GOVERNMENT OF TAMILNADU

SCIENCE

IX STANDARD

Untouchability
Inhuman - Crime

Department of School Education

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Chapter 1

IMPROVEMENT IN FOOD RESOURCES

1.1. IMPROVEMENT IN CROP YIELDS

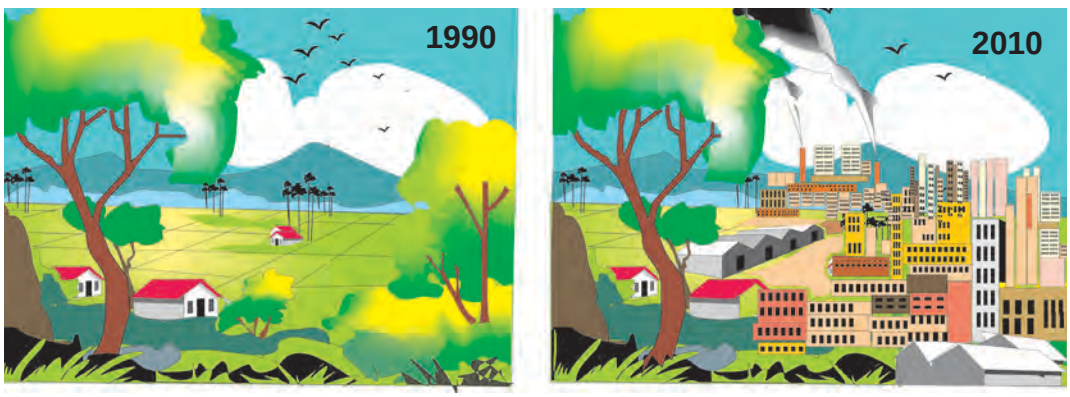
We eat several varieties of food like rice, sambar, idly, dosai, chappathi, poori, pongal, vadai, parotta, bread, sweets, fruit-salad, ice-creams, etc. All these are made from cereals, pulses, greens, vegetables, fruits and animal products like milk, egg, meat, etc.

Food, in general, is derived from plants and animals.

Food is required for growth, development and repair of the body. It also protects the body from diseases and provides energy. Food provides Proteins, Carbohydrates, Fats, Vitamins and Minerals.

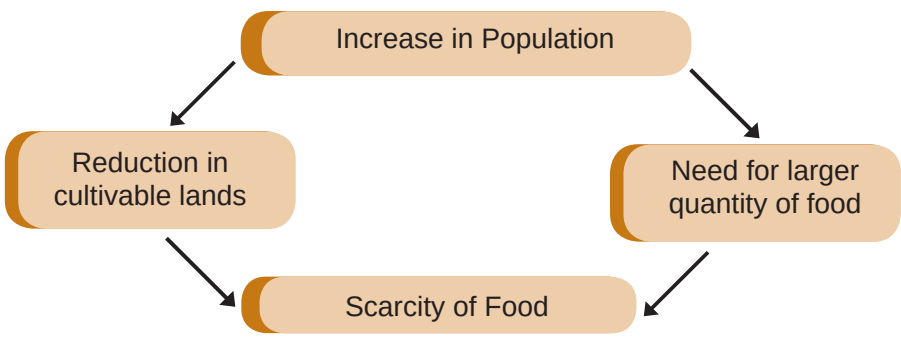
Food	Nutrient
Cereals	Carbohydrates
Pulses	Protein
Meat, (mutton, chicken....), fish and egg.	Fat and protein
Fruits and vegetables, especially green vegetables like spinach and cabbage	Minerals and Vitamins

Observe the pictures given below :



What do we infer from these pictures?

- There is an increase in population.
- Expansion of city and urbanization.
- Houses and Factories are constructed by destroying fertile lands.



Thus, we understand the reasons for the scarcity of food.

The scarcity of food can be overcome by

i) increasing the yield of crops
ii) retaining the cultivable lands without diversion to other uses.
iii) optimizing water usage for cultivation.
iv) improving the preservation and distribution system of food materials.

How to increase the crop yield?

Crop yield can be increased by

- introducing new and improved varieties
- adopting better farm practices

Cultivation or farming can be divided into four stages.

i) Selection of seeds and planting.
ii) Nurturing and protection of the plants.
iii) Harvesting and transporting the yield.
iv) Storing the yield.

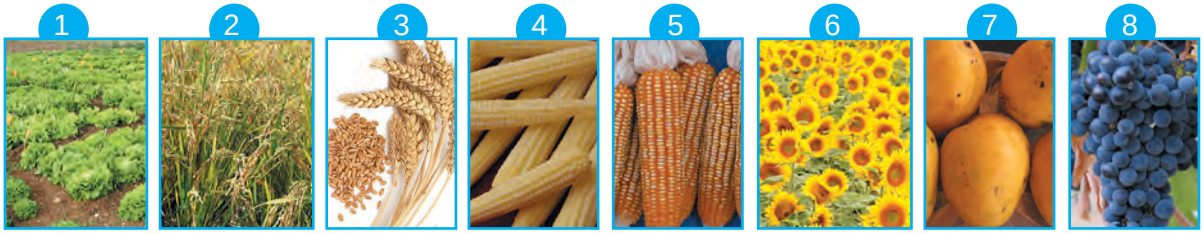
Introduction of new and improved varieties

Improved varieties or strains of crops are produced by selective breeding for various useful characteristics such as disease resistance, response to fertilizers, product quality, higher yield, etc.

Common factors for crop improvement

❍ Higher Yield	To increase the productivity of the crop per acre.
❍ Improved Quality	Quality of crop products vary from crop to crop. Baking quality in wheat, protein quality in pulses, oil quality in oil seeds, etc.
❍ Biotic and abiotic resistance	Crop production is decreased due to biotic (diseases, insects, pests, etc.,) and abiotic factors (heat, cold, salinity and drought). Varieties resistant to these stresses can improve crop production.
❍ Change in maturity pattern	Shorter maturity period; uniform maturity makes the harvesting process easy and reduces losses during harvesting.
❍ Wider Adaptability	One variety can be grown under different climatic conditions in different areas. Developing varieties of wider adaptability helps in stabilizing crop production.
❍ Desirable agronomic characters	Tallness and profuse branching are desirable characters for fodder crops. Dwarfness is desired in cereals. Developing varieties of desired agronomic characters give higher productivity.

Some improved varieties of crops and fruits:



1. Fodder crop 2. Paddy 3.Wheat 4.Baby corn 5. Maize 6. Sunflower 7. Mango 8.Grapes

1.2 NUTRIENT MANAGEMENT

The higher yields of crops mainly depend upon input applications like improved seeds, fertilizers and modern techniques of sowing and harvesting. Plants require a number of nutrients for their growth and development.

Plants get nutrients from air, water and soil.

Nearly 16 elements are essential for plant growth and reproduction.

On the basis of the requirement by the plants, they are further classified into Macro Nutrients and Micro Nutrients.

MACRO NUTRIENTS

Elements which are needed in large quantities for growth of the plants are called Macro Nutrients. They are Carbon, Hydrogen, Oxygen, Nitrogen, Phosphorous, Sulphur, Potassium, Calcium, Magnesium and Iron.

MICRO NUTRIENTS

Elements which are needed by the plants in very small quantities are called Micro Nutrients. They are Manganese, Copper, Molybdenum, Zinc, Boron and Chlorine.

Due to lack of nutrients, deficiency diseases occur in human beings. Likewise, deficiency of macro and micro nutrients affects physiological processes in plants including growth, reproduction and susceptibility to diseases resulting in low yield or no yield at all.

1.3 USES OF MANURE AND FERTILIZERS

We can eliminate deficiency of nutrients by using manures and fertilizers.

ACTIVITY –1.1

Take two potted plants of 'Keerai'. Name them as A and B. Apply cow dung or urea and sprinkle water for potted plant A. Sprinkle water alone for potted plant B. Keep them in sunlight and observe their growth for 15-20 days.

Which one grows faster? Why?

Manure is an organic substance and is prepared by the decomposition of plant and animal wastes.

Based on the kind of biological materials used, manure can be classified as,

i) Compost & Vermi Compost

ii) Green Manure

ACTIVITY –1.2

Collect animal wastes like cow dung, plant wastes, domestic wastes, sewage wastes, etc. and allow them to decompose in a pit in your garden for some days. What do you get?

Compost prepared by using earth worms to speed up the process of decomposition of plant and animal wastes is called Vermi Compost.

Vermi Compost

Green Manures

Leguminous plants like Sunn-hemp or Cluster Bean are grown and then mulched by ploughing them back into the soil. This helps in enriching the soil with Nitrogen and Phosphorous.

Sunn-hemp

Uses of Manure

- Manure enhances the water holding capacity of the soil.
- It increases the number of friendly microbes.
- It improves the soil texture.

FERTILIZERS

Fertilizers are chemicals commercially produced in factories and used as plant nutrients. They supply Nitrogen, Phosphorous, Potassium, etc., They are used to ensure good vegetative growth giving rise to healthy plants.

Type of Fertilizers	Examples
Nitrogenous Fertilizers	Urea, Ammonium Sulphate, Ammonium Nitrate, etc.
Phosphatic Fertilizers	Single Super Phosphate, Triple Super Phosphate
Potassic Fertilizers	Potassium Nitrate, Pottassium Chloride
Complex Fertilizers	Nitrophosphate, Ammonium Phosphate, Diammonium Phosphate (DAP)

Application of fertilizers results in higher yield of crops. At the same time, it increases the cost of farming. As the fertilizers are water soluble chemicals, large part of the fertilizers applied is washed away due to excessive irrigation. They are not fully absorbed by the plants.

This excess fertilizer is washed away into the ponds, lakes, canals and rivers, resulting in the growth of unwanted plants like Water Hyacinth, algae, etc. These plants disturb the water bodies and the flow of water. As a result, fishes and other living organisms do not get sufficient sunlight and oxygen and die.

ACTIVITY –1.3

Visit a nearby paddy field where fertilizer has been applied, and observe the number of earthworms. Compare this with the number of earthworms in a garden where no fertilizer has been applied. What do you observe? why?

Differences between Manures and Fertilizers

Manures	Fertilizers
1. Manure is a natural substance obtained by the decomposition of cattle dung, human waste and plant waste.	1. Fertilizer is a mineral or chemical compound containing nutrients like Sulphur, Phosphorous, Nitrogen, etc.
2. Manures are organic substances.	2. Fertilizers are inorganic compounds.
3. Manures can be prepared in fields.	3. Fertilizers are manufactured in factories.
4. Manures contain all nutrients but in small quantities.	4. They contain higher quantities of one or more specific nutrients.
5. Manures add plenty of humus to soil and improve the texture of the soil.	5. Fertilizers do not result in the addition of humus to the soil.
6. Manures are not easily absorbed because they are less soluble in nature.	6. Fertilizers are soluble in water and it is easily absorbed.
7. Manures are less soluble; they are not easily washed away from the soil and hence their effect is long lasting.	7. Fertilizers are easily washed away by water and hence their effect is of shorter duration and require repeated application.

Fertilizers should be applied carefully in terms of proper dose, time and observing pre-and post application precautions for their complete utilization.

Fertilizers have short term benefits. But manures give long term benefits. We must balance the use of fertilizers and manures to suit the long term and short term need of plants.

1.4 PROTECTION FROM PESTS AND DISEASES

Pests are organisms of plant or animal origin which damage cultivated crops or plant products in storage. Crop yield is lost due to pests during sowing, harvest, storage and consumption. This is a great loss to the national economy.

MORE TO KNOW

Fertilizers which are derived from living organisms are called Bio-fertilizers. The main source of bio-fertilizers are bacteria, cyanobacteria and fungi. Bio-fertilizers are renewable and non-polluting sources of plant nutrients. They also improve the soil condition. Rhizobium and Cyanobacteria such as Anabaena and Nostoc are some common bio-fertilizers.

1.4.1 PEST CONTROL

There are different methods of controlling of the pests. The most common method of controlling pests is the use of pesticides.

A man spraying pesticides

Pesticides are classified as Insecticides, Fungicides, Weedicides, Rodenticides, etc., depending upon their use.

i) **Insecticides :** The chemical substances which are used to kill the insects are called insecticides. e.g. DDT (Dichloro diphenyl trichloro ethane), Malathion etc.,

ii) **Fungicides :** The chemicals used to kill fungi are called fungicides. e.g. Bordeaux mixture.

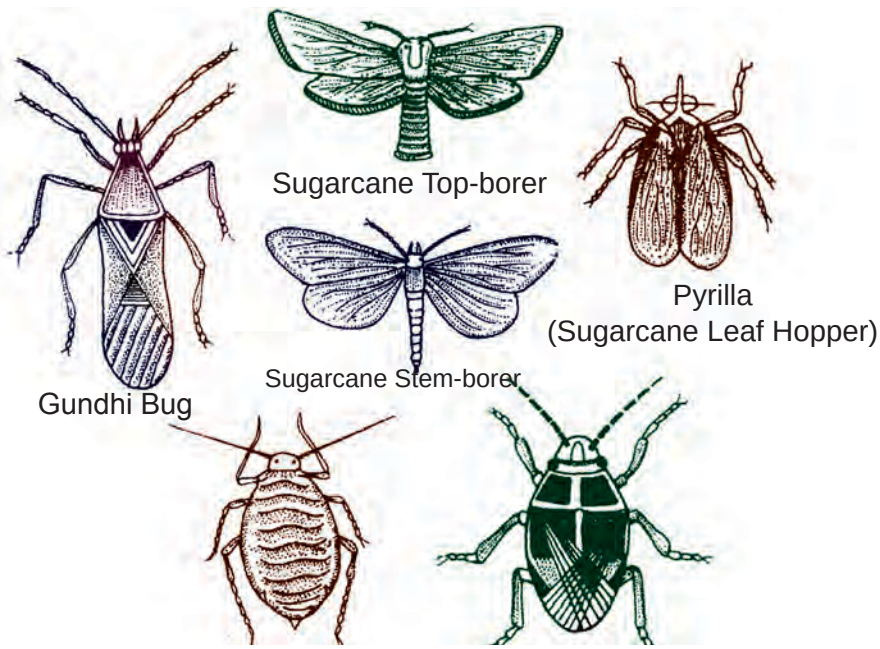
iii) **Weedicides :** The chemical substances which are used to kill the weeds are called weedicides. e.g.2-4-D. (2-4-Dichloro phenoxy acetic acid)

iv) **Rodenticides :** The chemicals used to kill rodents like rats, mice and squirrel are called rodenticides, e.g. Zinc Phosphate, Arsenic etc.

1.4.2 INSECT PESTS

Insects are serious pests of plants which attack them in all stages and parts. Based on the mode of attack, the insect pests can be classified into three types.

i) Chewing Insects: They cut and chew the root, stem and leaves of the plants. e.g. grasshoppers, caterpillars, etc.



Some common Indian Insect Pests of Crop Plants.

ii) Sucking Insects: They suck the cell sap from different parts of the plants. e.g. Leaf hoppers, aphids etc.,

iii) Borer Insects: They bore and enter different parts and feed on the plant tissues. e.g. sugarcane borer.

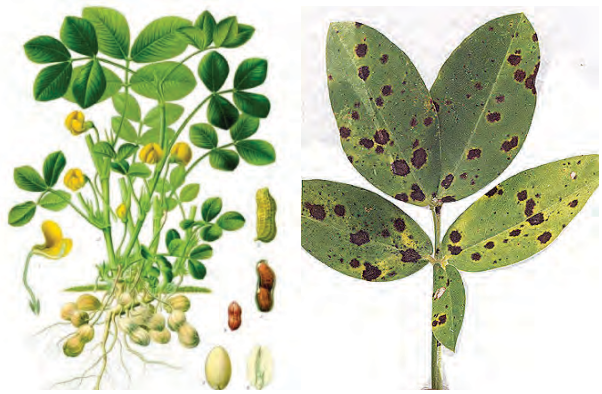
1.4.3 METHODSOFINSECT PEST CONTROL

The infestation of different types of insect pests can be controlled by the following methods.

- Root cutting insects are controlled by mixing insecticides in soil. e.g. Chloropyriphos.
- Stem and leaf cutting and boring insects are controlled by dusting or spraying contact insecticides. e.g. Malathion, Lindane and Thiodan.
- The sap sucking insects can be controlled by spraying insecticides. e.g. Dimethoate and Metasystox.

1.4.4. DISEASES OF CROP PLANTS

A wide variety of plant pathogens such as bacteria, virus and fungi exist in our environment. When they get favourable conditions for their growth and propagation, they spread and infest the crop plants causing diseases. Based on the mode of transmission, plant diseases are classified into four types.



Tikka disease of Groundnut

1.	Seed-borne diseases	They are spread through seeds. e.g. Leaf spot of rice, Loose smut of wheat.
2.	Soil-borne diseases	They are spread through the soil. They affect roots and stems in plants. e.g. Tikka disease of groundnut.
3.	Air-borne diseases	These diseases are transmitted by the air. They attack all aerial parts of the plants like leaves, flowers and fruits. e.g. Blast of rice, Rust of wheat etc.
4.	Water – borne diseases	The diseases which are transmitted through water are called water-borne diseases. e.g. Bacterial blight of rice.

1.4.5 PRECAUTIONS FOR APPLYING PESTICIDES

- Do not touch the pesticide with bare hands; use rubber gloves while handling it.
- Do not blow, suck or apply mouth to any sprinkler, nozzle or other parts of the spraying equipment.
- Do not spray pesticides against the direction of wind in the open field. Use only the prescribed dose of the pesticides for spraying.

Organic Pesticides

As the pesticides are toxic chemicals, they cause environmental pollution. Therefore we should try to avoid excessive use of such chemicals and should adopt the following preventive measures of protecting crops from pests.

- Use of resistant varieties.
- Crop Rotation and cropping system (growing different crops on a piece of land which leads to destruction of pests in the absence of specific host).
- Clean Cultivation (Proper sanitation of field before sowing the crop)
- Summer Ploughing.

Storage of Grains

Most crops are harvested once a year. In order to get food items regularly throughout the year, they are stored in safe storage.

Cereals or food grains are stored by the farmer, trader and Food Corporation of India (FCI).

During storage, grains and seeds are subjected to spoilage by various agencies. Factors responsible for such losses are

i) Biotic factors (insects, rodents like squirrel and rat, birds, fungi, mites and bacteria).

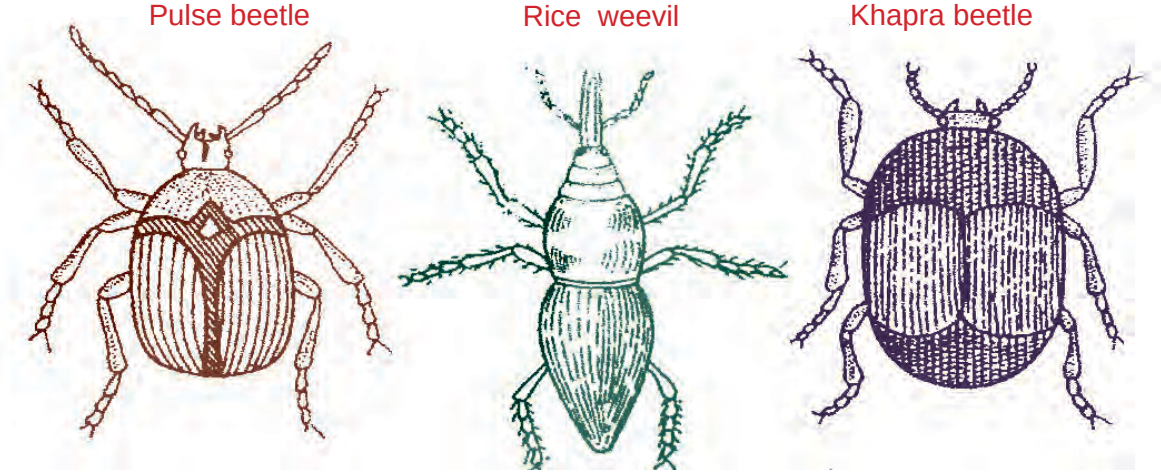
ii) Abiotic factors (moisture and temperature)

These factors cause

- infestation of insects
- degradation in quality
- loss in weight
- poor germinability
- discolouration of produce
- poor marketability.

Therefore, it is essential to protect the produce from any kind of loss during storage.

Preventive and Control Measures are used when produce is stored for future use. They include strict cleaning of the produce before storage, proper drying of the produce in sunlight and then in shade and fumigation using chemicals that kill pests.



