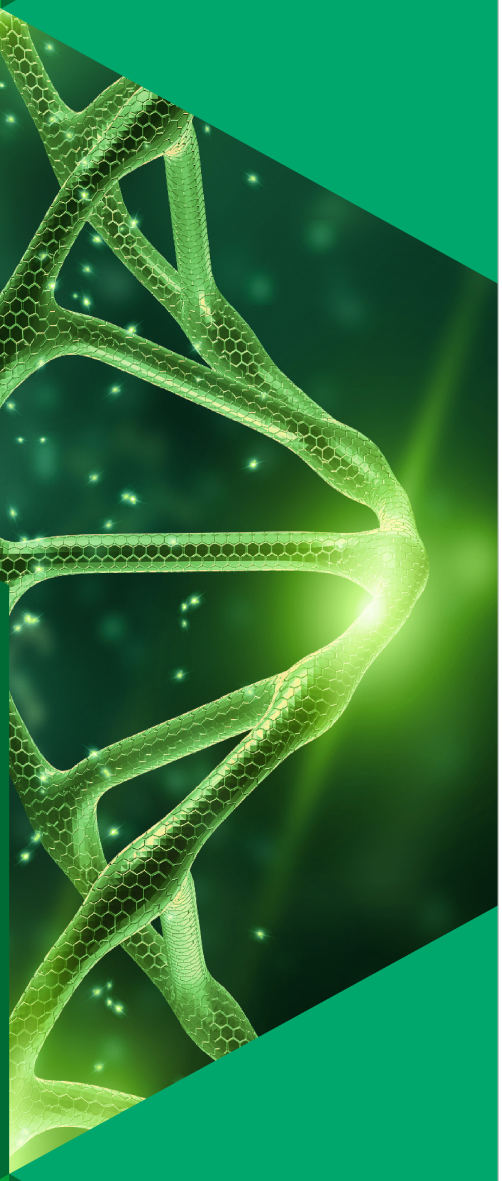
MATRIX OLYMPIAD

The Most Innovative Talent Recognition Exam



BIOLOGY

Class - X

MATRIX

Campus : Piprali Road, Sikar, Rajasthan 332001

Phone : 01572-241911, 01572-243911

Website: www.matrixedu.in

Few words for the Readers

Dear Reader,

"*Matrix Olympiad is established to encourage school students to go a step further than their regular studies, and get a chance and exposure to competition on a wide scale. It also helps students enhance their learning of basic cognitive skills and deeper knowledge of subjects like Science, Mathematics, English, Mental Ability, Social Studies.“Matrix Olympiad helps students nurture their minds for higher targets of tomorrow and enables them to study School for JEE, NEET, CLAT, NDA, Olympiads , NSEJS, NTSE , STSE etc.*"

The above thought has been our guiding principle while designing and collating the study material for **Matrix Olympiad** . And hence, we hope that this particular material will be helpful towards your preparation for **Matrix Olympiad**.

Our team at **MATRIX** has put in their best efforts for making this particular module interesting and relevant for you. Additional efforts have been made to ensure that the content is easy to understand and error free to the extent possible. However, there might remain some inadvertent errors in answer keys and theoretical portion and we would welcome your valuable feedback regarding the same.

If there are any suggestions for corrections, please write to us at **smd@matrixacademy.co.in** and we would be highly grateful.

Finally, we would like to end this message by a famous quote by Ernest Hemingway - "*There is no friend as loyal as a book*." So, please give your study material the time and attention it deserves, and it will surely help you reach newer heights in your fight with competition examinations.

With love and best wishes !

Team MATRIX

CONTENTS

HOW DO ORGANISMS REPRODUCE ?

1

Concepts

INTRODUCTION

Reproduction is a process by which living organisms produce new individuals of their own kind and maintain their existence generation after generation. Reproduction is not essential to maintain the life of an organism but it is essential to maintain life on earth and perpetuation of species from one generation to another. Reproduction at its basic level (cellular reproduction) is involved in making similar or dissimilar body designs through the genetic material (DNA) present in the chromosomes of its nucleus.

