
- Sex linked inheritance.

Complete dominance:

F1:

First filial generation.

Dominant:

A character which expresses itself in F1.

Recessive:

A character that does not express itself in F1.

Pure breed:

A breed itself fertilized produces only parental type. They are homozygous of a character.

Hybrid:

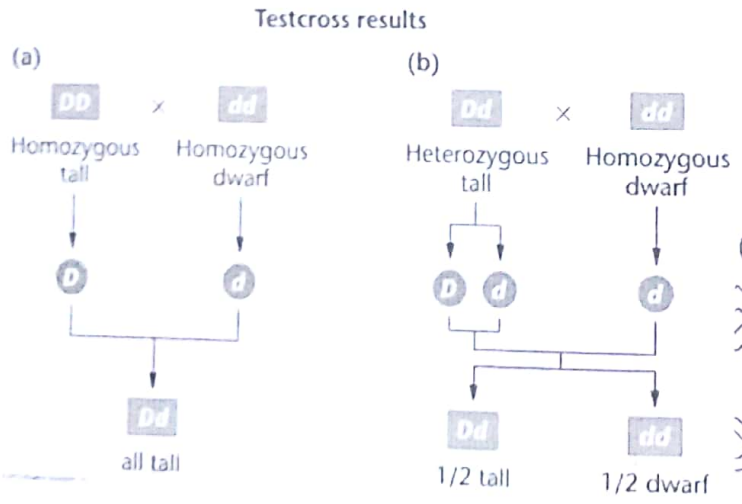
A character that has heterozygous genotype.

TT x TT	TT All tall
TT x Tt	TT, Tt All tall
TT x Tt	Tt All tall
Tt x Tt	TT, 2Tt, tt 3 tall, 1 small
tt x tt	tt short

Test cross:

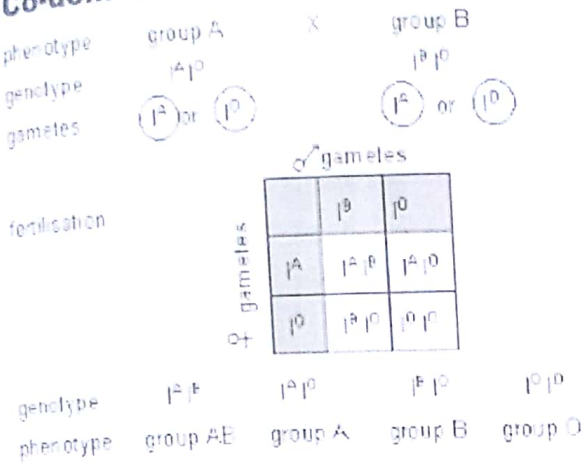
A type of a back cross, A cross between an off spring and a homozygous recessive parent is called test cross. It is done to determine the geno type of an individual.

Method of a test crosses:

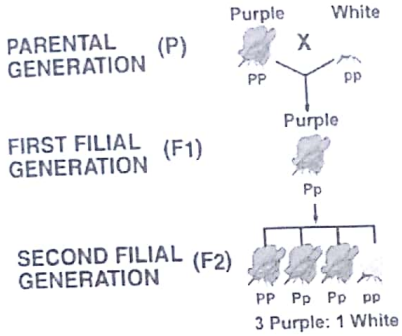


If off springs produces is all dominant the genotype of the dominant parent will be homozygous for dominant case II

Co-dominance:



Incomplete dominance:



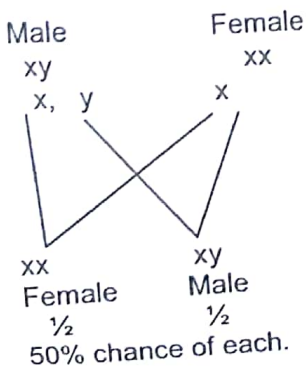
A women blood group A. Has a child with blood group O. She claims a person with blood group B to be the father of her child. Yes because both can be heterozygous.
Put the Q in the form of genetic diagram.

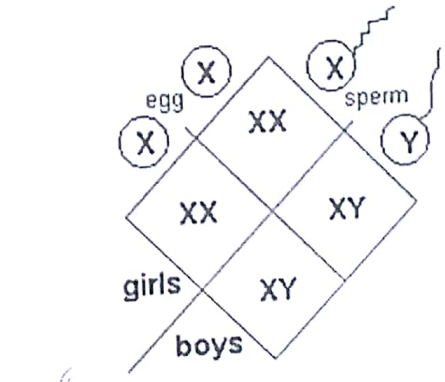
Women
Group A
I^AI°

Man
Group B
I^BI°

Group O
$I^\circ I^\circ$

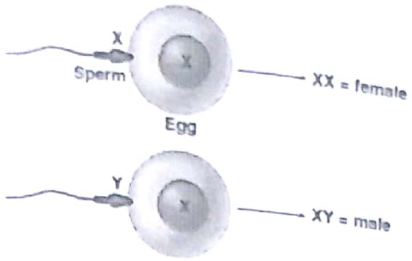
Inheritance of sex:





Role of the Sex Chromosomes

- Our cells contain 23 pairs of chromosomes
  - 22 pairs of autosomes
  - 1 pair of sex chromosomes (XY males: XX females)
    - males produce 50% Y carrying sperm and 50% X carrying
    - all eggs carry the X chromosome
- Sex of the child is determined by the type of sperm that fertilizes the mother's egg



17.4 SELECTION

Preferred inheritance of some characters over others is called selection

Natural Selection

1- over reproduction:

Living things over reproduce. For example a female peppered moth produces 500 eggs. But the population of peppered moth does not increase with same ratio.

2- Struggle for survival:

The living organisms' posses variations. Some variations are more suited to the natural environment than the other. The living things compete with each other for survival for

- Food
- Shelter
- Mate

Peppered moth has two verities, light coloured and dark coloured. The peppered moth are eaten by insectivorous birds. So the natural environment selects which type of moth to survive.

3- Survival of the fittest:

The natural environment acts as an agent for selections. Some variations have more advantage over the other. So the one is, that is adapted, suited to the environment will survive. The characters that are more suited to the environment will pass on to the next generation, where as the less suited do not survive and so are not passed on.

Artificial selection

In artificial selection, the human acts as agents for selection.

Examples:

Jersey cattle:

Which produces more milk with more cream.

Pedigree dogs:

Formation of a better variety by artificial selection.

- Cows that produces more milk are crossed to the bulls. That's have closely related genetic makeup.
- The off springs born that produce more milk are selected and allowed to self-fertilize repeatedly for many generations until the desire quality is obtained.

17.5 GENETIC ENGINEERING:

The study of alteration of genes in an organism is called genetic engineering.

Use of genetic engineering for formation of human insulin.

- Obtain gene for human insulin from pancreas cells. (Restriction enzyme).
- Combine the gene with a vector i.e.
  - Plasmid
  - Virus
- A vector with the combined gene is called recombinant DNA.
- Transfer this recombinant DNA to a non-pathogenic bacterium.
- Culture the bacterium in a fermenter
- Insulin is extracted and purified.