Some insect pests of stored grains

ACTIVITY –1.4

Visit nearby crop fields and observe and identify weeds, insect pests and diseases noticed in crops.

1.5 HYBRIDIZATION IN PLANTS AND ANIMALS

1.5.1 HYBRIDIZATION IN PLANTS

Hybridization is the method of producing improved varieties by crossing two or more plants of dissimilar genotypes together. A plant variety containing as many desirable characters as possible can be produced by hybridization.

Hybridization involves selection of parents with desirable qualities. Useful characteristics are scattered in different varieties. It is possible to bring all the characters in a single variety by Hybridization.

Hybridization can be

i) Intervarietal (cross between two different varieties)

ii) Interspecific (cross between two species of the same genus)

iii) Intergeneric (cross between different genera)

Of the above three types, intervarietal hybridization is widely adopted in plant breeding.

F_1

HYBRID VARIETY OF MAIZE

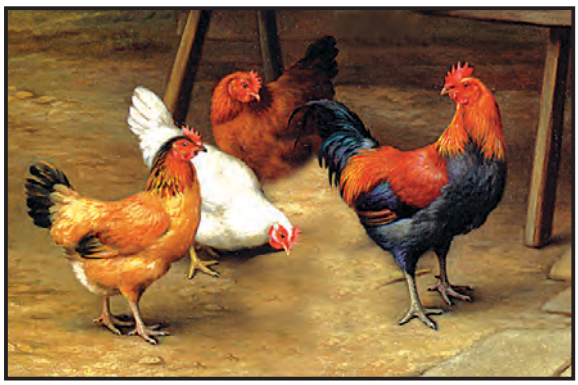
Hybridization procedure includes different steps. They are i) Selection of parents, ii) Selfing of parents, iii) Emasculation, iv) Bagging, Tagging and Labelling, v) Crossing and vi) Harvesting the hybrid seeds and raising F_1 generation.

1.5.2. HYBRIDISATION IN ANIMALS

Hybridisation is a method of breeding, where the offspring is formed by the union of two genetically dissimilar parents. It involves the application of the principles of genetics and physiology of reproduction. Hybridisation has long been used for commercial production of cattle, swine, sheep and poultry. Superior hybrids are likely to be obtained when genetically different parents are used in the cross. Practically, all hybrids of poultry and swine are produced by hybridisation.

The various characteristics of the parent animals which should be taken into consideration for animals breeding are,

1. Resistance to diseases
2. Tolerance to climatic conditions
3. General appearance
4. Size and configuration
5. Productivity
6. Good health
7. Proper age of reproduction



Poultry shed

The different methods of animal hybridisation are as follows :

Inbreeding

Breeding between closely related individuals within the same breed is known as inbreeding. The importance of inbreeding are

1. It is used as a tool primarily for building of desirable genotype and to promote homozygous desirable characters.

Inbreeding in cattle

2. To bring undesirable recessive genes to light. This enable the breeder to separate them from the stock.

3. Inbreeding promotes uniformity.

4. Inbreeding associated with selection can produce improved stocks.

Selection

It is a process of selecting productive individuals for further breeding.Modern approach of selection is based on records of performance.

Out breeding

It is a breeding of unrelated animals which may be between individuals of same breed

a) Out crossing: It involves the crossing of animals of the same breed (without a common ancestor).

b) Cross breeding: In this method, superior males of one breed are mated with superior females of another breed. It involves the fusion of two different breeds in order to combine the desirable qualities of both.

Zebu

c) Inter specific Hybridisation: In this method, male and female animals of two different species are mated. In some cases, the progeny may combine desirable features of both the parents. For example, mule is produced from a cross between female horse (mare) and male donkey. Mules are sturdier and hardier than their parental species, and are well suited for hard work in different terrains like mountainous regions. There are two methods of inter specific hybridisation.

i) Natural Method: In this method crossing of indigenous and exotic breeds takes place in order to significantly improve the yield.

ii) Artificial insemination:

It is a method used in hybridization in which stored semen of a desired male animal is introduced into the genital tract

of a selected female animal by the use of suitable instruments in order to obtain a better breed of the animal.

Advantages

1. Ensures the progeny with desirable qualities.
2. It is an economical method wherein semen from an animal is used to impregnate many females.
3. It provides high yielding animals with increased production of milk, eggs and meat.
4. Frozen semen can be stored for a long period and it can be transported even to the remote areas.

1.6. ANIMAL HUSBANDRY

The branch of agriculture which deals with the feeding, shelter, health and breeding of domestic animals such as cattle, pigs, horses and fowls is called animal husbandry.

The various elements of animal husbandry are :

1. Proper feeding of animals.
2. Provision for clean drinking water for animals.
3. Proper shelter for animals.
4. Prevention and cure of animal diseases.
5. Proper breeding of animals.

ACTIVITY 1.5

Visit an animal husbandry clinic to know about the common diseases of cattle.

MORE TO KNOW

Animal Product	Fat %	Protein %	Sugar %	Minerals %	Water %
Milk	3.60	4.00	4.50	0.70	87.20
Egg	12.00	13.00	Trace	1.00	74.00
Meat	3.60	21.10	Trace	1.10	74.20
Fish	2.50	19.00	Trace	1.30	77.20

1. Cattle feed

Cattle feed has two types of substances roughage and concentrates. Roughage is a coarse and fibrous substance having low nutrient contents. The concentrates are cotton seeds, oil seeds, oil cakes, cereal grains etc.,

2. Shelter

Domestic animals should be provided with proper houses and shelter which can protect them from heat, cold, rain, predator and disease causing organisms. The shelter should be clean, airy, well lighted and well ventilated so that they are safe guarded from various diseases. Proper arrangement should be made for removal of dung and the drainage of animal urine.

Protection of animal health

Protection involves prevention, control and cure of animal diseases to keep them fit and healthy. The diseases are mainly due to virus, bacteria, fungi, etc., Vaccination against infections should be administrated to protect animals from contagious diseases.

NUTRITIONAL VALUE OF MILK

SL.NO.	CONSTITUENTS	FUNCTION
1.	CALCIUM	Builds and maintains bone mass
2.	VITAMIN D	Promotes Calcium Metabolism
3.	PROTEIN	Builds and repairs muscles.
4.	POTASSIUM	Maintenance of Blood Pressure.
5.	VITAMIN B2	Cellular Metabolism
6.	VITAMIN B4	Functioning of Enzymes
7.	VITAMIN B12	Maturation of Red Blood Cells.

White revolution

White revolution attributes to increase in milk production by using new improved breeds of cattle. Dr. V.Kurien is the founder chairman of National Dairy Development Board (NDDB). This board designed and implemented the world's largest dairy development programme called **OPERATION FLOOD**. Dr. V.Kurien is considered as Father of White revolution.

1.7. POULTRY FARMING

Poultry forming is defined as rearing and breeding of avian species for the purpose of egg and meat. Chicken occupy 90% of the total poultry.

The term poultry includes chicken, ducks, geese, turkeys, pigeons, guinea fowls, etc., The poultry industry with its production in the form of eggs and meat is of particular importance in providing a balanced diet for the human population. Proper management of poultry includes methods of hatching, rearing, housing, sanitation, prevention of diseases and a sound marketing system.

Silver revolution

The increase in egg production brought about the 'Silver Revolution' in the area of animal husbandry.

There are more than hundreds of breeds of fowls. The fowls are classified on the basis of their utility to man. They are 1.meat type 2.egg type and 3. Dual type.

Breeds of fowl

Indian breeds – Chittagong, Aseel, Karakanth and busra are four breeds of indigenous fowls in India.

Asiatic Breeds – Brahma and Langshan are asiatic breeds.

Exotic breeds – Plymouth rock, Leghorn, Rhode island, Black Minorca are examples for exotic breeds.

MORE TO KNOW

Vegetarian eggs: Fertile eggs rot more rapidly than infertile eggs. Hence the production of infertile eggs is desired. Hens are capable of laying eggs without the presence of cock and the eggs obtained are infertile. Such eggs are called vegetarian eggs.

MORE TO KNOW

White leghorn is the most high egg yielding breed in the world.

India ranks fifth in the world poultry production.

Examples for cross breeds of Poultry are – HH-260, IBL-80, B-77, IIS-82

Advantages of Cross breeds

1. Cross breeds lay more number of eggs.
2. The eggs produced are larger in size.
3. They yield more meat.

Nutritional value

Eggs and meat are a good source of protein. Eggs also contain calcium, Phosphorus, sodium, Vit. B1, B12, D, etc,

Housing of Birds

The two principal methods of birds keeping generally used in India.

They are a) semi-intensive method and b) intensive method.

Poultry farm

Poultry feed

Poultry diets are composed primarily of a mixture of cereal grains, soya bean meal, Fish meal, Bone meal, Wheat bran, groundnut cake, barley, oats, maize, animal by product meals, etc. Trace minerals such as Zinc, iron, copper iodine, manganese, selenium etc. must be included in the poultry feed.

Poultry disease and control

Poultry are often affected by diseases and attacked by predators (eg. Cat, Dog, Fox). Some of the common diseases found in Indian fowl are Tick fever (Spirochaetosis), Tuberculosis, Fowl Cholera, Fowl Pox, Flu, etc.,

Disease control

Poultry diseases can be controlled by vaccination, Isolation of affected ones, improving the sanitary conditions, removing dampness and exposure to sunlight. Feeding poultry a well balanced diet will prevent them from developing deficiency diseases.

Poultry industry in Tamilnadu

The Tamilnadu Government is giving much importance to poultry industry. Namakkal, Palladam and Chennai are well known for poultry industries. Each child is given an egg on all school working days in Tamilnadu.

ACTIVITY –1.6

Visit a nearby poultry farm to observe rearing, feeding and breeding of birds.

1.8. PISCICULTURE

The process of rearing and breeding of fishes in rivers, streams, ponds, irrigation canals, paddy fields, etc., is known as pisciculture.

Pisciculture has an important place in Indian economy. It provides income and employment to millions of fishermen and

Common carp

farmers, particularly in the coastal areas.

Factors to be considered for pisciculture

1. Topography or location of pond.
2. Water resources and quality of water.
3. Soil quality (Nutrients)
4. Temperature of the water.

Types of fish culture

a. **Extensive fish culture** – growing fish on natural feed.

b. **Intensive fish culture** – Growing fish on artificial feed to maximize production

c. **Monoculture** – Growing a single type of fish in a given water body.

d. **Poly culture** - Growing one or more types of fishes with different feeding habits together in a water body.

e. **Integrated fish culture** – Growing fish with agricultural crops or other animals.

Types of fishing ponds

Fish culture requires different types of ponds for the various stages of growth of fish. The types of ponds are as follows,

1. **Breeding ponds:** Sexually mature males and females are collected and left in these ponds for the breeding.
2. **Hatchery ponds:** The seeds collected from breeding ponds are placed in order to hatch the young fishes called fish fries.
3. **Nursery pond:** 3 to 5 day old fish fries are fed well and retained for about 20 days.
4. **Rearing ponds:** These are deeper ponds in which fish fries from the nursery ponds are transferred and maintained here for about three months. The fish fries grow to a size of about 125 mm length and are now called fish fingerlings.
5. **Stocking ponds:** These are larger ponds and the fingerlings are fed with artificial feed. Organic and inorganic fertilizers are used in increase growth. Antibiotics are used to prevent infectious diseases. When the fishes attain the required size, they are harvested.

Nutritional value of fishery products

Fishes are rich in animal protein, vitamins and minerals. The vitamin-A content of fish liver helps in good vision. Vitamins such as B6, B12, Biotin, Niacin, D and minerals such as phosphorus, potassium and iron promotes normal growth of human body. Fish meal for cattle and poultry is prepared from the non-edible parts of fishes.

MORE TO KNOW

Facts about Indian fisheries (both capture and culture)

1. Total fish production
   – 7th position in the world.
2. Marine fish production
   – 10th position in the world.
3. Aquaculture production
   – 2nd in south east Asia.
4. Fish industry contribution
   – Rs. 400 Crores annually as foreign exchange.

1.9. APICULTURE

The scientific method of rearing honeybees for honey and wax is called 'Apiculture' or 'Bee keeping'. Honey bees are social insects. They live in colonies. They exhibit team work and division of labour. They feed on the pollen and nectar of flowers. The honey bees collect nectar from various flowers. The nectar is swallowed by the bees. In the stomach, the nectar is converted into honey and stored in the honey combs.

There are three types of bees in a colony.

a. **Queen** – The only fertile female in the hive and it's function is to lay eggs.

b. **Drones** – These are fertile male bees and it's function is to mate with queen bee and fertilize the eggs.

c. **Workers** – These are sterile females. They take care of the queen and young bees, collect nectar build honey combs and protect the bee hive.

Honeybee varieties

a. Indigenous varieties

i. Apis Indica – Common Indian honey bee.

ii. Apis dorsata – Rock bee

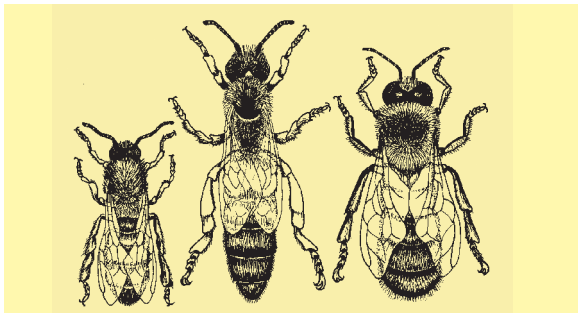
iii. Apis florea – Little bee.

MORE TO KNOW

Round dance Waggle dance

HONEYBEECOMMUNICATION (Dance forms)

Round dance indicates that the source of nectar is within 100 mts., Waggle dance signifies a long distance. The dance movements specifies the direction of nectar with respect to the sun. In 1973 KARL VON FRISCH received Noble prize for deciphering this language.



Worker Queen Drone

b. Exotic varieties

i. Apis mellifera (Italian bee)

ii. Apis adamsoni (South African bee)

Economic importance of honey bees

Honey bees are used in the production of honey and bee wax.

Uses of honey

1. Honey is an energy rich food. For eg. 1 Kg of honey contains 3200 calories of energy.
2. Honey contains sugars, minerals, vitamins, enzymes and pollen.
3. Honey is an antiseptic and contains formic acid as the preservative.
4. Honey is a blood purifier, a cure against cough, cold,sore throat, ulcers of tongue, stomach and intestine.
5. Honey is helpful in building up the haemoglobin content of the blood.
6. Honey is used in the preparation of bread, cakes and biscuits.

Bee wax

It is utilized in the manufacture of cosmetics, lubricants, cold creams, shaving creams, polishes, candles, ointments and in medical preparations.

1.10. AQUACULTURE

Aquaculture deals with the farming of economically important aquatic organisms both plants and animals under controlled condition in a confined environment. Aquaculture includes culture of prawn, lobsters, fish, pearl oysters, mussels, crabs, etc.,

EVALUATION

Section – A

Choose the correct answer :

1. Tallness and profuse branching are desirable characters for (oil seed varieties, fruit trees, vegetables, fodder crops).
2. Nutrients are provided to the plants by air, soil and (rock, fossil, water, volcano).
3. Anabaena is a (cyanobacteria, green alga, brown alga, red alga).
4. 2,4 – D is a (insecticide, fungicide, rodenticide, weedicide).
5. An insect which cut and chew the root, stem and leaves of the plants (cotton ball, weevil, aphid, grasshopper, leafhopper)

Section – B

6. complete the table with suitable answer.

Name of the crop	Disease	Type of disease
Rice	?	Seed- borne
Ground nut	Tikka	?

7. As our country is the second in population in the world, it Is necessary to increase the yield of crops. How can we improve the crop yields?
8. i) Deficiency diseases occur in human beings due to the lack of nutrients. Does it occur in plants too?

   ii) If the growth of the plants in your garden is stunted, what will you do to hasten the growth?
9. Make lists of macro and micro nutrients from the following;

   Copper, chlorine, boron, calcium, nitrogen, phosphorous, potassium, sulphur, zinc, iron, magnesium.

Section C

10. i) Match the items in Column A with the items in Column B

Column A	**Column B**
1. Emasculation	a. Storage of grain
2. Fertilizer	b. Bordeaux mixture
3. Fungicide	c. Hybridization
4. FCI	d. Urea

ii) To eliminate the nutrient deficiency we use manures and fertilizers.

a) Which one is absorbed easily by plants ?

b) Explain why.

Section – A

1. In Artificial insemination method, the frozen semen is utilized to impregnate many females. Mention its advantages.

Section – B

2. Minerals are essential for the proper development of poultry animals. Mention at least four minerals.
3. Honey is a good medicine. List out any four medicinal uses of honey.
4. Rearrange Column B to match Column A

Inbreeding	--------	a) Desirable qualities
Cross breeding	--------	b) Frozen Semen
Inter specific hybridization	--------	c) Homozygous Characters
Artificial insemination	--------	d) Mule.

Section – C

5. Observe the given table with a set of 4 terms in Column A. Pick out the odd term and enter in column B. Identify the common features of the remaining three items and note down in Column C.

MODEL	A	B	C
1.	Aseel. Karknath. Busra, Leghorn.	Leghorn	Indian breeds of Poultry
2.	Inbreeding, Crossbreeding,Inter specific hybridization, Artificial insemination.		
3.	Monoculture, Polyculture, Integrated Fish Culture,Intensive Fish Culture		
4.	Apis indica, Apis dorsata, Apis florea, Apis Mellifera		

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Chapter 2

ADDICTION AND HEALTHY LIFESTYLE

2.1. ADDICTION

The term addiction is used to describe a compulsion by an individual to engage in some specific activity. Addiction leads to harmful consequences to an individual's health, mental state, and social life.

Histologically, addiction has been defined as psycho-active substances which cross blood – brain barrier temporarily altering the chemical nature of the brain.

The drugs and alcohol are misused and consumed in large quantities by an individual without the consultation of medical practitioners. They affect the central nervous system, liver spleen, kidney, heart etc., Slowly the individual becomes addicted to these drugs and alcohol. This addiction leads to personal as well as social problems.

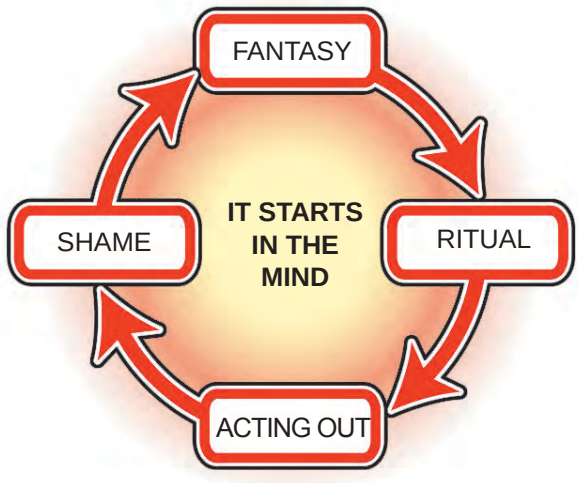
PERSONAL REASONS FOR ADDICTION

1. Mental susceptibility of an individual towards alcoholism.
2. Some use drugs for pain relief and it causes addiction.
3. Highly common reason for drug addiction is inability to cope up with emotional stress, anxiety, depression, environmental stress etc.
4. Some people become addicted due to underlying psychological disorders such as post traumatic stress disorder or attention deficit disorder.

SOCIAL REASONS FOR ADDICTION

1. Individuals become addicted because of peer compulsion.
2. Some people become addicted due to disturbing environment in the factories.

The Addiction Cycle



3. People relax after heavy physical work, and become addicted.
4. Hopelessness in life leads people to become addicted.

2.2. KINDS OF ADDICTION

a) ALCOHOLISM

Alcoholism, also known as alcohol dependence, is a disabling addictive disorder. Ethyl alcohol (C_2H_5OH) or

Fate of men after drinking alcohol

ethanol, is an intoxicating ingredient found in beer, wine and liquors. Alcohol is produced by the fermentation of yeast, sugar and starch. It is a central nervous system depressant that is rapidly absorbed from the stomach and small intestine into the blood stream.

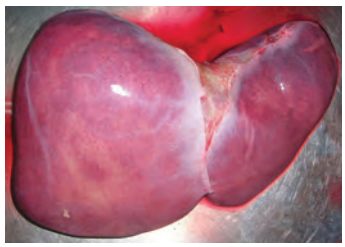
The study of alcoholism is both fascinating and frustrating . Certainly it is little understood .