DNA is the source of information for making proteins. Any change in the information leads to production of different proteins, which ultimately lead to altered body designs. Basic event in reproduction is production of DNA copies in a reproducing cell. The process is called DNA replication. When the cell divides into two, each new cell gets a copy of each DNA or chromosome along with the whole cellular apparatus. Complete accuracy in DNA copying leads to two exactly identical cells but any error in duplication can lead to dissimilar cells or variations. The inbuilt tendency for variations during reproduction forms the basis for evolution. Variations during reproduction enable the population of a species to get adapted easily to a particular inhabiting place/niche. Hence, reproduction is linked to the stability of populations of species. Stronger variations are useful for the survival of species over time and enable the organisms to tide over any drastic alterations in their habitats.

1. IMPORTANCE OF REPRODUCTION

(i) **Maintenance of the existence :-** Organisms are maintaining their existence on the earth since their origin, million years ago only because of reproduction.

(ii) **Preservation of species :-** Species are preserved because of reproduction. It is possible because reproducing organisms produce new individuals which are very similar to themselves.

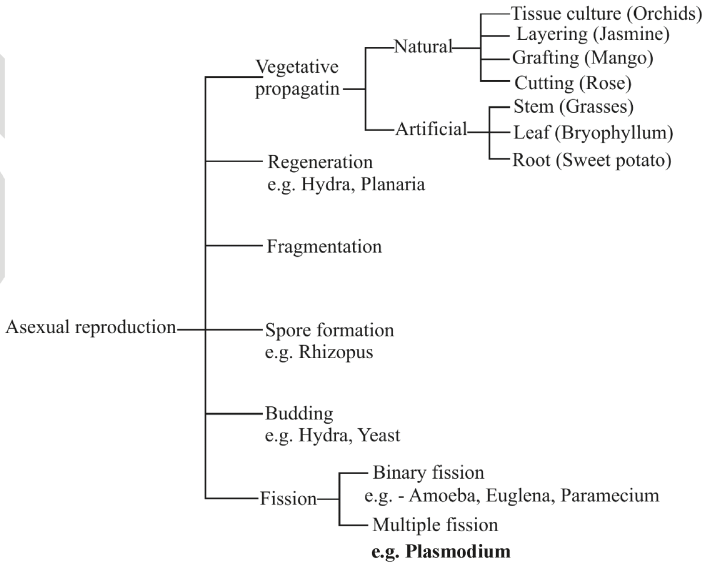
(iii) **Role in evolution :-** Some variations are produced in the new organisms during reproduction which play an important role in evolution.

2. TYPES OF REPRODUCTION

There are two main methods of reproduction in living organisms.

(A) ASEXUAL REPRODUCTION

Production of offsprings by a single parent without the formation and fusion of gametes is called **asexual reproduction.** It is a primitive type of reproduction in which **offspring** is produced by a cell or any vegetative organ of an organism. In this type of reproduction **offsprings** are genetically identical to their parents.



Modes of asexual reproduction are fission, budding, spore formation, fragmentation, regeneration and vegetative propagation.

(i) **Fission :** It is a kind of asexual reproduction in unicellular organisms to create two new individuals. It can be of two types :

(a) **Binary fission.** One cell splits into two equal halves, e.g., many bacteria and protozoa like Amoeba, Euglena, Paramecium and Leishmania.

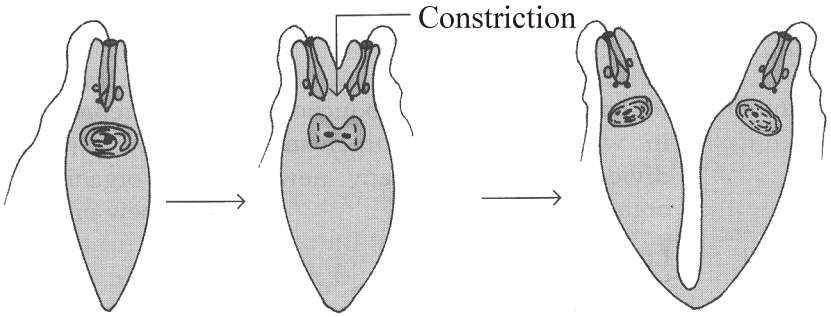


Figure : Binary fission in Euglena

(b) **Multiple fission.** One cell divides into many daughter cells simultaneously, e.g., Plasmodium (malarial parasite), Amoeba in unfavourable conditions.