HARMFUL EFFECTS OF ALCOHOLISM

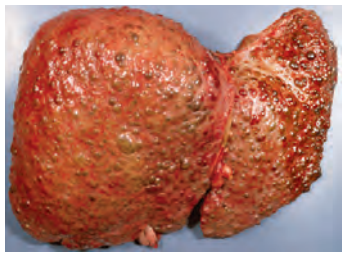
Many other physiological studies

showed that there is a physiological pre disposition towards the loss of control. Certainly the Cerebellum (small brain) is affected, that is why the skeletal muscles have an impaired function.

Liver cirrhosis: A healthy liver is able to regenerate most of its own cells when they become damaged. At the final stage of cirrhosis, the liver can no longer effectively replace damaged cells. Every year, there are about 27,000 deaths because of liver cirrhosis all over the world. Heavy alcohol use over several years can cause chronic injury to the liver. Alcohol-related cirrhosis led to more death than cirrhosis due to any other cause.



Normal Liver



Liver affected by liver cirrhosis

MORE TO KNOW

In South America Vehicles like buses are powered with ethyl alcohol. It is a very good pollution free fuel.

Ethyl alcohol is also a very good solvent for paints and varnish.

PREVENTION OF ALCOHOLISM

- Addiction of alcohol can be prevented at early stage by taking the following steps:
- The harmful effects of alcohol such as

drowsiness, Induce sleep, damaged liver cells which cause for death must be explained to the people.

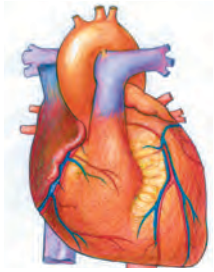
- If the addiction is developed due to being idle and by the pressure of the job, both the idleness and the nature of the jobs should be changed.
- Psychotherapy helps the patient in changing their life style.
- By educating parents and teachers to help the patients recover from alcoholic addiction.
- Drug therapy is also a valuable treatment.Medicines like Benzodi-azepines, high dose of vitamin B and antidepressant like phenothiazines are effective in the recovery of alcoholic addiction.
- A number of voluntary organizations are financially assisting to undertake the educative work in various communities and target groups.

2.2.(b). SMOKING CIGARETTES

A cigarette (French “small cigar”) is a small roll of finely cut tobacco leaves wrapped in a cylinder of thin paper for smoking.

Nicotine is one of the most frequently used addictive drug and the leading preventable cause of disease and disability and death in India. Cigrattes and tobacco in any form are illegal substance in most of the countries.

EFFECTS OF SMOKING ON HEART



Cigarette Smoking

Cigarette contains many toxic substances like nicotine, carbon, etc.

When inhaled, these toxic substance get deposited on the inner walls of the blood vessels that carry blood to the heart

This results in plaque formation

This plaque causes narrowing of the blood vessels. Blood supply to the walls of the heart is gradually reduced

As blood carries oxygen to heart, Oxygen supply is also reduced

As there is no sufficient blood supply and oxygen supply to heart, it damages the heart muscle

Leads to heart attack

Smoking causes diseases like Heart attack, Hypertension (high blood pressure), Cardiovascular diseases and finally leads to Death

LUNGS

Smoking destroys small hairs (cilia) present in the upper respiratory track (trachea). In normal persons these hairs protect lungs from germs, dust, smoke and other harmful chemicals enter lungs causing infection, cough and lung cancer. The air sacs of lungs (alveoli) get permanently damaged causing difficulty in breathing.

DIGESTIVE SYSTEM

Smoking causes heart burn, delays the healing of peptic ulcer, increases risk of Crohn's diseases and formation of gall stones. It affects liver and increases the chances of stomach cancer.

LEGS

Smoking affects blood vessels of legs causing chronic pain in legs.

EYES

The sensitive blood vessels of eyes are easily damaged by smoking. This causes redness of eyes and itching. Heavy smoking may lead to degeneration and loss of eye sight.

SKIN

Due to smoking, the skin is deprived of oxygen and it loses its texture. An average smoker looks five years older than his healthy nonsmoking counterparts. The skin loses its healthy glow and takes yellowish-grey cast. The more cigarettes smoked, the worse the skin will look. Wrinkles start appearing very quickly as smoking affects the elastic nature in the tissues of the skin.

BONES

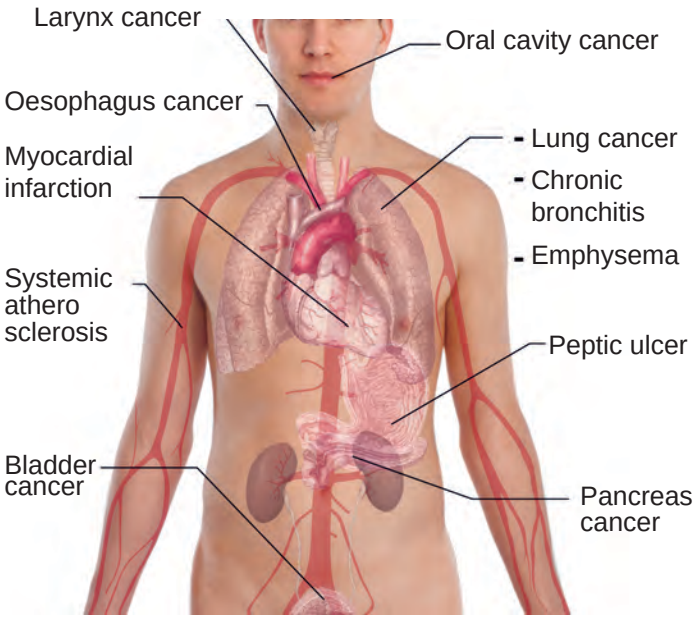
It accelerates the process of Osteoporosis.

CANCER

Smoking causes cancer in lungs, larynx, oral cavity, pharynx, oesophagus and bladder. Tobacco smoke contains more

Common adverse effects of

TOBACCO SMOKING



than 60 substances which cause cancer. 90% of lung cancer death occurs due to smoking.

REPRODUCTIVE SYSTEM

Smoking reduces fertility in both men and women.

IN WOMEN

Smoking imbalances estrogen hormone in women and it reduces blood flow to genital organs. Women who smoke can get diseases in fallopian tubes and their egg production is affected. Smoking can cause abortion. It accelerates ageing process and can cause early menopause.

The growth of baby retards when mother smokes in pregnancy. It affects the brain development of the baby and reduces its IQ. This happens even when mother is a passive smoker. The chances of miscarriage premature birth and foetal death increase.

IN MEN

Smoking causes damages to the male reproductive system in many ways.

2.2 (C). DRUG ABUSE - NARCOTIC DRUGS

In the study of addiction, the term 'drug' means unauthorized and improportionate use of chemicals which is injurious to health. Sometimes the authorized drugs are consumed in large quantities without doctors advice. It also leads to drug addiction. Consumption of such drugs for a long period of time have direct effect on the central nervous system and its related problems. Heroin, Opium, Cocaine are some of the drugs that are injurious to health. These drugs are also called narcotics.

Harmful effects of drug abuse

- Impaired health, infectious diseases , HIV / AIDS.
- Absence from school and college.
- Possible death due to frustration or illhealth.
- Drug addicts may commit crimes like theft, rape or murder.
- Corruption, Narco-terrorism.

SIGNS OF DRUG ABUSE

- Sudden change of mood and temper.
- Bouts of drowsiness or sleeplessness.
- Body pain, nausea, unsteady gait.
- Losing interest in job and studies.
- Telling lies and stealing money.

Following constitute offence in relation to illicit drugs.

- Possession even in small quantity.
- Cultivation of drug crops without permission.
- Allowing your premises to store, sell or consume.

- Illicit manufacture, sale, purchase and transportation.
- Trafficking of drugs is a non-bailable offence (Prison sentence up to 20 years and fine up to Rs.2 lakhs)
- Death penalty for repeat offenders.

What students should do

- Always resist peer pressure and say " No to Drugs "
- Drugs are not "Cool" Decide your self.
- Girl students should be cautious of taking drinks containing " date rape drugs".
- Report drug abuse or trafficking to your school, college or police.

2.3. PREVENTION OF ADDICTION

Non- addiction is a term used for the prevention of addiction. It narrates the management of alcoholism and drug abuse. There are Government and Non Government organizations in our country which have Rehabilitation centre to treat and counsel the drug addicts and alcoholics by means of medical and psychological approaches. The following are the steps taken in rehabilitation centre to deaddict the individuals.

First step	The identification of addicted individuals.
Second step	The composition of drug is analyzed.
Third step	The addicted individual is identified to find out whether the dependency is physical or psychological.
Fourth step	A suitable chemotherapy is given to the addicts to the detoxify drug consumed.
Fifth step	Treatment should be given for a long time.
Sixth step	There should be periodical observation given according to his physical, mental, social and the occupational status.

2.4 HEALTHY LIFESTYLE

Healthy lifestyle is a term given to a group of habits like healthy eating, being physically active, leading a smoke free and stress free life. Our motherland India is predicted to become the diabetic and cardiovascular disease capital of the world.

Obesity

Obesity is defined as an excessive accumulation of fat in the body that leads to increased health problems. Obesity can have its grassroots from childhood and those children are significantly much above the standard of weight for height for their age group. Lethargy, sluggishness and difficulty in carrying out activities of daily living are some of the adverse effects of obesity. The causes of obesity are unhealthy dietary

habits, lack of physical activity, genetic susceptibility, endocrine disorders and some medications.

Prevention of Heart Disease and Obesity

1. Dietary and lifestyle changes

- Eat plenty of food rich in fibers such as fruits and green leafy vegetables as part of your diet. Intake of more amount of steamed and oil free foods like idle, idiyappam, puttu etc.,
- Nuts, whole grains, seasonal fruits and vegetables can be consumed.
- Eating fish twice a week helps to prevent blood clot formation in arteries as it contains omega-3 fatty acids.
- Eat less amount of red meat (mutton, beef) and fried foods (chips, etc.,) because it raises the blood cholesterol level
- Though milk and milk products (Ghee, Butter, Cheese) are a good source of calcium, excessive amount leads to overweight.
- Avoid high calorie fast foods.
- Reducing dietary sugars(sweets, chocolates, etc.,) and salt (pickles, pappads, etc.,) in the diet.
- Cigarette smoking and alcohol consumption should be avoided.

2. Physical activity

- Reduce or limit the time of watching television, using computer, playing video games, etc.,
- Increase physical activity to burn out calories which in turn enhances optimal blood circulation. Eg., Walking for an hour every day, playing games in the play ground, jogging, running, cycling, swimming, dancing, etc.,
- Aim for ideal weight for(body mass index) by height following appropriate dietary habits and adequate physical activity.

3. Stress relieving activities

Share your feeling with family and friends, manage your time, get enough sleep, spend time in nature, listen to good music, engage yourself in gardening, painting, playing with pets, time outs for picnics with family ect., helps in relieving stress.

EVALUATION

Section – A

1. This is a wall paper pasted in many places. What does it mean?

Section – B

2. June 26 is International day against drug abuse and is trafficing day. It is proposed to conduct an awareness programme for the public. Write five messages to make people aware against the use of drugs. Explain your message.

3. This is an illustration made by the Government.

a) Write what actually this illustration tells us.

b) Write two diseases caused by smoking.

c) How can we create awareness about smoke among the people?

4. Fill in the blanks with suitable answer.

Liver can no longer effectively replaced damage cells called

[1.] . [2.] is the character of mammals.

It connects [3.] and [4.].

Here the problem arries due to over drinking of alcohol.

Answers:

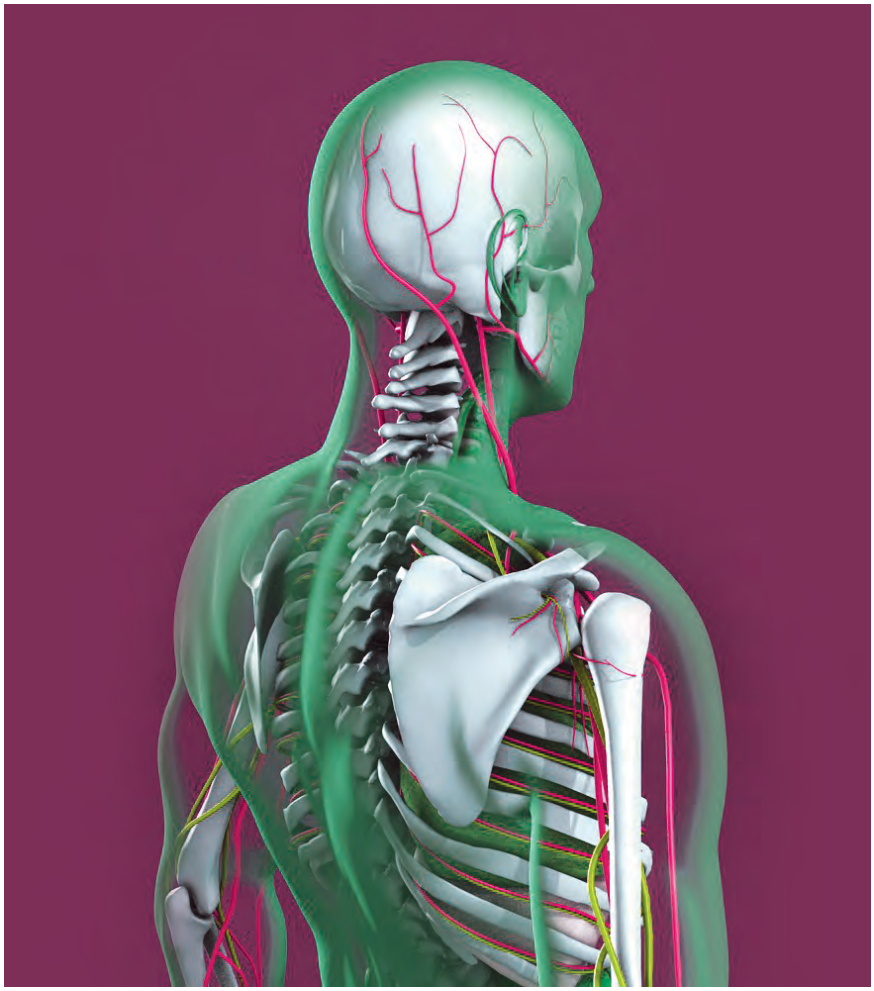
a) Small intestine, b) Liver, c) Liver Cirrhosis, d) Hepatic Portal System.

Section – C

5. The following are the some of the illeffects of smoking. Arrange them in a correct form with the organs.

Organs	Illeffects
1.Heart	a) Degeneration and loss of eye sight.
2.Lungs	b) Loses its texture.
3.Digestive system	c) Causes abortion.
4.Eyes	d) Air sacs get permanently damaged.
5.Skin	e) delays healing peptic ulcer.
6.Bones	f) Atherosclerosis.
7. Reproductive organ (Female)	g) Osteoporosis.

Chapter 3



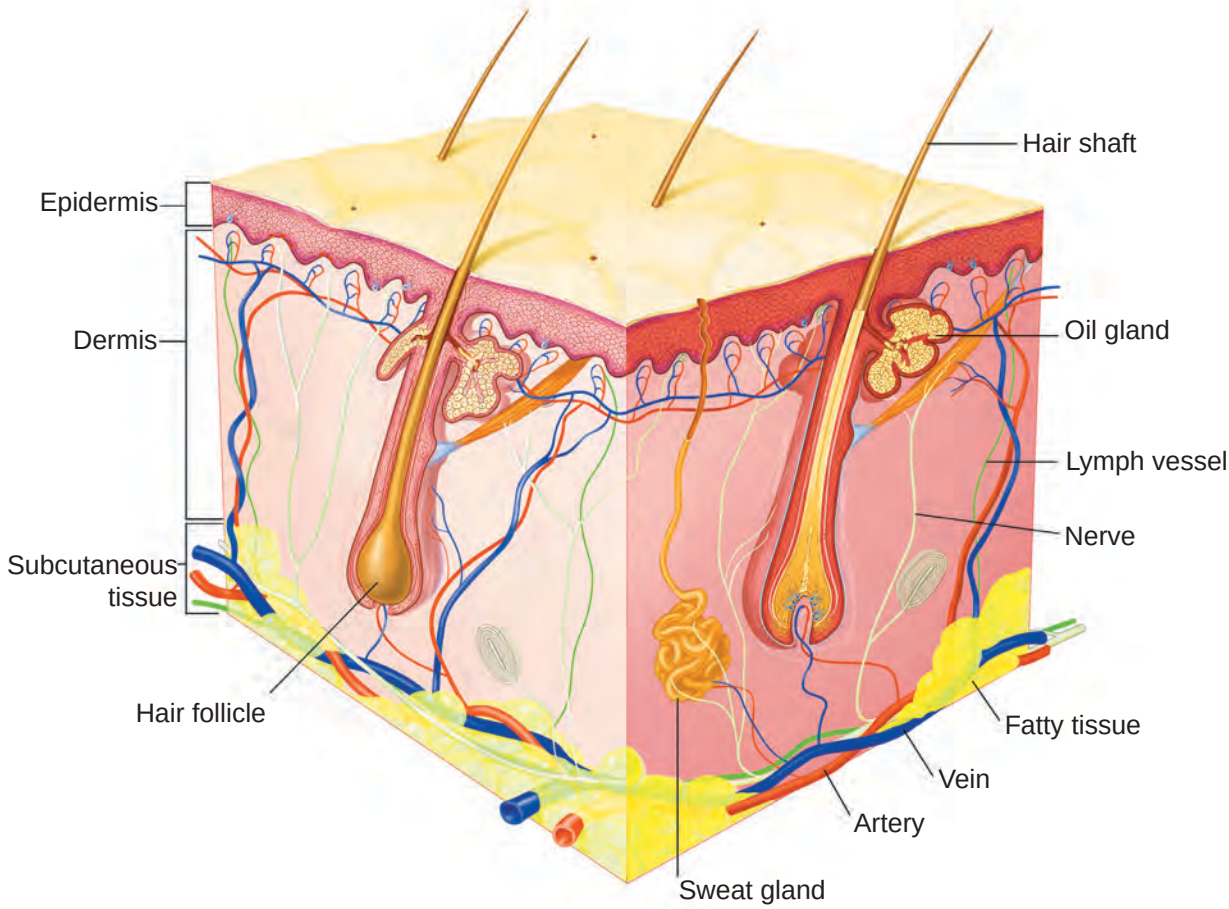
HUMAN BODY ORGAN SYSTEM

3.1. SKIN

Skin is an integumentary system that covers the outside of the body. It is highly essential to protect internal organs and prevent the entrance of pathogens.

The skin is composed of three major tissues:

1. Epidermis. 2. Dermis. 3. Hypodermis.



Structure of skin

1. Epidermis

Epidermis is the upper layer of the skin. The outer most layer consists of flat, thin and scale - like dead cells. It is separated from the dermis by basement membrane. It contains melanocytes, giving colour to the skin. The deepest layers of epidermis have the nerve endings.

2.Dermis

The dermis is the middle layer. It is thick but elastic. The dermis consists of nerves, blood vessels, hair follicles, sweat glands and sebaceous glands (oil glands). The sweat glands separate sweat from the blood.

The sebaceous gland secretes sebum which keeps the skin smooth and shiny. The arectorpili is the smooth muscle necessary to move the hair.

3.Hypodermis

It is the lower most layer, which contains large amount of adipose tissue.

Functions of Skin

1. Skin protects the internal organs of our body.
2. It prevents the entrance of infectious agents.
3. It reduces water loss.
4. Skin regulates the body temperature.
5. Skin can prepare Vitamin D with the help of sunlight.
6. It allows us to feel touch, pain and temperature.
7. Skin acts as an excretory organ and excretes sweat.

MORE TO KNOW

Skin colour of human is determined by the melanocytes of the basement membrane. The formation of melanocytes is by hereditary. Even then there is some impact of colour by external factors like temperature, sunlight, wind and costumes.

ACTIVITY –3.1

1. Identify various derivatives of skin like hair, feather, nail and scales in various animals.

MORE TO KNOW

Wrinkles: If you pinch your skin and let go, it springs back into shape. This happens because skin contains proteins in the dermis that stretch like elastic. As people get older, their skin become less elastic, so it begins to form wrinkles.

MORE TO KNOW

The Europeans are white in colour because of the lack of melanin pigments. That is why they cannot tolerate sunlight.

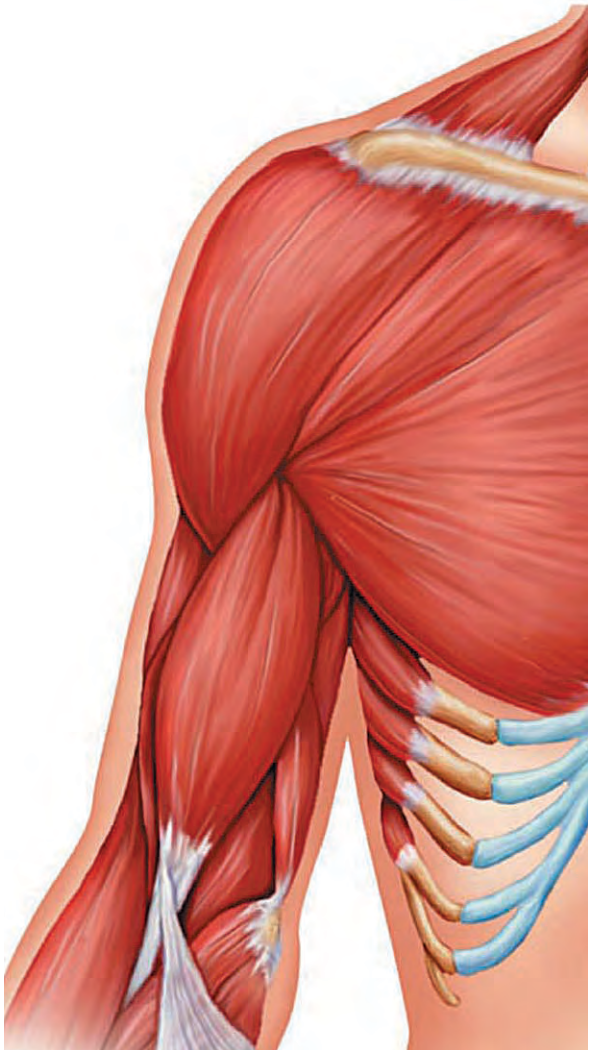
3.2. MUSCULO – SKELETAL SYSTEM

3.2.1. MUSCULAR SYSTEM

Locomotion and bodily movement are characteristic features of the animals. The movements are effected by various cells such as cilia, flagella and organ like muscles. Muscle movement is more powerful and energetic. Human body contains 700 to 800 muscles.

Various animals and their locomotory organs

Animals		Locomotory organs
1	Amoeba	Pseudopodia
2	Paramecium	Cilia
3	Euglena	Flagella
4	Earthworm	Body setae
5	Star fish	Tube feet
6	Fish	Fins
7	Birds	Wings
8	Bat	Petagium



Skeletal Muscles:

Based on the structure, function and occurrence, three different types of muscle tissues have been identified. They are the skeletal, visceral and cardiac muscles.

Skeletal Muscles

The skeletal muscles are attached to bones by tendons which helps in transferring the forces developed by skeletal muscles to the bones. These muscles are covered by sheets of connective tissues called fascia.

Tendons

These are connective tissue structure showing slight elasticity. They are like cords or straps strongly attached to bones. The tensile strength of tendons is nearly half that of steel. A tendon having 10 mm diameter can support 600 – 1000 kg.

Fascia

These are assemblages of connective tissue lining skeletal muscles as membranous sheets. The fascia may be superficial or deep. The superficial fascia is a layer of loose connective tissue found in between skin and muscles. The deep fascia are collagen fibers found as a tough, inelastic sheath around the musculature. They run between groups of muscles and connect with the bones.

Distribution of muscles

There are five different sets of muscles in our body.

1. Muscles of the head.
2. Muscles of the neck.
3. Muscles of the trunk region
4. Muscles of the upper limb.
5. Muscles of the lower limb.

MORE TO KNOW

1 sq.cm of muscle can lift 3.5kg.

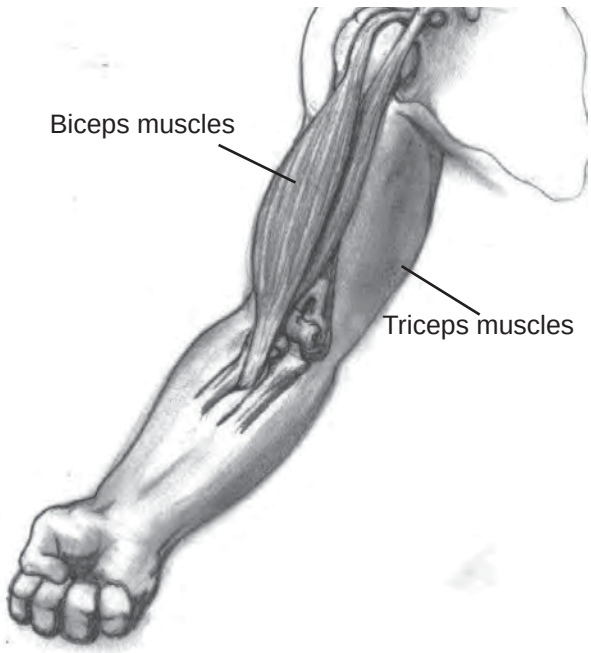
Few muscles and their functions

Facial Expressions

Facial expression, such as looking, shocked or smiling, are tiny voluntary movements made by more than 30 different muscles. Although they are voluntary, we often make these movements without our knowledge.

Breathing

Four important thoracic muscles are associated with the process of breathing. The process of inspiration is due to scalene and external intercostal muscles. The expiration is performed due to internal intercostal muscles and transverse thoracis. Major breathing movement is due to diaphragm, a curved musculo fibrous sheath that separates thoracic cavity from abdominal cavity.



Biceps and triceps muscles:

MORE TO KNOW

Sound is not produced while the muscles function. But machines are producing sounds. If muscles make noise imagine how a rat will escape from a cat.

LUIGI GALVANI

By accident, the Italian professor of Anatomy, Luigi Galvani (1737-98) discovered that a dead frog's legs contracted if they were pegged to an iron frame with brass pins. Galvani thought that frog's muscles movement made electricity, which caused the contractions. Galvani was right to think that electricity made the muscle move, but in fact it was the two metals acting together that made the electricity. We now know that in living animals, electrical signals from the nerve make the muscles contract.

Functions of muscles

1. Muscles are responsible for locomotion.
2. It provides beautiful shape to our body.
3. The inner smooth muscles of the visceral organs make them work like a machine all through our life.

ACTIVITY –3.2

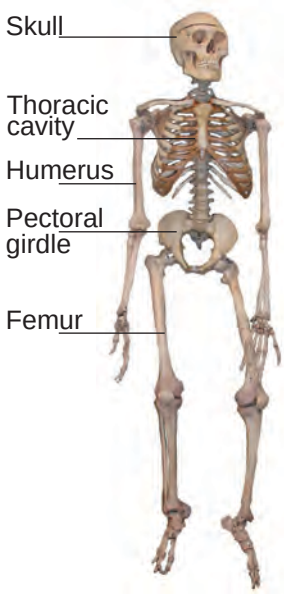
1. Go to the Government Medical college hospital and observe the different types of human muscles and organs.

Significant muscles, their location and movement

S.no	Name	Location	Movement
1	Trapezius	Upper back and each side of neck	Upper pulling movement
2	Deltoids	Shoulders	Arm raising
3	Pectorals	Chest	Horizontal pressing and drawing of arm across the body
4	Lattismus dorsi	Wide back muscle	Pulling and rowing movement
5	Biceps	Front portion of the upper arm	Arm bending and twisting
6	Triceps	Back of upper arm	Pushing and straightening of upper arm.
7	Calves	Lower leg between ankle and knee	Raising and lowering of toes.

3.2.2. SKELETAL SYSTEM

The skeletal system consists of bones, cartilages and ligaments. It is a frame on which all organs are arranged. The bones can be long, short, flat or irregular in shape.



Human skeleton

The human skeletal system is divided in two categories.

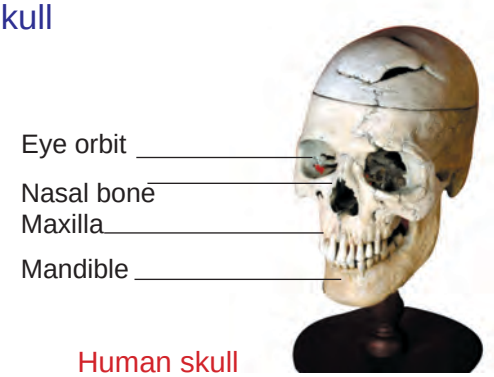
1. The axial skeleton

2. The appendicular skeleton.

Axial skeleton

It is the upright axis of the body. Axial skeleton consists of skull, hyoid bones, vertebral column and thoracic cage.

Skull



Human skull

Skull consists of 22 bones. Among the 22, 8 are head bones and remaining 14 are facial bones. Skull supports the organ of vision, hearing, smell and taste. The skull is divided into head bones and facial bones. The cranium is covered by eight bones. All are flat bones. They are joined with immovable joints. It protects the brain.

A large opening is found at the base of the skull. Through this opening the

medulla oblongata of the brain descends down as the spinal cord.

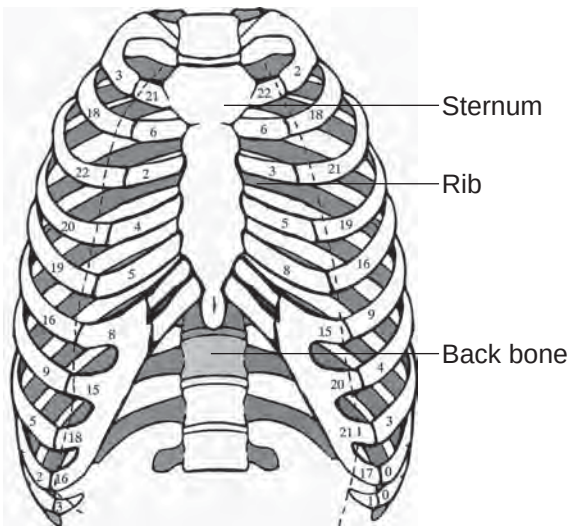
MORE TO KNOW

All animals can move their lower jaw (mandible).

Crocodile alone can move its upper jaw (maxilla).

Thoracic cavity

The thoracic cavity consists of three different types of bones. The front portion has single bone named sternum. The back portion has a long vertebral column. Both the bones are connected by ribs on the lateral side.



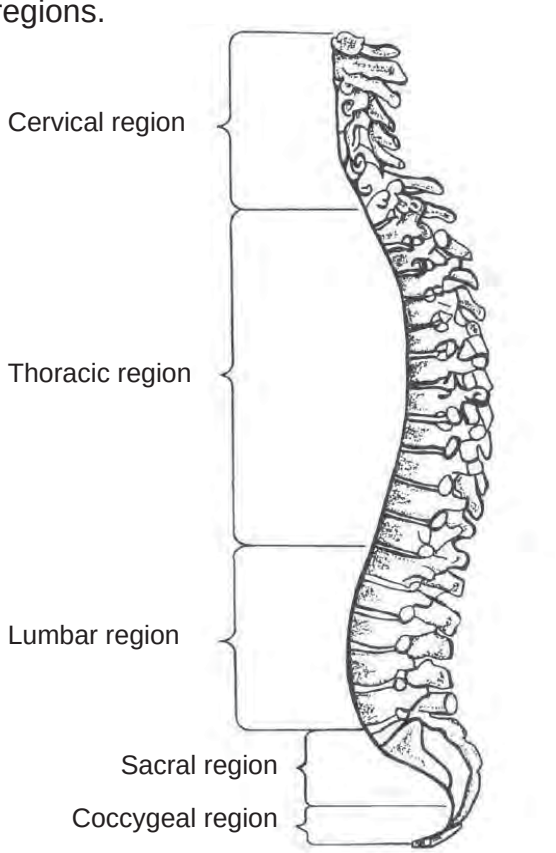
Thoracic cavity of a human

Rib Cage

There are 12 pairs of ribs. Each articulates with a thoracic vertebrae. In the front, the first ten pairs are attached with the sternum. The first seven are directly attached with sternum. They are called the true ribs. Cartilages of the 8th, 9th and 10th are fused and attached to the sternum indirectly. They are called false ribs. 11th and 12th pairs are not attached to the sternum. They are called floating ribs.

The vertebral column or vertebrae

The vertebrae make up slight “S” shaped vertebral column or back bone. Acutally back bone consists of 33 vertebrae. They are divided into 5 regions.



vertebral column of a human

They are

1. Cervical vertebrae-7
2. Thoracic vertebrae -12
3. Lumbar vertebrae -5
4. Sacral vertebrae -5
5. Coccygeal vertebrae -4

But,the sacral five bones are joined together to form one bone, and also coccygeal four bones join together to form another bone. So the total vertebrae in the back bone is only 26.

Appendicular skeleton

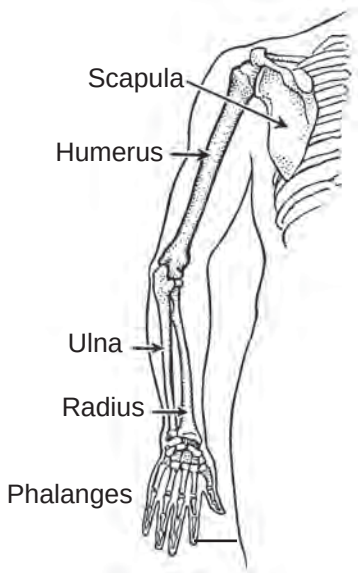
Appendicular skeleton consists of Pectoral girdle and the upper limb (hands)

Pelvic girdle and the lower limb (Legs).

Upper limb or hands

Hands are attached to the pectoral girdle. Each pectoral girdle has a pair of scapula or shoulder bones and a clavicle or collar bone.

Upper arm has a long bone named humerus. The distal end of the upper arm articulates with two forearm bones named ulna and radius. Wrist consists of eight carpels, arranged in two rows. The frame work of the hand is formed of five metacarpels. Each hand has five digits. They include one thumb and four fingers. Each digit has small long bones called phalanges. The thumb has two phalanges and each finger has three phalanges.

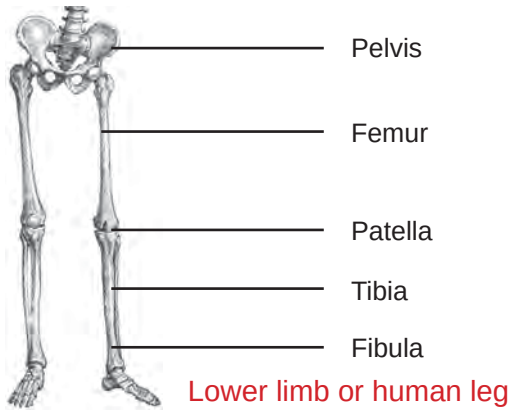


Upper limb or human hand

The pelvic girdle and leg

The pelvic girdle is a ring of bones in the hip region formed by sacrum and paired bones called coxae or hip bones.

Each coxa is formed by the fusion of three bones namely ilium, ischium and pubis. The thigh region contains the longest bone called femur. The distal end



Lower limb or human leg

of the femur has connection with lower limb tibia and fibula. The knee region has a large flat bone called the patella.

The ankle consists of seven tarsal bones. The ankle articulates with tibia and fibula through tarrus.

Foot is formed by metatarsals and phalanges. They correspond to the metacarpals and phalanges of the hand.

Functions of Bones

- Bones remain as region for the attachment of muscles.
- It also helps to hold weight of our body.
- They give safety to the inner organs.
- This system is useful for locomotion.
- The bones remain as a reservoir for calcium and fat.
- The bone marrow is the site for the production of red blood corpuscles.

Number of bones in human body

In human body, there are 206 bones of those 80 are in the axial skeleton, 126 are in the appendicular skeleton. Among the bones of the axial skeleton 28 bones are in the skull, 26 bones are in the vertebral column, 25 bones are in the thoracic cage and one remains as the hyoid bone.

MORE TO KNOW

Phylum mollusca is the animal group that do not have internal skeletal system.

3.3. DIGESTIVE SYSTEM

Digestion is process of conversion of complex compounds into simpler molecules that can be assimilated either by blood or by lymph.

Large compounds	Simple molecules
1. Carbohydrates	Glucose
2. Proteins	Amino acids
3. fat	Fatty acid and glycerol

Generally two major types of digestion are encountered

1. Intra cellular digestion
2. Extra cellular digestion

1. Intra cellular digestion

Amoeba like unicellular organisms digest its prey inside the food vacuole and expels the undigested food. This type of digestion is called intracellular digestion. **e.g. Amoeba.**

2. Extra cellular digestion

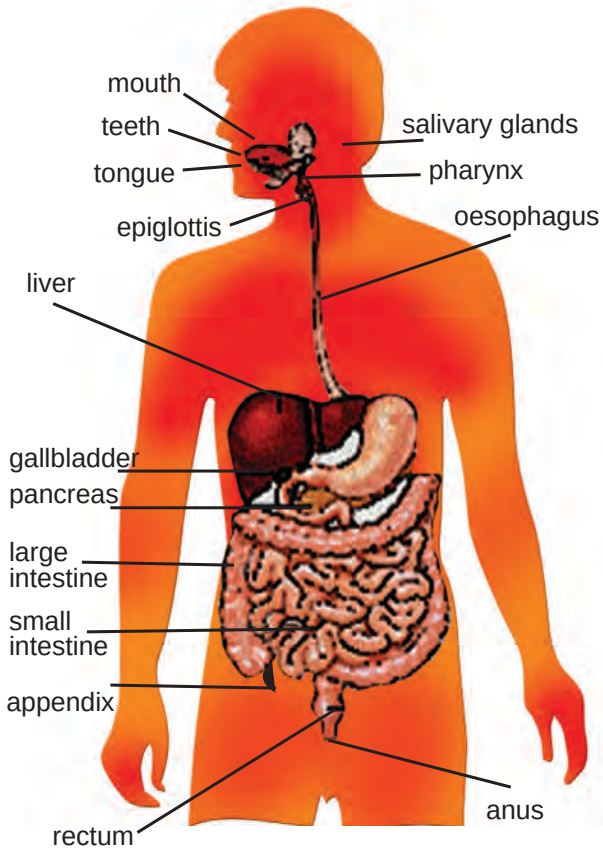
In multicellular organisms various glands secrete enzymes into the digestive cavity and digest the food extra cellularly. This kind of digestion outside the cell, but within the cavity is extracellular digestion. **e.g. Human.**

The alimentary canal

It is a coiled muscular tube extending from the mouth to the anus. It is about 6-9 meters long and consists of many specialized sections. Arranged sequentially, these are mouth, buccal cavity, pharynx, oesophagus, stomach, small intestine, Large intestine, rectum and anus. It also includes, some accessory digestive organs like salivary glands, pancreas and liver.

Mouth

It is an oval shaped cavity bounded in front by lips and laterally by the jaws. The roof of the cavity is lined by the palate. The floor contains a tongue. The upper



Organs of digestion

jaw and lower jaw are lined by the tooth. Mouth helps ingestion.

Teeth

In man, teeth are 32 in number. 4 incisors, 2 canines, 4 premolars and 6 molars in each jaw. The last set of molar teeth grow after the age of 20. Hence they are named as wisdom teeth.

Tongue

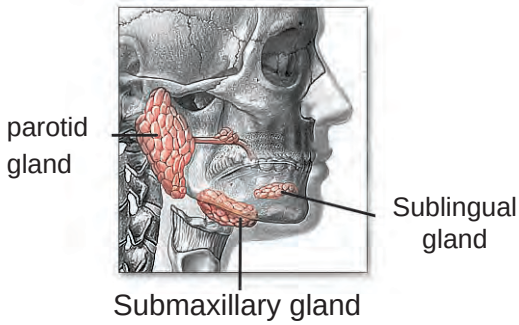
It is the organ for the sense of taste. It is attached to the floor of the mouth. Its

tip is thin and narrow. The upper surface of the tongue contains several papillae or sensory buds.

MORE TO KNOW

The hardest part of the human body is the tooth.

Salivary gland



3 pairs of salivary glands open into the mouth. They are parotid, sub-maxillary and sub-lingual.

- **Parotid glands -** It is the largest gland of the three pairs. It is found below the ear.
- **Submaxillary gland -** It is found below the jaw and irregular in shape.
- **Sublingual gland -** It is the smallest gland. It is found at the base of the tongue.

MORE TO KNOW

Parotid gland is the only salivary gland affected by mumps virus.

The three pairs of salivary glands secrete approximately 1.5 litres of saliva every day.