(ii) **Budding :** Process in which an outgrowth (bud) is formed on the body of parent organism which then detaches and become a new organism. e.g. Yeast and Hydra.

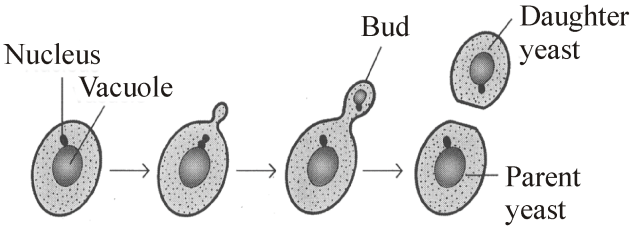


Figure : Budding in Yeast

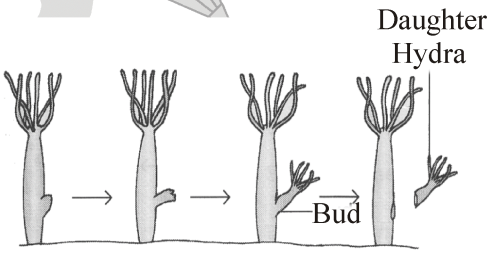


Figure : Budding in Hydra

(iii) **Spore formation :** Spores are the microscopic asexual reproductive bodies with a thick wall. Spores are formed in **'sporangium'.** Each spore on germination give rise to a new organism e.g. Rhizopus, Penicillium.

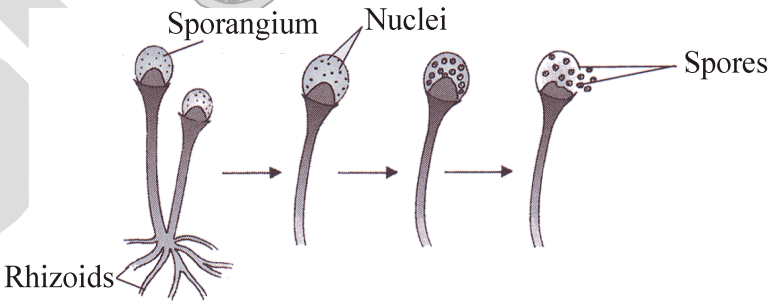


Figure : Formation in Rhizopus

(iv) **Fragmentation :** In this process an organism breaks up into two or more fragments and each fragment develops into an adult organism e.g. Spirogyra.

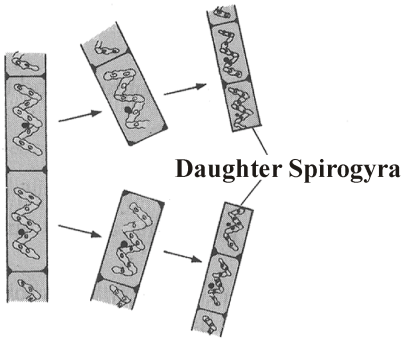


Figure : Spirogya

(v) **Regeneration :** The process of getting back a full organism from the body parts of the parent is called **regeneration.** Regeneration is carried out by specialised cells. **e.g.** Hydra, Planaria.

(vi) **Vegetative propagation :** This is an asexual method of reproduction in plants where vegetative parts namely root, stem and leaves give rise to new plants.

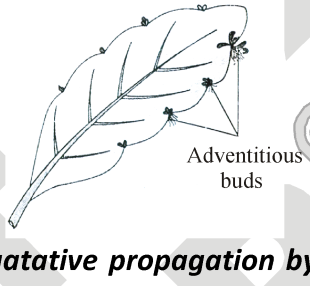


Figure : Natural vegatative propagation by leaf (Bryophyllum)

(a) **Natural vegetative propagation :**

- **By leaves :** Leaves of some plants produce adventitious buds on their margin. These buds develop into new plants e.g. Bryophyllum, Kalanchoe.
- **By stem :** In many plant, underground stems produce aerial shoots annually under favourable conditions e.g. Potato, Zinger, Onion, Grass.