Salivary gland secretes saliva.

The saliva has the following

1. Ptyalin(Amylase) - enzyme
2. Bicarbonate - salt
3. Mucus - carbohydrate
4. Lysozyme - enzyme

MORE TO KNOW

If our mouth dries due to dehydration we could not develop speech.

Pharynx

Pharynx is found below the nose and mouth. It is about 11 cm in length. This region has 7 openings . They are 2 internal nostrils, 2 eustachian tubes, mouth, larynx and oesophagus.

Oesophagus

It is a musculo-membranous canal about 22 cm length. It extends from pharynx to the stomach. The inner lining has a mucus coat and it is lined by epithelium.

Stomach

Since Stomach is the main organ of digestion, it is the most dilated part of the alimentary canal. Stomach is a horizontal chamber containing 3 conspicuous regions. They are cardiac, fundus and pyloric. The stomach secretes gastric juice. The gastric juice contains the following:

1. Pepsin
2. Renin
3. Hydrochloric acid

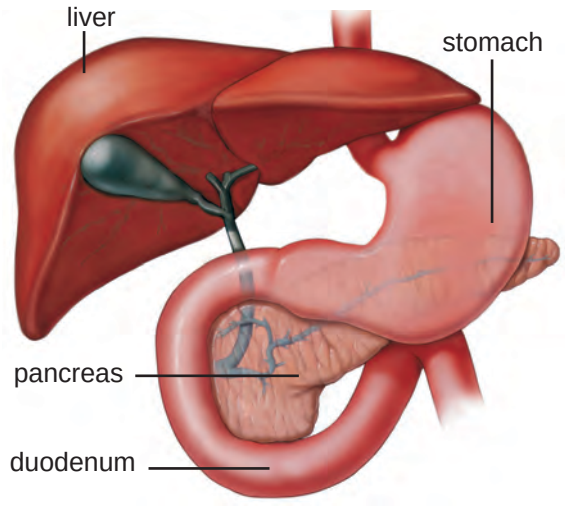
Hydrochloric acid is secreted by a special type cells in the gastric pit namely oxyntic cells.

Small intestine

The stomach opens into the small intestine through pylorus. The small intestine is divisible into 3 regions duodenum, jejunum and ileum.

Duodenum

Duodenum is around 22 cm in length. In this region where the liver and pancreas are connected to the alimentary canal.

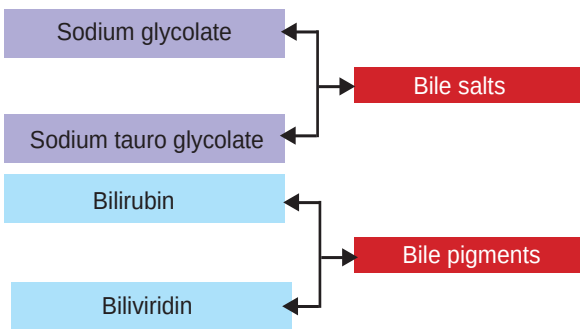


Anatomy of liver and pancreas

Liver

Liver is the largest glandular organ in human. It weighs about 1500 gms. It contains two unequal lobes. The right lobe is larger. Liver secretes bile juice which is greenish yellow in colour. The bile is temporarily stored in gall bladder. The gall bladder is attached to the bile duct. The duct opens into the duodenum. Bile juice helps the digestion of fat. It does not have any enzyme. It has bile salts and bile pigments.

Bile juice



MORE TO KNOW

Excess of eating fatty foods leads to the formation of bile stones in the gall bladder.

Pancreas

Pancreas is a long, leaf like transparent gland. It is 15 to 20 cms long. Pancreas secretes pancreatic juice and it is connected with duodenum through pancreatic duct. Pancreas acts as an exocrine gland and endocrine gland. The gland's upper surface bears the islets of langerhans. The pancreatic alpha cells secrete the hormone glucagon, and the pancreatic beta cells secrete the hormone insulin.

As an exocrine it secretes the following enzymes

1. **Trypsin,** 2. **Chymotrypsin,**
3. **Carboxy peptidase,** 4. **Amylase,**
5. **Lipase**

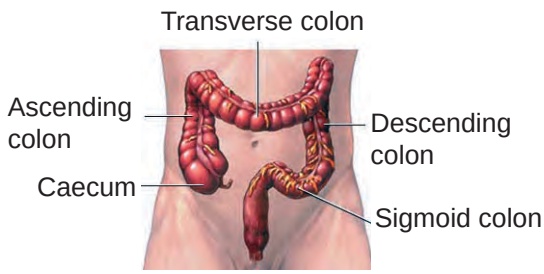
Jejunum

Jejunum constitutes 2/5th of the small intestine. It starts from the duodenum and ends with ileum. The secretion of small intestine is intestinal juice. The intestinal juice contains the enzymes:

1.**Sucrase,** 2. **Maltase,** 3. **Lactase,** 4. **Lipase**

Ileum

It is a coiled tube-like structure which constitutes 3/5th of the small intestine. It contains numerous minute finger-like projections called villi (1 mm) in length. They are approximately 4 million in number. Internally each villus contains fine blood capillaries and lacteal tubes. Food absorption takes place here.



Large Intestine

Large intestine

It extends from the ileum to the anus. It is about 1.5 metres in length. It is divided into caecum, colon, and rectum.

Caecum

Caecum is a large blind pouch and measures about 5 cm in length. The terminal part of the caecum is vermiform appendix.

CLAUDE BERNARD

The french scientist Claude Bernard (1813-78) was one of the first people to study physiology. He discovered that glucose, the main source of energy for the body, is stored in the liver as glycogen and released as and when it is needed. He also studied digestion ,how drugs change the way the body works and the nervous system.

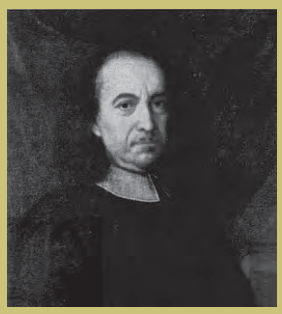
Functions of alimentary canal

1. Ingestion, 2. Digestion, 3. Absorption, 4. Assimilation, 5. Egestion

MORE TO KNOW

Dogs regulate body temperature by panting.

MARCELLO MALPIGHI (1628-1694)



Marcello Malpighi, was born in Italy in March 1628, studied Aristotelian philosophy and graduated as a medical doctor. Malpighi developed an intense interest in scientific research with a fond love for the teaching. He is considered as the founder of comparative psychology.

In 1669, Malpighi published the result of his work on the silkworm. He discovered that these insects had no lungs, but breathed through a row of holes located on the lateral side of their long bodies. Distribution of air within the insect occurs through a system of tubules that Malpighi termed as trachea. While observing dissected lung tissue, Malpighi discovered tiny, thin walled microtubules, which he named capillaries. He went on to hypothesize that the capillaries were the connection between arteries and veins that allowed blood to flow back to the heart, and these are the vital organs which do all the functions of the circulatory systems.

A number of anatomical structures still bear his name. Malpighian corpuscles in the circulatory and lymphatic systems, the Malpighian layer of epidermis (rete malphigi) and the, malpighian tube in insects. Excretion of nitrogenous waste such as uric acid and water removal from the faeces is carried out by Malpighian tubules.

3.4. EXCRETORY SYSTEM

Excretion: The process of elimination of metabolic wastes from our body.

There are three types of organisms on the basis of excretion of waste matter

1.Ammonotelism

Most teleost fish (bony fish), tadpole and acquatic insects excrete nitrogenous waste as ammonia.

2. Ureotelism

Urea excretion is called ureotelism. For example mammals and adult amphibians, marine fishes and turtles.

3.Uricotelism

Excretion of uric acid is called Uricotelism. For example Birds and reptiles.

Organs which are involved in excretion are called excretory organs.

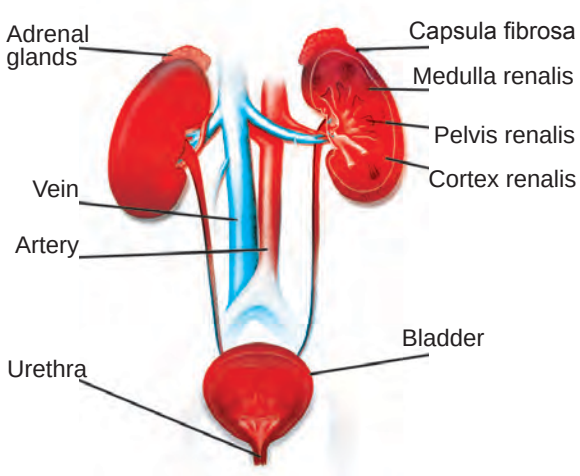
Animals and their excretory organs

1.	Amoeba	-	Contractile Vacuole
2.	Earthworm	-	Nephridia
3.	Tapeworm	-	Flame cells
4.	Insects	-	Malphigian tubules
5.	Mammals	-	Kidneys

Human excretory system consists of a pair of kidneys, a pair of ureters, a urinary bladder and urethra.

Kidneys

Kidney is a chief excretory organ. It is a pair of dark red, bean shaped organ placed behind the abdomen, on each side of the vertebral column. The average adult kidney measures about 12 cm in length, 6 cm in width, and 3 cm in thickness.



Urinary system

The outer surface of the kidney is convex and the inner surface is concave and it faces the vertebral column. The right kidney is just lower than that of the left kidney because the right side of the body is occupied by the the liver. Each kidney is surrounded by a fibrous membrane called capsule. Two ureters join the kidneys with urinary bladder. Urinary bladder is the temporary storage organ of urine. Urine is expelled through the urethra to the exterior.

Nephron

Kidneys are made up of millions of nephrons, which are the structural and functional unit of kidneys. Each kidney consists of about one million of nephrons.

Other excretory organs in human body

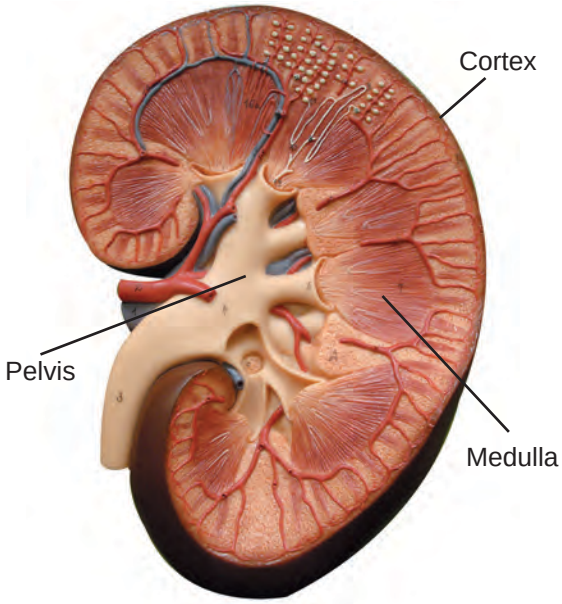
Lungs : Lungs excrete CO_2 and water from the blood.

Skin : Skin excretes sweat. The sweat consists of dissolved urea, uric acid and lactic acid.

Liver : Liver excretes bile pigments, formed during the breakdown of haemoglobin. It is incharge for the formation of urea through ornithine cycle.

Functions of kidney

1. It excretes nitrogenous wastes (urea) formed as a result of protein metabolism.
2. It helps to maintain the fluid and electrolyte balance of our body .
3. It helps to regulate acid-base balance of blood.
4. It helps to maintain osmotic pressure in blood and tissue.
5. It helps to retain important plasma constituents like glucose, amino acids, etc,.



Longitudinal section of Kidney

MORE TO KNOW

Kidney functions are the basis of blood pressure.

1. There are approximately 1 million nephrons in each kidney. At least 450,000 of them must remain functional to ensure survival.
2. Every minute kidneys receive 1/5th blood of the cardiac output that is approximately 1.250 liters every minute.

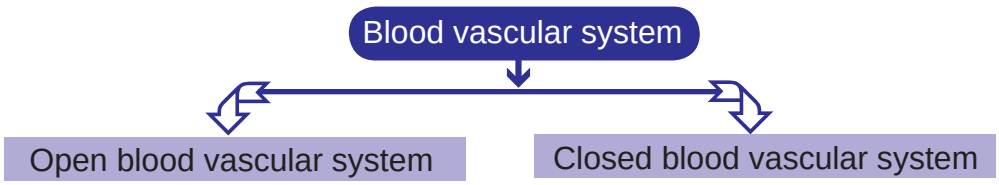
MORE TO KNOW

Among reptiles only the crocodiles have a four chambered heart.

3.5. CIRCULATORY SYSTEM (BLOOD VASCULAR SYSTEM)

Circulatory System Or Blood vascular system

Circulatory system is a special system which contains heart, blood vessels and blood. This system makes the blood to circulate around the body because of the contraction and expansion of heart.



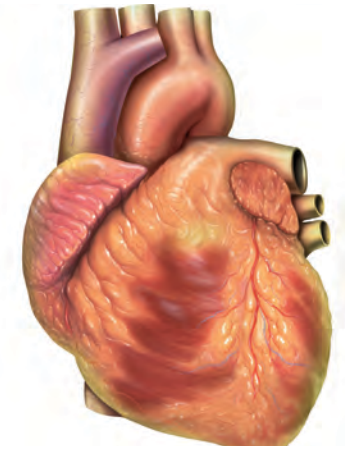
Open blood vascular system

In open type, the blood is pumped by the heart into the blood vessels that opens into blood spaces(cavities). There is no capillary system e.g. most arthropods. These cavities are called haemocoel. The pressure of the blood here is very low. e.g. cockroach

Closed blood vascular system

The blood is circulating through the blood vessels and it creates blood pressure inside the blood vessels e.g. human blood vascular system.

Heart



The heart is a hollow, muscular organ. It is somewhat conical in shape. The heart is covered with double walled membrane called pericardium. The space between the pericardial membrane is called pericardial space, which is filled with pericardial fluid. The pericardial fluid protects the heart from shock. The heart is placed inside the thoracic chamber in between the two lungs in the mediastinum.

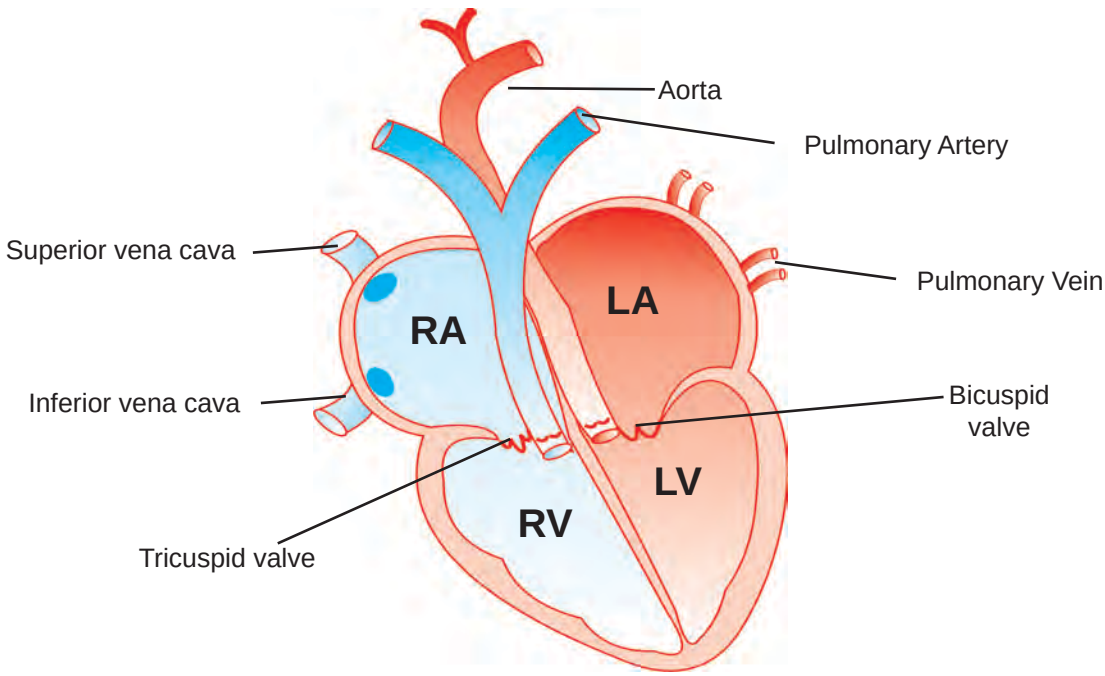
Animals and their hearts:			
1.	Earthworm	:	8 pairs of lateral hearts
2.	Cockroach	:	13 chambered heart
3.	Fish	:	2 Chambered heart
4.	Amphibians	:	3 chambered heart
5.	Reptiles	:	3 chambered heart, ventricle is partially separated.
6.	Birds	:	4 chambered heart
7.	Mammals	:	4 chambered heart

MORE TO KNOW

The total voulme of blood in blue whale is 12 tonnes. It can be pumped by its heart.

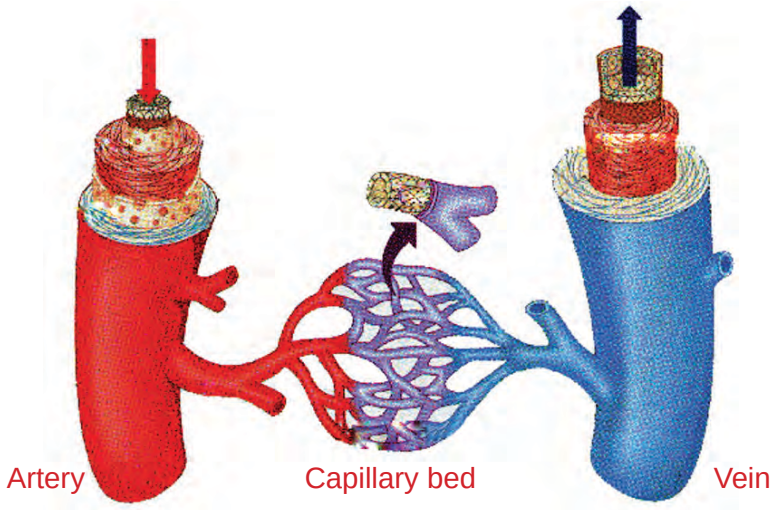
Internal structure of human heart

Human heart consists of four chambers. Two upper thin chambers are called atria (Singular-atrium) and two lower thick chambers are called ventricles. The right side of the heart is separated from the left side by a longitudinal wall named inter atrio ventricular septum.



Blood vessels connected with heart

Right Atrium receives	-	a) Superior venacava b) inferior venacava c) Coronary vein
Right Ventricle	-	Pulmonary artery (Deoxygenated blood)
Left Atrium receives	-	Pulmonary veins (Oxygenated blood)
Left Ventricle	-	Aorta



Valves in heart

1. **Tricuspid Valve:** Located in between right atrium and right ventricle.
2. **Bicuspid Valve(Mitral valve):** Lies in between left atrium and left ventricle.
3. **Semi lunar valves:** Present near the mouth of pulmonary artery and aorta.

Arteries

The blood vessels carrying blood away from the heart are the arteries. Generally, the arteries carry oxygenated blood except pulmonary artery.

Veins

Generally, the veins carry deoxygenated blood except pulmonary veins.

Capillaries

Capillaries are fine, small tubes found spreading in the midst of the cells. They perform all the functions of blood vascular system. It is considered as a vital tube of the blood vascular system.

Human blood

Human blood consists of two components.

1. Plasma
2. Blood corpuscles

MORE TO KNOW

72x60x24x365x80

This is the number of heart beat for a human living up to the age of 80.

Difference between artery and vein

No	Arteries	Veins
1	It carries blood from the heart to the organs.	It carries blood from the organs to the heart.
2	It carries oxygenated blood except pulmonary artery.	It carries deoxygenated blood except pulmonary veins.
3	The wall is thick and elastic.	The wall is thin and less elastic.
4	It is found deep inside the muscles.	It is found superficialy.
5	Valves are absent.	Valves are present.

1. Plasma

It is an extra cellular fluid of about 55 per cent of the blood volume. It is a faint yellow colour fluid, which is alkaline in nature.Plasma contains proteins, enzymes, hormones, wastes and elements.