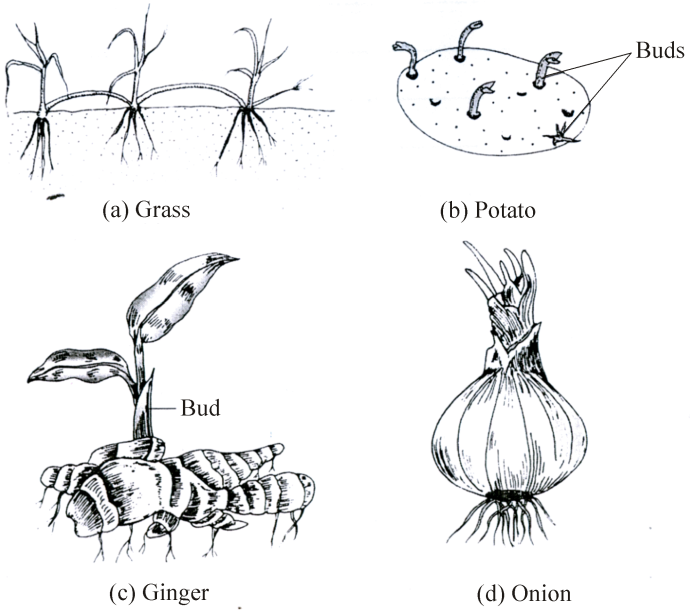


Figure : Natural vegetative propagation by stems.

- **By roots :** Roots produce adventitious buds which develops into new plants. e.g sweet potato.

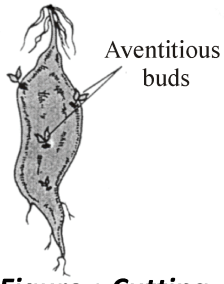


Figure : Cutting

(b) **Tissue culture or micropropagation :** Cells or tissue which is isolated from the growing tip of plant called **explant**. The explant develops into undifferentiated mass of cells called **callus** in the proper culture medium. The callus is transferred to another medium containing hormones for growth and differentiation, that forms **plantlet**.

- The plantlets are transplanted into pot or soil to form mature plant.
- This technique is known as micropropagation. e.g. Orchids, Chrysanthemum.

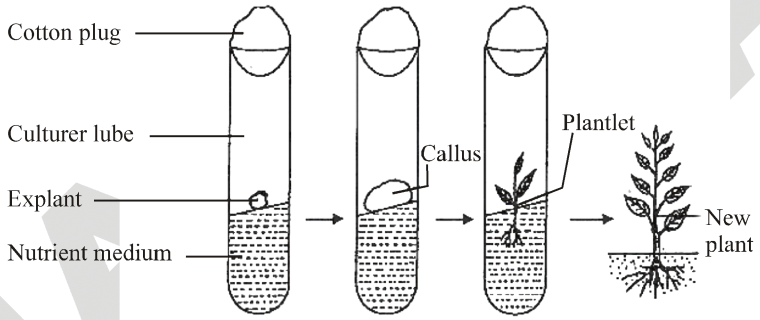


Figure : Artificial vegetative propagation by tissue culture

ADVANTAGES OF VEGETATIVE PROPAGATION

- It is a rapid, cheap and easy method of reproduction for the multiplication of plants.
- Disease free plants can be produced.
- Superior quality fruits or flowers can be produced by grafting.
- Genetically identical plants are produced.
- Plants raised by vegetative propagation can bear flowers and fruits earlier than those produce from seeds.

Focus Point

- Grafting is not possible in monocot plants. Cambium activity is essential for the union of stock and scion.
- Tissue culture is also called micro-propagation because a large number of plants are formed from a small tissue.
- Virus free plants are produced by micropropagation.

(B) SEXUAL REPRODUCTION

It is a type of reproduction in which two different sexes (male and female) are involved. It involves the fusion of gametes from two different parents and results in the formation of new organism, which is genetically different from the parent.