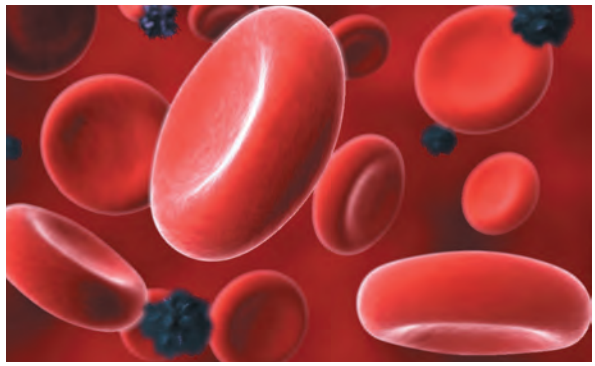
2. Blood corpuscles

Nearly 45 per cent volume of blood contains corpuscles. The blood corpuscles are of three types.

1. Erythrocytes or red blood corpuscles(RBC)
2. Leucocytes or white blood corpuscles(WBC)
3. Thrombocytes or blood platelets.

1. Erythrocytes

They are red, biconcave and disc shaped cells. The red colour of the RBC is due to the presence of respiratory pigment haemoglobin. Haemoglobin helps in transporting oxygen and carbon-di-oxide in our body. One cubic mm of blood contains 5 millions of RBC. The life span of RBC is 120 days. They are destroyed in the liver and spleen. RBC's are produced by red bone marrow.

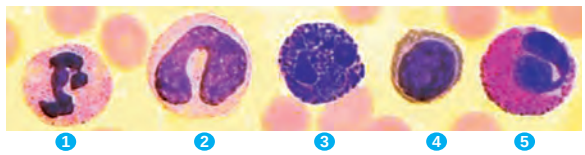


Red blood corpuscles (RBC)

2. Leucocytes

They are colourless, irregular and nucleated cells. The WBC's are fewer in number compared to RBC's and they are larger in size. One cubic mm of blood contains 8000 WBC's. There are 5 types of WBC which are monocytes, lymphocytes, neutrophils, eosinophils and basophils. The life span of WBC is 4 weeks.

They are prepared by yellow bone marrow and lymphatic tissue. WBC's attack the invading germs and protect our body.



1. Neutrophils, 2. Eosinophils, 3. Monocytes, 4. Basophils, 5. Lymphocytes

White blood corpuscles (WBC)

3. Thrombocytes (Blood Platelets)

These are small, non-nucleated and colourless structures floating in the plasma. In one cubic mm of blood there are 2,00,000 to 4,00,000 thrombocytes.

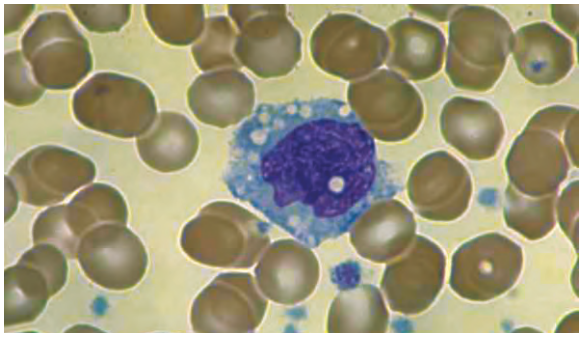
Whenever there is an injury, the thrombocytes disintegrate to give rise to thromboplastin, which helps in the clotting of blood.

Functions of blood

1. Blood distributes the digested food.
2. Blood carries the metabolic wastes to the excretory organs.
3. Blood carries hormones, which are the secretions of endocrine glands.
4. Blood distributes the heat evenly throughout the body.
5. Blood keeps all the tissues moist.

ACTIVITY –3.3

1. Observe the human blood smear under compound microscope and identify RBC and WBC.



Blood smear showing
Thrombocytes (Blood platelets)

3.6. RESPIRATORY SYSTEM

Respiration

The phenomenon of release of energy by oxidation of various organic molecules is known as respiration.

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy (2900 KJ)}$$

Glucose + oxygen ⟶ carbon dioxide + water.

Respiration is of two types on the basis of usage of oxygen.

1. Aerobic Respiration
2. Anaerobic Respiration

Aerobic Respiration

Respiration, with saturated amount of oxygen. This type of respiration is found in higher animals.

Anaerobic Respiration

Respiration, without oxygen. In this process little amount of energy is liberated. For example Bacteria.

Breathing

Breathing is entirely different from that of respiration. It is an initial step in respiration. Inhaling of atmospheric air and exhalling of carbon-di-oxide is called breathing.

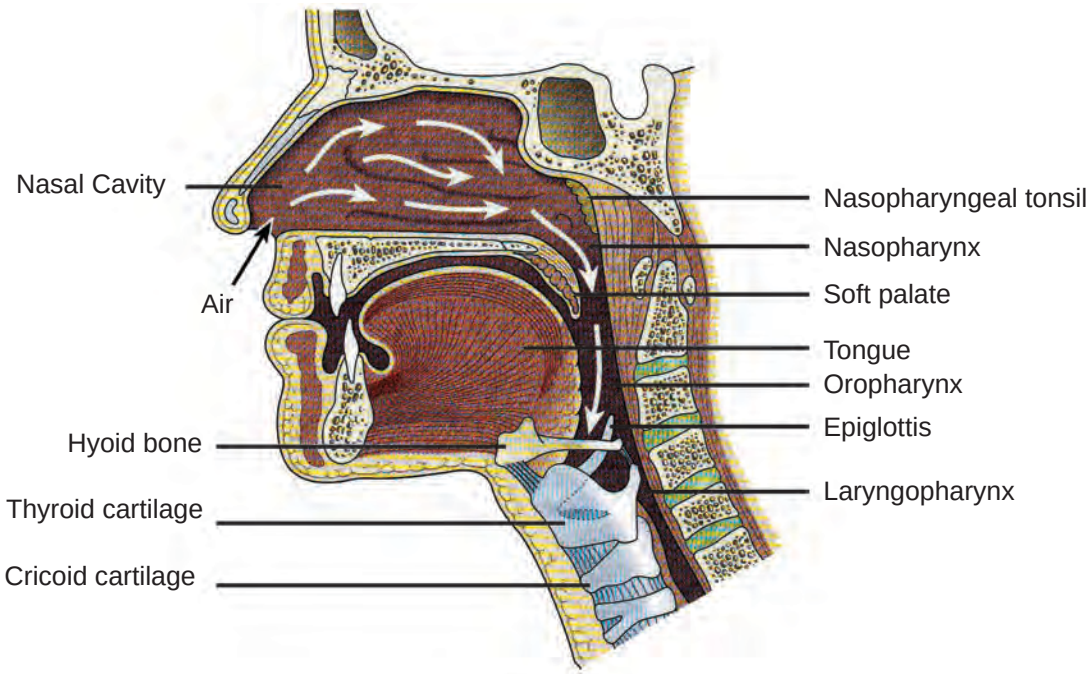
Breathing activity

Count, how many times do you breath every minute.(i) at rest (ii) after climbing a stair case. Compare your results with those of your friends. You will notice that the breathing rate goes up with exercise. When you exercise, your body needs more energy and therefore more oxygen.

Animals and their mode of Respiration

1. **Amoeba**	:	simple diffusion
2. **Cockroach**	:	through tracheoles
3. **Sea cucumber**	:	through respiratory trees (found near rectum)
4. **Fishes**	:	through gills
5. **Frog**	:	a) cutaneous respiration(skin) b) Pulmonary respiration (lungs) c) Buccalcavity respiration (buccal cavity)

3.6.1. HUMAN RESPIRATORY SYSTEM



The pathway of air from the nose to the larnyx

The respiratory organs include nasal cavity, pharynx, larynx, trachea, bronchi and lungs.

The nasal cavity follows the external nose. The nose is a visible prominent structure. The nasal passage opens outside through external nostrils. It opens inside the internal nostrils at pharynx.

The trachea (or wind pipe) is a membranous tube supported by 'C' shaped cartilage rings. The inner wall is lined by mucous membrane. It consists of ciliated columnar epithelium.

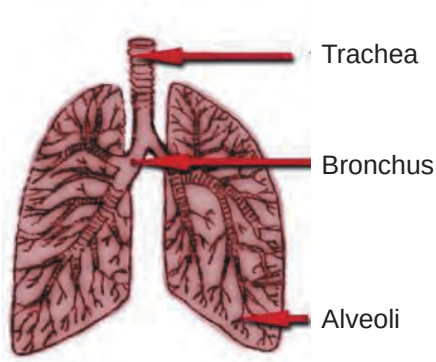
MORE TO KNOW

The cartilage ring found at the basal region is called carina. Foreign objects reaching carina stimulate a powerful cough.

Respiratory area

The total surface of the alveoli will be around 80-100 metre square and equals the size of the tennis court.

Lungs



Structure of Lungs

The pair of lungs are the actual organs of respiration. It is conical in shape and placed inside the thoracic chamber. The base of the lungs rests on the diaphragm. The right lung has three lobes and left lung has two lobes.

Each lung is surrounded by a double wall membrane called pleura. The region inside the pleural membrane is named as the pleural cavity. The cavity is filled with pleural fluid.

The primary bronchi on entering into each lung is divided further into secondary bronchi. The secondary bronchi in turn gives rise to tertiary bronchi. They divide still further and finally gives rise to bronchioles. The bronchioles divide several times to become still smaller terminal bronchioles. The terminal bronchioles end in small air filled chambers called alveoli. This is the place, where exchange of gases takes place. Exchange of gases is only by simple diffusion. Human lungs have about 300 million alveoli. Every minute lung contracts and expands between 12 to 15 times.

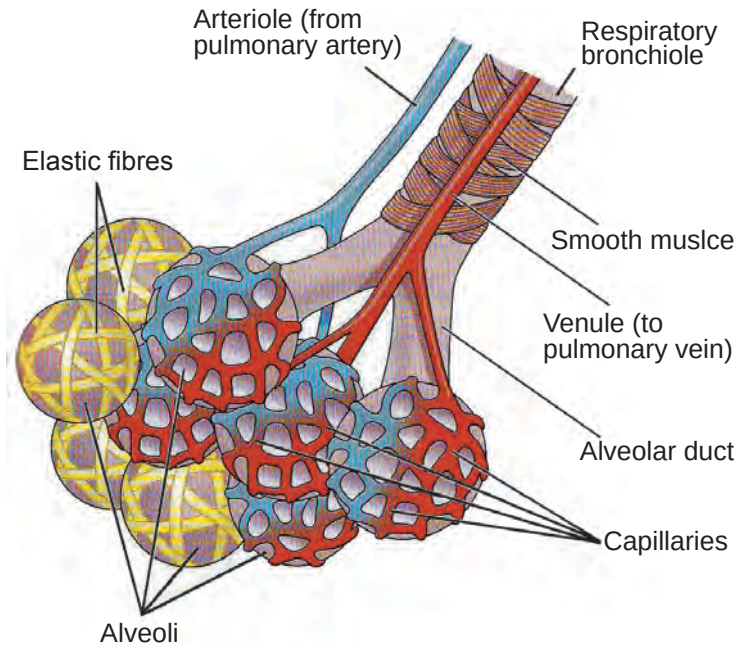
Functions of Lungs

1. The lungs separate CO_2 from the blood.
2. It can excrete water vapour.

MORE TO KNOW

People suffer due to smoke. Smoke contains large amount of CO, a toxic gas.

The respiratory pigment haemoglobin has affinity towards O_2, more affinity towards CO_2 and most affinity towards CO. That is why people entering into the burning place die due to suffocation.



Enlarged view of the alveolus and its capillary network

EVALUATION

Section – A

1. Study the relationship of the given pair and write the missing word or sentences

   a) Heart : Pericardium ; Lung : _____

   b) Mouth : Saliva ; Liver : _____

   c) Skin : Prevents the entrance of infectious agents WBC _____

2. Bile salts : _____: _____

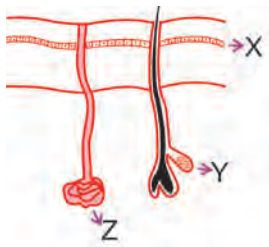
   Bile Pigments : _____ : _____

3. Renin, Lactase, Lipase : Enzymes

   Glucagon, Insulin : ----------

Section – B

4. Observe the given diagram of skin.



   a) What are X, Y and Z ?

   b) Write the importance of X.

   c) Name the secretions of Y and Z.

   d) Write the importance of the secretions.

5.Match the Column A with B.

A. Animals	B. Locomotory organs
1. Amoeba	a) Flagella
2. Paramoecium	b) Pseudopodia
3. Euglena	c) Tube feet
4. Earthworm	d) Cilia
5. Starfish	e) Body setae.

6. Assertion : A) Skin colour of human is determined by the presence of melonocytes present in the skin.

   Reason : B) The skin colour of human cannot be changed by cosmetics.

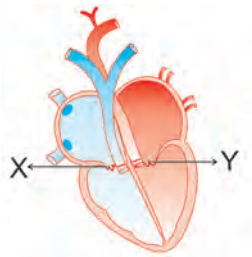
   a) A is right B is wrong. b) A is wrong, B is right.

   c) B explains A d) B does not explain A.

7. Which one is not correctly matched?

Organs	Enzymes
1. Salivary glands	Ptyalin
2. Stomach	Pepsin
3. Pancreas	Sucrase
4. Jejunum	Maltase

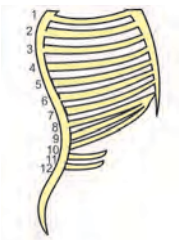
8. It is an illustration of human heart.



1) What is X and Y ?
2) Where are they?
3) Write their functions.

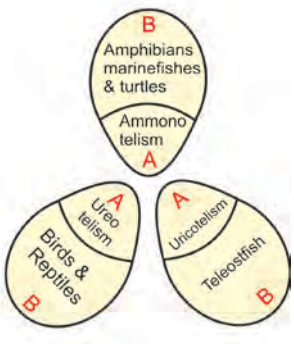
Section – C

9. Diagram of human chest is given. Copy the diagram and mark parts.



a) 1 to 7 ribs are called ----------. Why?
b) 8 to 10 ribs are named ----------. Reason.
c) Write the significance of 11 and 12 ribs.
d) Name to organs in the thoracic chamber.

10. Complete the sehematic representation of animals and their mode of excretion.



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Websites

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http://www.khanacademy.org

Chapter 4

STRUCTURE AND PHYSIOLOGICAL FUNCTIONS OF PLANTS

4.1. PLANT CELLS

Cells are the structural and functional units of all living organisms. They form the building blocks of organisms. Cells of living organisms could be observed only after the discovery of microscope. The study about the structure and function of the cell is called Cytology or Cell biology.

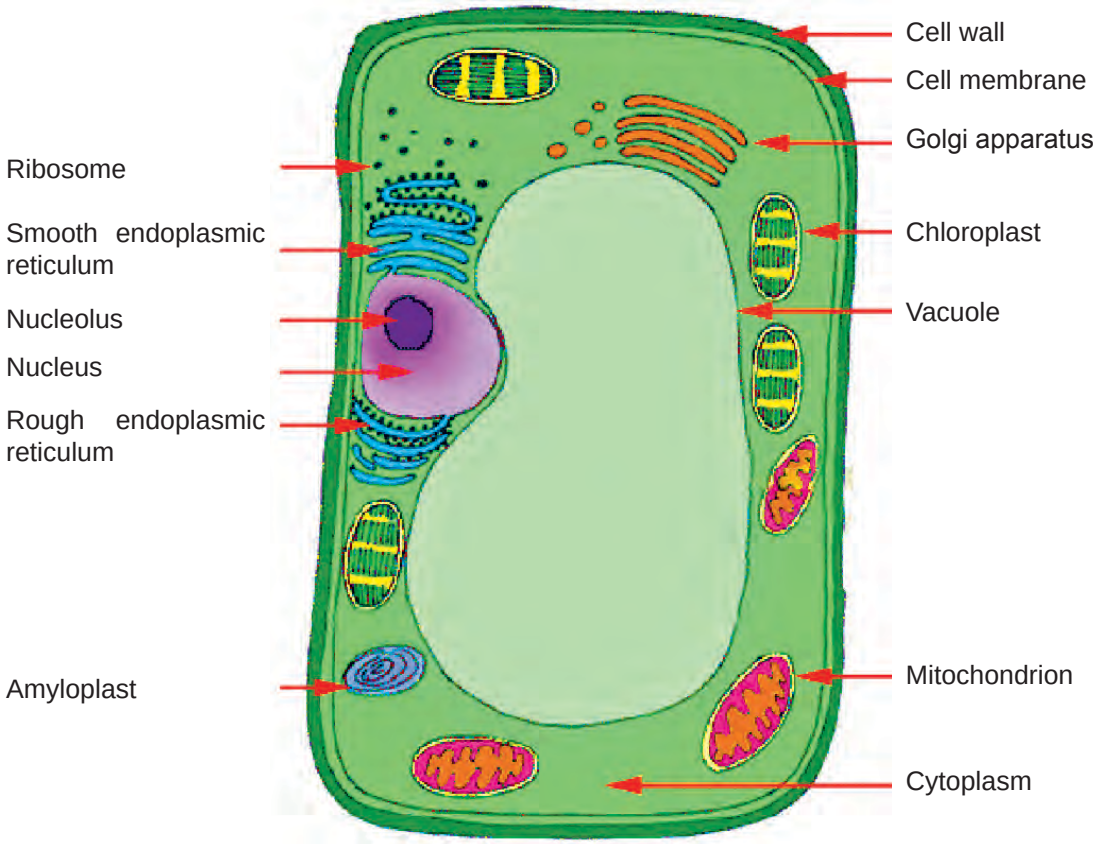
All living organisms are made up of one or more cells. Organisms which are made up of only one cell are called unicellular organisms. e.g. Chlamydomonas. Organisms which are made up of many cells are called multicellular organisms. **e.g.** Most plants and animals.

ACTIVITY –4.1

Cut a small piece of onion and separate a peel. Place the peel on a glass slide in a drop of water. Put a drop of methylene blue on the peel. Wash it in water to remove the excess stain. Put a drop of glycerine and cover it with a coverslip. Observe it under the microscope.

The boundary of the onion peel is the cell membrane covered by another thick covering called cell wall. The central dense round body in the centre is called nucleus. The substance between the nucleus and cell membrane is called cytoplasm.

Structure of a Plant Cell



Ultra structure of a plant cell (an eukaryotic cell)

The plant cell may be spherical or rectangular or hexagonal in shape. It consists of a cell wall and protoplast. Cell wall is absent in animal cells. Protoplast denotes the whole of protoplasm present in a cell. It is differentiated into plasma membrane, nucleus, cytoplasm and vacuoles. Various cell organelles like endoplasmic reticulum, mitochondria, chloroplast, golgi bodies, ribosomes, etc are embedded in the cytoplasm.

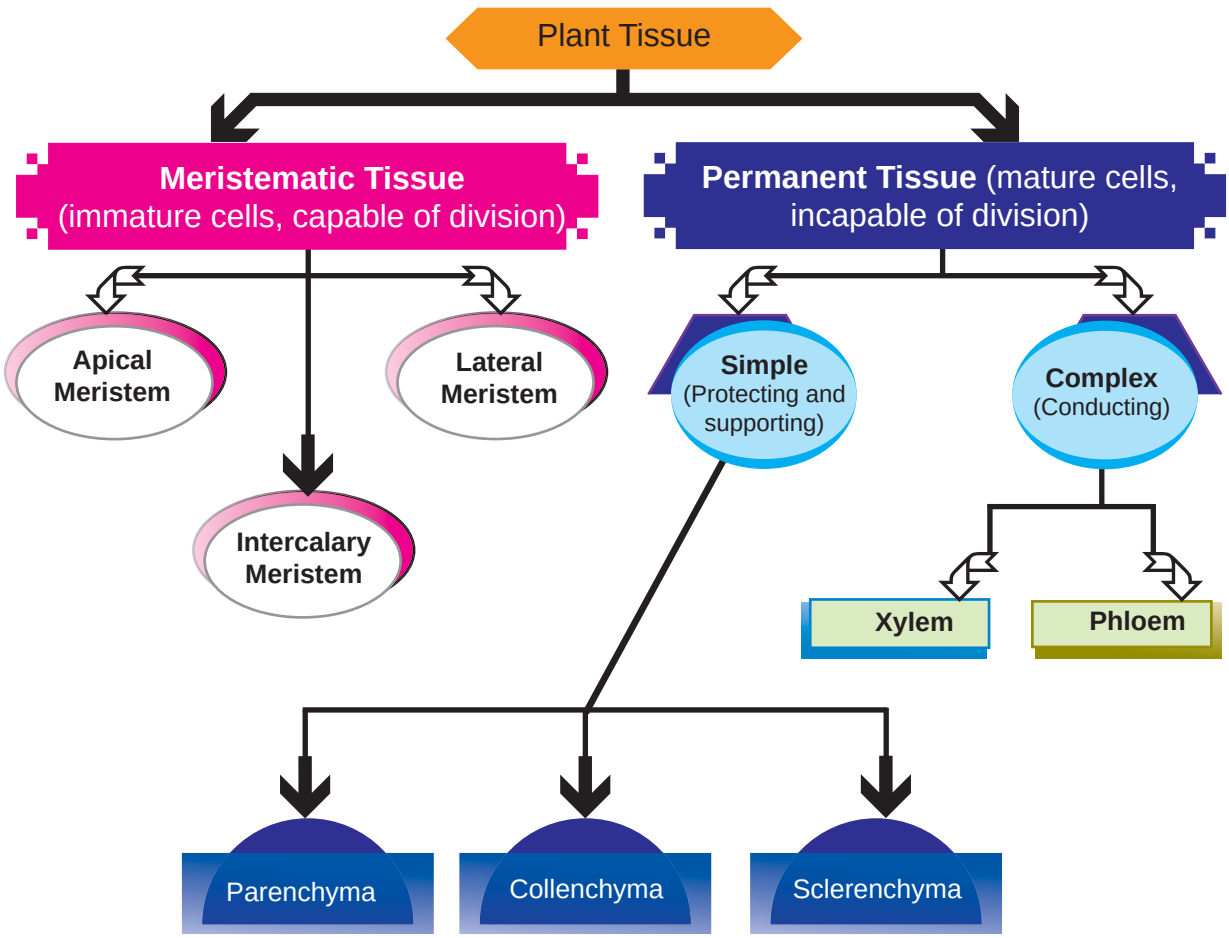
4.2. PLANT TISSUES

The body of plants and animals is made up of different types of cells. These cells originate from a single cell by repeated divisions and get differentiated during development.