S. No.	Features	Asexual reproduction	Sexual reproduction
1.	Number of parents	One	Two
2.	Resemblance with parents	Organisms produced resemble exactly with the parent.	Organisms do not resemble exactly with the parent but resemble in certain features with both the parents.
3.	Type of cell divisions	Amitotic/ mitotic.	Mitotic and meiotic both are present.
4.	Time duration	Takes less time.	Takes more time.
5.	Variations	Variations are absent.	Variations are present.
6.	Adaptability	Organisms produced have less adaptability	Organisms produced have more adaptability.
7.	Examples	Amoeba, Euglena, Plasmodium, Yeast.	Human beings, higher plants.

3. SEXUAL REPRODUCTION IN FLOWERING PLANTS

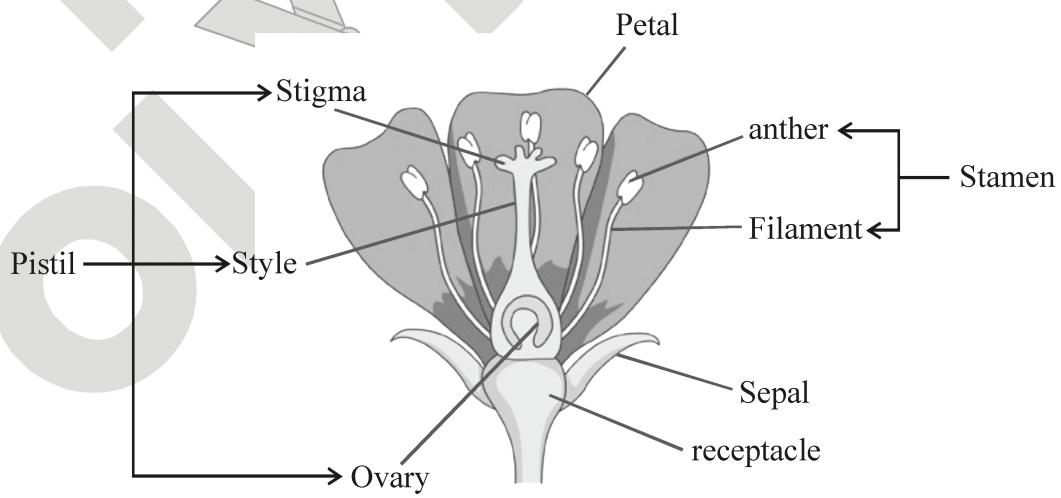


Figure : Parts of flower

Sexual reproduction takes place through the agency of flowers in angiosperms (flowering plants). Flower is a specialized condensed reproductive shoot of flowering plants on which the essential reproductive parts are inserted.

A typical flower has four whorls arranged on the **thalamus**.

- Calyx
- Corolla

} Non essential whorls

- Androecium
- Gynoecium

} Essential whorls

(i) **Calyx :** It is the outermost whorl consisting of **sepals**. Sepals are green and leaf like structure. Calyx protect the flower bud before it opens.

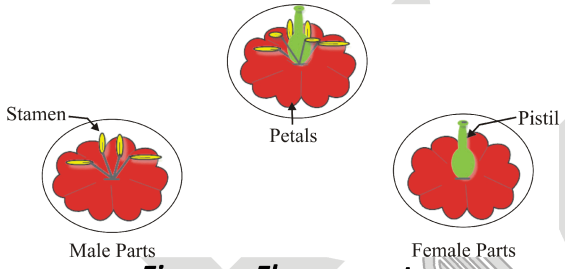


Figure : Flower parts

(ii) **Corolla :** It is the second whorl, inner to calyx, consisting of **petals**. Petals are generally large, coloured and showy. Corolla attract insects for pollination.

(iii) **Androecium :** It is the third whorl, inner to corolla, consisting of male reproductive parts called **stamens**. Each stamen has two parts – Filament and anther. Anther is lobed structure present at the tip of filament. Each anther has pollen sacs (microsporangia) which contain pollen grains (microspores). Each pollen grain produces two male gametes/ male germ cells.