In unicellular organisms all the body functions are performed by a single cell. But in multicellular organisms, different functions are performed by different groups of cells.

The groups of cells having a common origin and performing similar functions are called tissues. Several tissues are organized to form tissue system and the tissue systems form the organs and several organs into organism.

CLASSIFICATION OF TISSUES



4.3. PLANT FUNCTIONS

Plants germinate from seeds, grow, develop, mature, reproduce and die. Plant physiology deals with how plants function.

Water is essential for all physiological activities of plants. It is an universal solvent. It plays a vital role in photosynthesis, respiration, transpiration, transportation from root to leaf, etc. Presence of water in the soil is essential for the normal functioning of plants. Soil water contain minerals in dissolved state.

Plants absorb water and minerals from the soil with the help of root hairs. This process is called absorption.

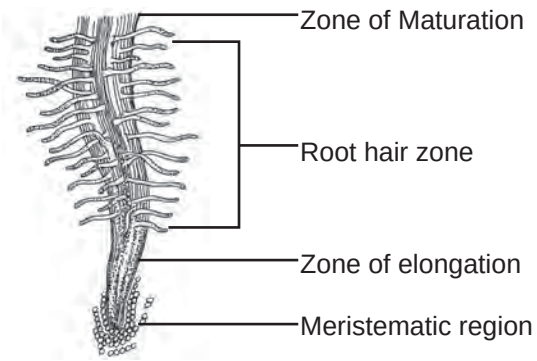
Absorption in plants is done by three forces namely

(i) **Imbibition,** (ii) **Diffusion** and (iii) **Osmosis**

(i)Imbibition:

Imbibition is the uptake of water or other solvents by substances that do not dissolve in water resulting in swelling of these substances. Such substances are called imbibants. **e.g.** wood, seeds, etc.

In plant cells, the cell wall is the imbibant. It absorbs water and forms a channel for movement of water into the cell by diffusion and osmosis.



Regions of the root

Imbibition plays a very important role in seed germination which involves absorption of water by seed coats, their swelling and rupture causing the emergence of the radicle and plumule.

ACTIVITY –4.2

Place a lighted incense stick at one corner of the room. The sweet fragrance of the incense stick spreads all over the room. Here the fragrance moves out from a region of higher concentration to a region of lower concentration till it becomes uniform.

(ii) Diffusion

Dissolved molecules move from a region of higher concentration to the region of lower concentration until the molecules are evenly distributed throughout the available space.

Gases such as Oxygen, Carbon dioxide and nutrients like minerals move into or between the cells by diffusion.

(iii) Osmosis

The movement of a solvent (water molecule) from a region of its higher concentration to the region of its lower concentration through a semipermeable membrane is called Osmosis.

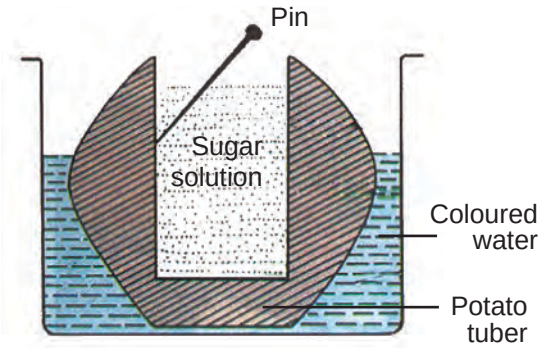
Demonstration of Osmosis

A potato is taken and peeled. Its base is cut to make it flat. A hollow cavity is made in the centre of the tuber and filled with sugar solution. The initial level of solution is marked with the help of a pin. It is placed in a beaker containing coloured water.

After sometime, it is observed that the sugar solution in the cavity of the potato becomes coloured and level rises. How has this taken place? This is due to the entry of water from the beaker into the cavity of potato through the living cells of potato. Here the living cells of potato act as a semipermeable membrane.

Active absorption and Passive absorption

Two mechanisms are involved in



Potato Osmoscope Experiment

helping soil water to enter into the root hairs. They are (i) **Passive Absorption** (ii) **Active Absorption.**

ACTIVITY –4.3

1. Take a few fresh grapes and keep in a dish containing concentrated sugar solution.
2. Take a few raisins (dried grapes). Soak them in water. Observe the changes in both the cases.

Passive Absorption

The absorption of mineral ions without the use of metabolic energy is called passive absorption.

Active Absorption

The uptake of mineral ions by using metabolic energy is called active absorption.

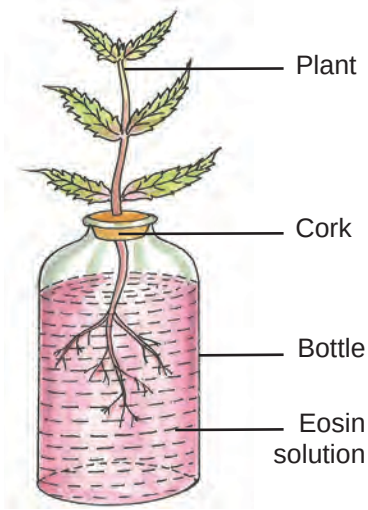
Ascent of Sap

The water, along with mineral salts, is absorbed by the root through its root hairs. The absorbed water reaches the xylem vessels and finally reaches the leaves. This movement of water and mineral salts is known as Ascent of Sap.

Demonstration of Ascent of Sap

Take an entire balsam plant without damaging the roots. Wash the roots to remove the soil particles. Insert the roots into a bottle containing dilute eosin solution or red ink solution. Leave the setup aside for sometime.

After sometime, red streaks can be observed on the stem and veins of leaves. If a section of the stem is mounted on a microscope and observed, it shows that only xylem vessels are coloured showing that ascent of sap takes place only through the xylem vessels.



Ascent of Sap Experiment

The leaf is a flattened, lateral out growth of the stem. The functions of the leaf are

a) **Photosynthesis** - *Synthesizing Carbohydrate using light energy, CO_2 and water.*

b) **Respiration** - *Taking in oxygen and giving off CO_2.*

c) **Transpiration** - *Giving out excess water as water vapour.*

d) **Food Storage** - *Leaves also serve as organs of food storage in some plants.*

e) **Vegetative reproduction** - *Buds that can develop into new plants.*

4.31. PHOTOSYNTHESIS

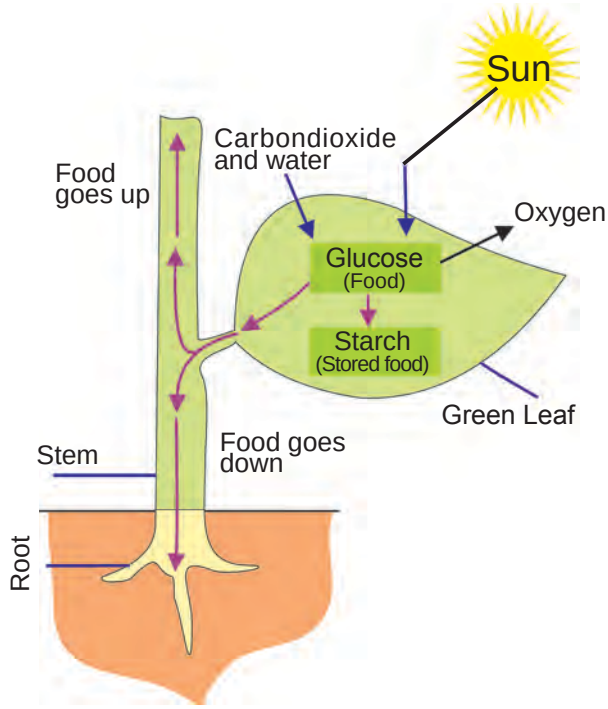
Green plants are autotrophic and synthesize their own food by the process of photosynthesis. 'Photo' means 'light' and 'synthesis' means 'to build' thus 'photosynthesis' means 'building up by light'.

How do green plants prepare food?

The process of photosynthesis takes place in the green leaves of a plant. The green leaves prepare the food by combining carbon dioxide and water in the presence of sunlight and Chlorophyll.

Carbon dioxide from the atmosphere enters the leaves through tiny pores called stomata. Water is taken from the soil. This water is transported to the leaves through roots and stem. The green pigment called Chlorophyll present in green leaves absorb light energy. The sunlight provides energy required to carryout the chemical reactions involved in the preparation of food.

The process by which green plants synthesize carbohydrate from Carbon dioxide and water by using energy from sunlight in the presence of Chlorophyll is called Photosynthesis. Oxygen is released during photosynthesis.



A schematic representation of Photosynthesis

The overall equation of photosynthesis is,

$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 \text{ (glucose)} + 6O_2$$

Materials required for Photosynthesis

1) **Light energy**
2) **Chlorophyll**
3) **Carbon dioxide** and
4) **Water**

Site of Photosynthesis

Leaves which contain chloroplasts are the main photosynthetic organelles of the plant. Chloroplasts have chlorophyll pigments which are necessary for the synthesis of food.

Mechanism of Photosynthesis

The process of photosynthesis occurs in two phases. :

(i) **Light reaction** (ii) **Dark reaction.**

Light Reaction

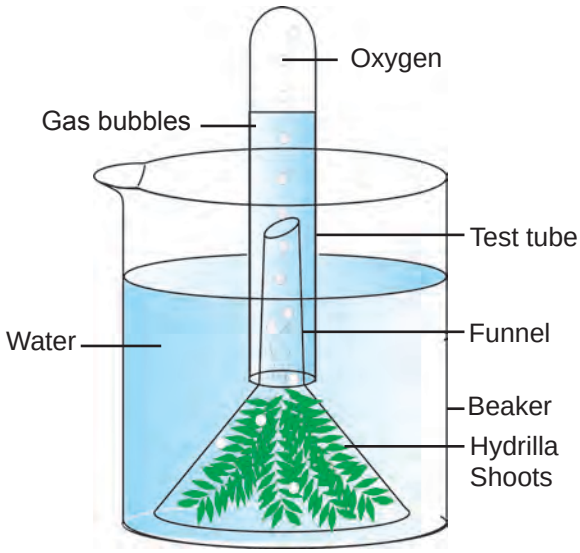
The reaction involving pigments, solar energy and water that produces ATP (Adenosine Tri Phosphate) and $NADPH_2$ (Nicotinamide Adenine Dinucleotide Phosphate- reduced form) is called light reaction.

Dark Reaction

The reaction in which CO_2 is reduced

to carbohydrate by making use of ATP and $NADPH_2$ generated by light reaction is called Dark reaction. Light is not required for this reaction. So it is called dark reaction.

Experiment to show that oxygen is evolved during photosynthesis. (Test tube and funnel experiment).



Test tube and funnel experiment

Place a few cut branches of Hydrilla in a beaker of water and invert a glass funnel over the cut branches in such a way, that the cut end faces the stem of the funnel. The stem of the funnel should be below the level of water. A test tube is filled with water and it is inverted over the stem of the funnel. A pinch of Sodium bicarbonate is added to the water as a source of Carbon dioxide.

ACTIVITY – 4.4

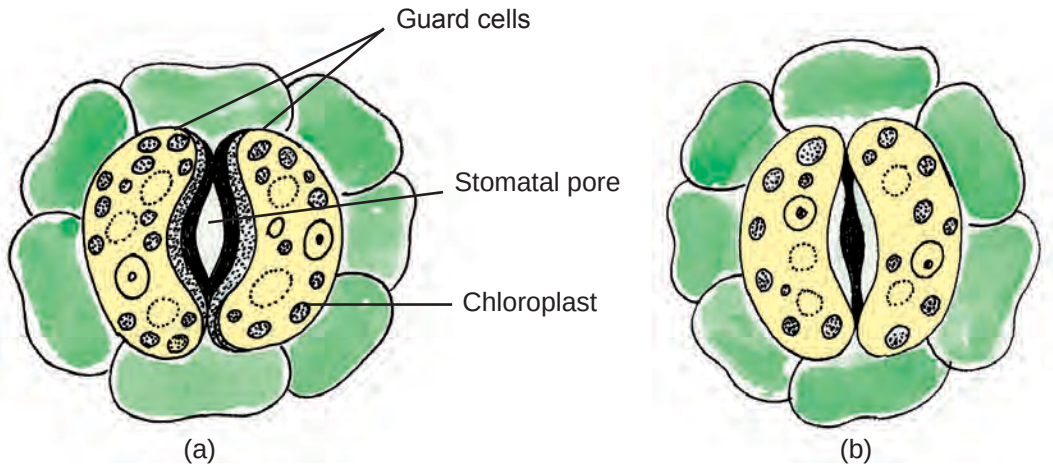
Pluck a leaf from a plant. Dip it in boiling water for 5 minutes. Then dip it in 90% alcohol to decolourize it. Wash in water and add few drops of Iodine solution. Observe the change if any. Why does the colour change?

Now the apparatus is kept in sunlight for 4 to 6 hours. The gas bubbles may be observed from the cut ends of hydrilla branches kept with in the funnel. These gas bubbles are collected in the test tube by downward displacement of water. The gas is tested for oxygen. When a burnt splinter is taken near the mouth of the tube, it glows brightly and this proves that the gas is oxygen. This experiment proves that oxygen is evolved during photosynthesis.

Factors affecting Photosynthesis

Photosynthesis is influenced by various factors. They are light, temperature, CO_2, Chlorophyll distribution, Water, Mineral salts and age of the leaf.

4.3.2. TRANSPIRATION



(a) Open and (b) closed stomatal pore

Plant absorbs a large quantity of water from the soil by the root hairs. They use only a fraction of this absorbed water. A large amount of water is lost by plants in the form of water vapour. The loss of water through the aerial parts of the plant such as leaves and green shoot is known as Transpiration.

Types of Transpiration

There are three types of transpiration

i) **Stomatal transpiration.**

ii) **Cuticular transpiration**

iii) **Lenticular transpiration**

ACTIVITY – 4.5

Apply some nail polish (very light pink) on the lower surface of the leaves of a potted plant. After a few minutes, gently peel of the nail polish. Now place one such nail polish peeling on a drop of water placed on a slide. Fix a cover slip and observe this peeling under a microscope.

Through the microscope you can see the impression of the cells and the stomatal openings on the lower surface of a leaf.

Stomatal transpiration

Stomata are tiny pores in the epidermis of leaves and other aerial parts of the plant like stem. They are surrounded by two kidney shaped cells called guard cells. Each guard cell has an elastic outer thin wall and a thick inner wall. When the guard cells are turgid (full of water), the outer walls are stretched and the stomata remains open. This happens during day time. At night, the guard cells become flaccid by losing water to the surrounding cells. The inner walls come closer. This reduces the stomatal opening. The transpiration of water through stomata is called stomatal transpiration. A large quantity of water is lost through the stomata during transpiration.

ACTIVITY – 4.6

Take some Coriander leaves and keep them in a polythene bag for few hours. Observe what happens.

Cuticular transpiration

Cuticle is the waxy layer lying over the epidermis of the leaf. Only a small amount of transpiration occurs through the cuticle. This is known as cuticular transpiration.

Lenticular transpiration

Lenticels are minute pores found on the barks of woody plants. A small amount of transpiration occurs through lenticels also. This is known as lenticular transpiration.

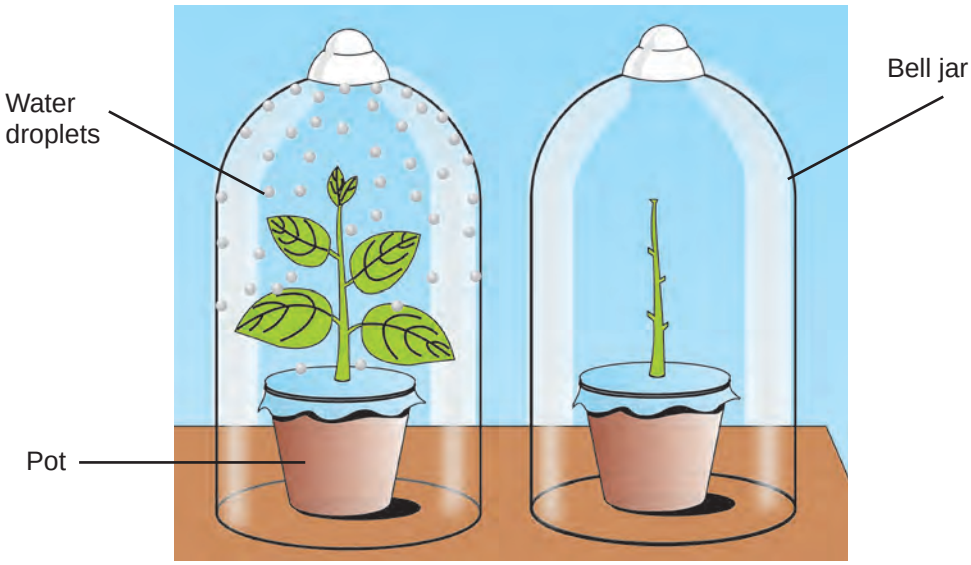
Experiment to show that transpiration takes place through the leaves (Bell Jar Experiment)

Take two identical potted plants with broad leaves. Cover the surface of the pot with rubber sheet so that the soil is not exposed. In one plant, remove all the leaves and apply vaseline to the cut ends of the leaves. Cover both the potted plants separately with two dry bell jars. Leave this set up for few hours. Observe what happens?

Droplets of water are seen on the inner surface of the bell jar which covered the plant with leaves, where as no water droplet is seen in the other bell jar. The presence of water droplets proves that transpiration takes place only through leaves.

Factors affecting transpiration

Light, temperature, wind, quantity of water in the soil, number of stomata and surface area of the leaf are the factors that affect transpiration.



Bell Jar Experiment

4.3.3. RESPIRATION

All living organisms perform various functions. For this, energy is required.

The process of breathing is very much related to the process of release of energy from food. All the energy required for life processes is obtained by the oxidation of food.

Mitochondria are the seats of biological oxidations which furnish energy for the various activities of the cell. The process by which food (Carbohydrate) is broken down and the energy is released for use in other activities is called oxidation. It is commonly referred to as biological oxidation or respiration.

Respiration is defined as a biochemical process consisting of oxidation and degradation of food with the release of energy.

The energy released during respiration is stored in the form of ATP (Adenosine Tri Phosphate) molecules in the cells and are used by the organism as and when required.

ATP has a high energy content. So ATP is known as the energy currency of the cell.

Types of respiration

Oxidation of food can occur in the presence of oxygen as well as in the absence of oxygen. Based on this, there are two types of respiration.

i) **Aerobic respiration**
ii) **Anaerobic respiration**

Aerobic respiration (Aerobic – with air)

This type of respiration occurs normally in all plants. In this type of respiration glucose is completely oxidized in the presence of oxygen, releasing CO_2, water and energy.

$$C_6H_{12}O_6\,(glucose) + 6O_2 \longrightarrow 6CO_2 + 6\,H_2O + 2900\ KJ\ energy$$

Aerobic oxidation of glucose occurs in 4 steps

1) **Glycolysis** 2) **Oxidation of Pyruvic acid** 3) **Kreb's Cycle**

4) **Electron transport chain**

Anaerobic Respiration (Anaerobic - without air)

Organisms like Bacteria and Yeast undergo respiration in the absence of oxygen. It is called anaerobic respiration. In this type, oxidation of food material is incomplete.

$$C_6H_{12}O_6(glucose) \xrightarrow[Zymase\ (enzyme)]{Yeast} 2C_2H_5OH + 2\,CO_2 + 50\ KJ\ energy$$

Glycolysis is common for both aerobic and anaerobic organisms.

Factors affecting respiration:

Oxygen, Temperature, Water, Light, CO_2, and Glucose are some of the factors that affect respiration.

4.3.4. TRANSPORTATION

What is meant by transport?

"Transport" means 'to carry things from one place to another'.

In biology, transport is a life process by which a substance absorbed or made in one part of the body of an organism is carried to the other parts of the body. Special tissues and organs are needed for the transport of substances in plants and animals.

TRANSPORT IN PLANTS

Due to the branching shape of a plant, all the cells of a plant can get oxygen for respiration and carbon dioxide for photosynthesis directly from the air by diffusion.

So, the substances which are to be supplied to a plant through a transport system are water and minerals. Another work of the transport system of plants is to transport food prepared in the leaves to the various parts of the plants like stem, roots etc.

The plants have two transport systems

1. **Xylem** 2. **Phloem**

The transport of materials in a plant can be divided into two parts.

i) Transport of water and minerals in the plant.

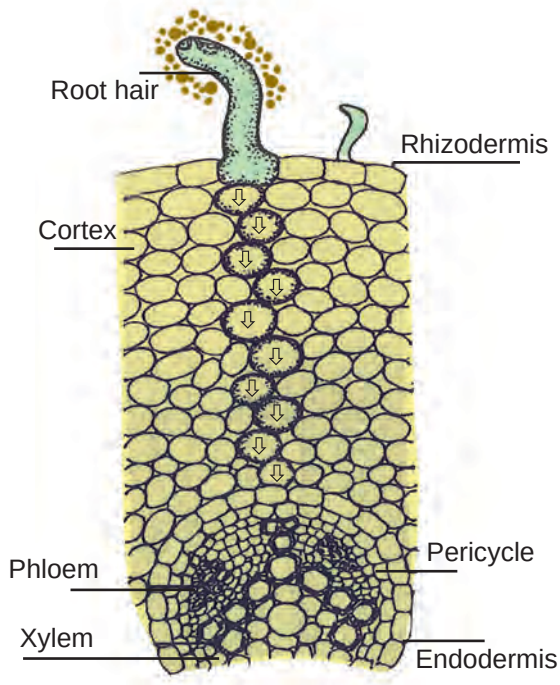
ii) Transport of food and other substances like hormones in the plant.

Transport of Water and minerals

Water and minerals are absorbed from the soil by the roots of the plant and transported to the various parts of the plant like stem, leaves and flowers. The

MORE TO KNOW

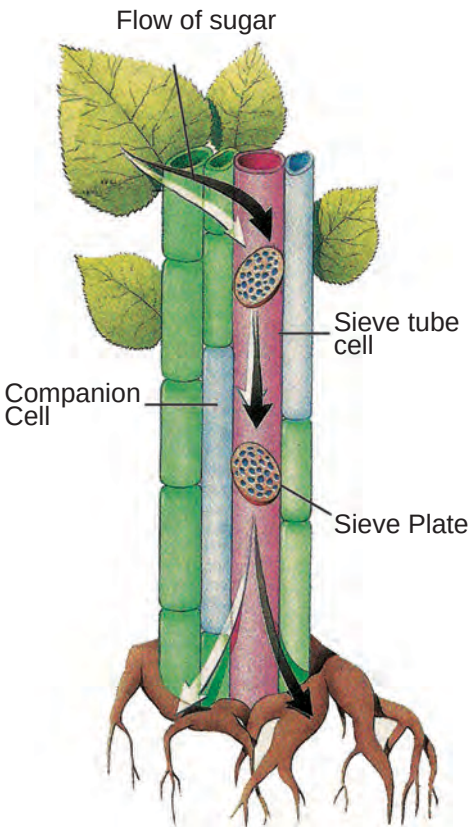
The world's tallest tree in the giant Sequoia, water has to travel to an incredible 84m (275 ft) before it reaches the highest leaves at the top of the tree.



Path of Water across the root

water and minerals dissolved in it move from the roots to the other parts through the two kinds of xylem cells called xylem vessels and tracheids.

In Pteridophytes and Gymnosperms, tracheids are the only water conducting tissue. In Angiosperms either only xylem vessels transport water or both xylem vessels and tracheids transport water.



Food Transportation

Transport of Food and other substances

The transport of food from leaves to the other parts of the plant is called translocation. The movement of food materials through phloem depends on the action of living cells called sieve tubes.

The food is made in the mesophyll cells of a leaf. The food made by the mesophyll cells of a leaf enters into the sieve tubes of the phloem. Once the food enters the sieve tubes in the leaves, it is transported to all other parts of the plant body by the network of sieve tubes present in all parts of the plant like stem and roots.

The movement of water and dissolved salts in xylem is always upwards and it is caused by the suction of water at the top because of low pressure created by transpiration from leaves.

The movement of food in phloem can be, upwards or downwards or lateral depending upon the needs of the plant.

4.4. PLANT NUTRITION

Autotrophs

All living organisms require a continuous supply of carbon containing compounds for growth and for building up their body structures. Energy is also required to maintain their daily activities. It is derived by oxidizing either organic or inorganic compounds. Intake of nutrients into the body by an organism is called nutrition. All the nutrients required by organisms are obtained through the food they consume.

Organisms differ in their modes of nutrition. There are mainly two modes of nutrition.

1) **Autotrophic nutrition.**
2) **Heterotrophic nutrition**

Autotrophic nutrition

In autotrophic nutrition, the organism synthesizes its own food. Organisms which are able to synthesize their own food materials are called autotrophs. They convert carbon dioxide and water into various organic compounds with the help of energy. Depending on how the plants obtain energy for converting carbon dioxide to organic compounds, they are classified as

1) **Photo autotrophs**
2) **Chemo autotrophs**

Photo autotrophs

Organisms which use energy from sunlight for the synthesis of food are called photo autotrophs. e.g. Green sulphur bacteria, purple sulphur bacteria and all green plants.

Chemo autotrophs

Organisms which use chemical energy

ACTIVITY – 4.7

Take a piece of bread, moisten the bread with water and keep it in a closed box for a few days.

What do you see?

for the synthesis of carbon compounds are called chemo autotrophs. They get energy by oxidizing simple inorganic compounds such as hydrogen, sulphur containing compounds, hydrogen sulphide, ammonia, etc. eg. Nitrosomonas

Heterotrophic nutrition

Some organisms cannot synthesize their own food. They depend on other organisms for their food directly or indirectly. Organisms which are not able to synthesize their own food are called heterotrophs.

Heterotrophic nutrition is of two types

i) **Saprophytic nutrition**

ii) **Parasitic nutrition**

Saprophytic Nutrition

Plants which obtain nutrition from dead or non-living organic matter are called Saprophytes. e.g: Mucor (Fungus), Bacillus subtilis (Bacteria) and Monotropa (Angiosperm)

Parasitic Nutrition

In parasitic nutrition, an organism derives its food from the body of other living organism (host).

Cuscuta (Dodder plant)

Some plants get their nourishment from other living plants or animals. They are called parasitic plants. The plants or animals from which the parasites get their nourishment are called hosts. They have some special structures which penetrate the host and absorb food, water and minerals. These special structures are called haustoria.

e.g: Xanthomonas citri (bacteria)
Cercospora personata (fungus)
Cuscuta (angiosperm)

Monotropa (Indian pipe)

Mushroom

MORE TO KNOW

Some plants are capable of synthesizing food by photosynthesis but they are not able to synthesize proteins due to the deficiency of nitrogen. They overcome this deficiency by catching small insects and digesting them. Such plants are called insectivorous plants. e.g. Nepenthes, Drosera and Utricularia.

Nepenthes (Pitcher plant)

Drosera (Sundew plant)

Utricularia (Bladderwort)

Symbiotic Nutrition

In this type of nutrition there is an association of two different living organisms. When two organisms live together, they exchange nutrients and are benefited mutually. Such type of nutrition is called symbiotic nutrition and the organisms are called Symbionts. e.g. Lichen, Mycorrhiza and Rhizobium.

Lichen

Rhizobium

4.5. MOVEMENTS IN PLANTS

Can plants move?

The plants are fixed at a place with their roots in the ground. So they cannot move from one place to another. They lack the power of locomotion. Movements of the individual parts or organs of plant are possible when they are subjected to some external stimuli like light, water, chemical substances and touch.

The plant movements made in response to external stimuli fall into two main categories.

1) **Tropisms** 2) **Nasties**

Tropisms

A growth or movement of a plant part in response to an external

stimulus in which the direction of stimulus determines the direction of response is called tropism.

If the growth or movement of a plant part, is towards the stimulus, it is called positive tropism.

If the growth or movement of a plant part, is away from the stimulus, it is called negative tropism.

Stimulus	Type of tropism
Light	Phototropism
Gravity	Geotropism
Chemical	Chemotropism
Water	Hydrotropism
Touch	Thigmotropism

Phototropism

The movement of a plant part in response to light is called phototropism. If the plant part moves towards the light, it is called positive phototropism. If the plant part moves away from the light, it is called negative phototropism. The stem always grows towards light and root always grows away from sunlight.

Phototropism

ACTIVITY – 4.8

i) Take a potted plant growing in a transparent glass jar in a normal position. You can see that its roots are growing downwards and its stem is growing upwards.

ii) Now tilt the potted plant and keep the pot horizontally on its side.

What is the position of the roots?

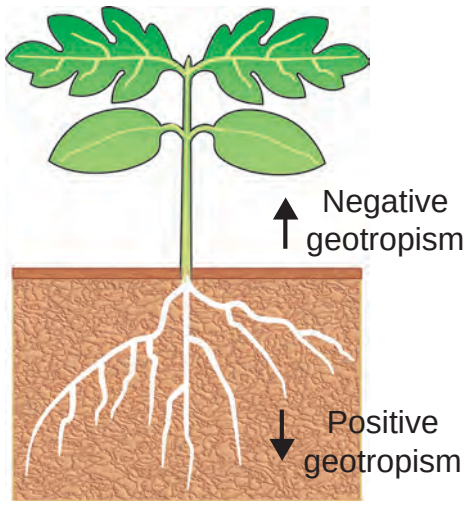
What is the position of the stem?

Are they both parallel to the ground or not?

iii) Allow the plant to remain in this position for a few days. After a few days what do you observe?

Geotropism

The movement of plant part in response to gravity is called geotropism. If the plant part moves towards the direction of gravity, it is called positive geotropism. If the plant part moves against the direction of gravity, it is called negative geotropism. Roots of a plant always grow down wards in the direction of gravity and stem always grows upwards against the direction of gravity.



Geotropism

ACTIVITY – 4.9

1. Take a potted plant growing in a transparent glass jar. Keep it in the open space.

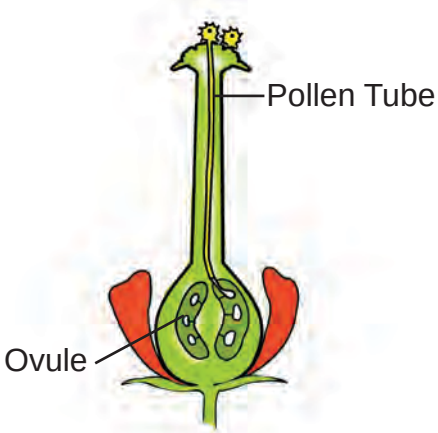
   What do you observe?

2. Take another potted plant and keep it having a straight stem and root near the window in a dark room so that sunlight falls on it through the window only.

   What do you see?

Chemotropism

The movement of a plant part in response to a chemical stimulus is called chemotropism. If the plant part shows movement towards the chemical, it is called positive chemotropism. On the other hand if the plant part shows movement away from the chemical, then it is called negative chemotropism.

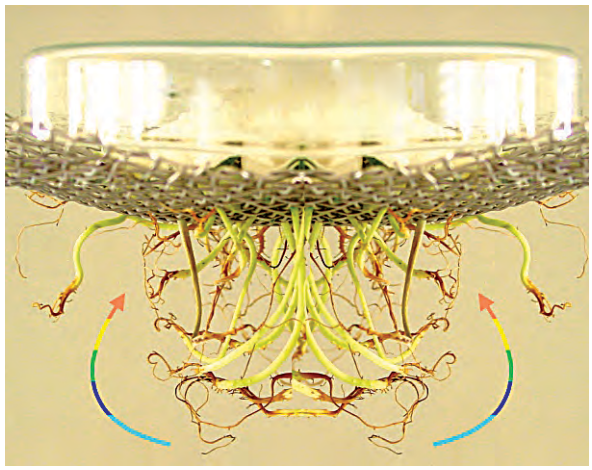


Chemotropism

The growth (movement) of a pollen tube towards the ovule induced by a sugary substance as stimulus, is an example of chemotropism. The ripe stigma in the carpel of a flower secretes a chemical substance (sugary substance) into the style towards the ovary. This sugary substance acts as a stimulus for the pollen grains which fall on the stigma of the carpel. The pollen grain responds to this stimulus by growing a pollen tube in the downward direction into the style of the carpel and reaches the ovule in the ovary of the flower for carrying out fertilization.

Hydrotropism

The movement of a plant part in response to water is called hydrotropism. If the plant part moves towards water, it is called positive hydrotropism. On the other hand if the part moves away from water it is called negative hydrotropism. The roots of a plant always go towards water and they are positively hydrotropic.



Hydrotropism

Thigmotropism

Climbing plants have weak stems, so they cannot stand erect. They have climbing organs called tendrils.

Tendrils are the thin, thread-like growths on the stems or leaves of climbing plants. Tendrils are sensitive to touch or contact of other objects. When a tendril touches an object, then the side of tendril in contact with the object grows, slower than its other side. This causes the tendril to bend towards the object by growing towards it, wind around the object and cling to it. The winding movement of the tendril of a climbing plant is an example for thigmotropism.

ACTIVITY – 4.10

i) Take two glass troughs A and B and fill each one of them with two – thirds of soil.

ii) Plant a tiny seedling in trough A.

iii) Plant a similar seedling in trough B and also place a small 'clay pot' inside the soil.

iv) Water the soil in trough A daily and uniformly.

v) Do not water the soil in trough B but put some water in the clay pot buried in the soil.

vi) Leave both the troughs for a few days.

vii) After a few days, dig up the seedlings carefully from both the troughs without damaging their roots.

What do you observe?

Is the root of seedling in trough A straight or bent?

Is the root of a seedling in trough B bent? Why?

Thigmotropism:

NASTIES

The movement of a plant part in response to an external stimulus in which the direction of response is not determined by the direction of stimulus is called nastic movement.

Example :

i) The folding up of the leaves of a sensitive plant (Mimosa pudica) – touch.

ii) The opening of the petals of Dandelion flowers in morning in bright light and closing in the evening – light.

iii) The closing of the petals of moon flower in the morning in bright light and opening at dark – light.

The folding up of the leaves of a sensitive plant on touch is not a growth movement but the opening and closing of petals of flowers is growth movement.

Some of the nastic movements are as follows:

i) Thigmonasty (Seismonasty)

The non-directional movement of a plant part in response to the touch of an object is called thigmonasty. The best example for thigmonasty is Mimosa pudica (Touch-me-not plant). It we touch the leaves of the sensitive plant with our fingers, then its leaves fold up and droop immediately.

Before touch After touch

Mimosa pudica (Touch-me-not plant)

ii) Photonasty

Dandelion

The non-directional movement of a plant in response to light is called photonasty. The opening of leaves and flowers during day time and their closure at night is an example.

A Dandelion flower opens up in the morning in bright light but closes in the evening when the light fades and it gets dark.

iii) Thermonasty

The non-directional movement of a plant in response to temperature is called thermonasty. In Crocus, the flowers open at high temperature and close at low temperature.

4.6. SENSITIVITY IN PLANTS

i) When a torch light is focused to our eyes, we automatically close our eyes.

ii) When we come in contact with a hot surface unexpectedly, immediately we withdraw our hands.

All these things happen because human beings as well as animals are sensitive to stimuli like light, heat, etc.

When we touch the leaves of Mimosa pudica, suddenly the leaves fold up. Even though the plants don't have any nervous system, they respond to stimuli. How?

The petiole of Mimosa pudica leaves are pulvinate. (pad – like swellings at the base of leaf). The pulvini (singular pulvinus) contain a lot of water in their cells. Due to the internal 'water pressure' in them, all the pulvini are very firm and hold the leaves above them upright. The pulvini have also large intercellular spaces between their cells.

The folding up of the leaves of a sensitive plant on touching is due to the loss of water from the Pulvini. The pulvini lose their firmness causing the leaves to droop and fall.

When the leaves of sensitive plants are touched with a finger, then an electric impulse is generated which travels through ordinary cells. This electrical impulse acts on a plant hormone. The plant hormone makes the water migrate from the cells of one half of a pulvinus to the intercellular spaces in the other half of pulvinus. This loss of water forces the leaf to fold. Similarly, all the pulvini lose firmness and become limp. As a result all the leaves above them collapse and droop. After a gap of 15 to 30 minutes, water usually diffuses back into the same cells of pulvinus from which it left, and the leaf returns to its original position.

EVALUATION

Section – A

Choose the correct answer

1. A plant cell differs from an animal cell in the presence of (cell membrane, endoplasmic reticulum, plasma membrane, cell wall).
2. A parasitic plant (mushroom, mucor, cuscutta, yeast).
3. The loss of water from the aerial parts of the plant is known as (photosynthesis, transpiration, reproduction, respiration).
4. The movement of a plant part in response to light is called (geotropism, hydrotropism, phototropism, thigmotropism).
5. The energy currency of cell (FAD, NADP, NAD, ATP)

Section – B

6. i) Is man an autotroph or heterotroph?

   ii) Explain why.
7. Complete the equation

   $6CO_2$ + _____ $\longrightarrow$ $C_6H_{12}O_6$ + _____
8. Plants absorb water and minerals from the soil with the help of root hairs. Name the forces involved in absorption.

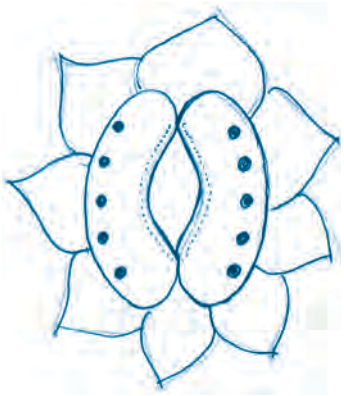
Section C

9. a) Plants prepare their own food.

   i) Name the process by which plants make food.

   ii) Apart from carbondioxide and water, what other things are required for making food.

   b) Observe the diagram



   i) Copy the diagram and label the following parts

   a) stomatal pore b) chloroplast

   ii) Point out the function of each part labelled.

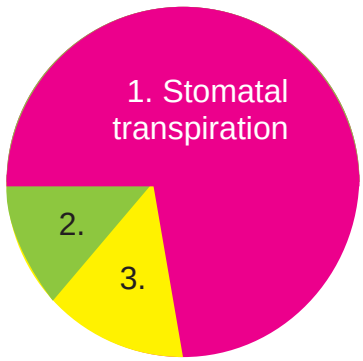
10. Respiration is defined as biochemical process consisting of oxidation and degradation of food with release of energy.

a) Differentiate Aerobic and Anaerobic respiration.

b) $C_6H_{12}O_6 \xrightarrow[\text{zymase}]{\text{yeast}} \_\_\_\_\_ + 2CO_2 + 50KJ$ energy

c) List out the factors affecting respiration.

11. a) Complete the pie chart which shows the types of transpiration.



b) Match the column A with column B

Stimulus (A)	Type of Tropism (B)
Gravity	Chemotropism
Chemical	Thigmotropism
Touch	Geotropism

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