(iv) **Gynoecium :** It is the fourth and innermost whorl consisting of **carpels**. Carpel is present in the centre of flower. Each carpel has three parts – Ovary, Style and Stigma. Ovary is a swollen basal part of carpel. It contains ovules which are attached to placenta. Each ovule contain an embryosac that bears a haploid egg (female gamete). Style is the middle part of the carpel. It has stigma above it and ovary below it. Stigma is the apical part of carpel. It receives pollen grains.

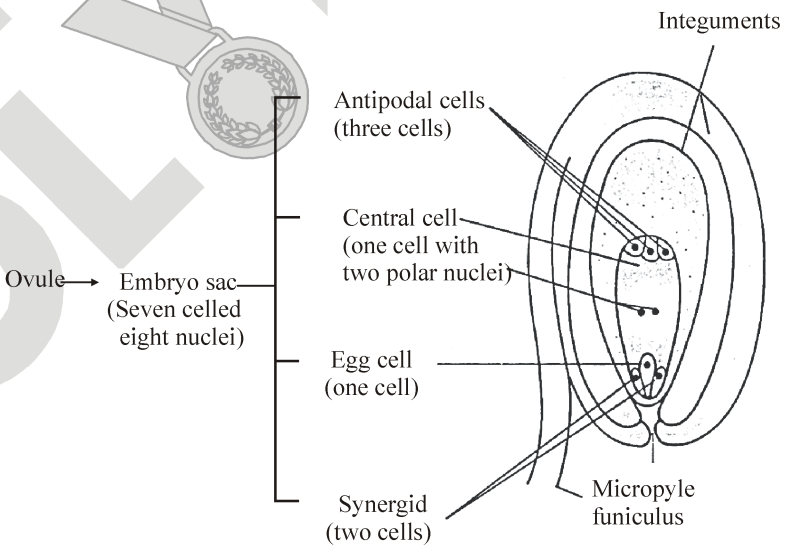


Figure : L.S. of Ovule

BUILD THE CONCEPT

- **Perianth :-** If both sepals and petals are coloured and can not be distinguished from each other, then their whorl is known as **perianth**.
- Calyx and corolla are non essential parts of the flower because they are not directly involved in reproduction.
- **Bisexual flower :-** When the male and female reproductive parts are present in the same flower then it is called bisexual flower e.g. Hibiscus**,** Mustard.
  Unisexual flower :- When the male and female reproductive parts are present in different flowers. e.g. : Papaya, Date palm, Mulberry, Gourd, Water melon.

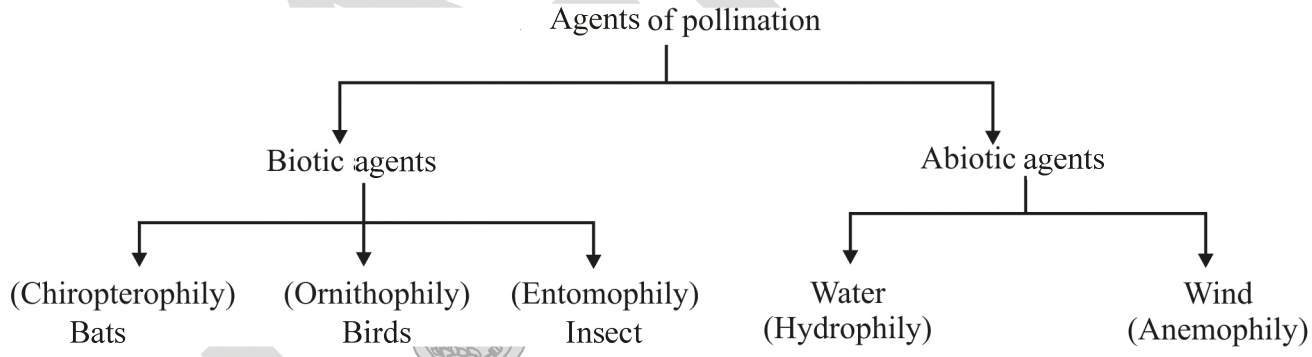
4. POLLINATION

Process in which pollen grains are transferred from the ripe anther to the stigma. It is of two types :

(i) **Self pollination :-** It is the transfer of pollen grains from an anther to the stigma of the same plant. If it is in the same flower it is called **autogamy** (e.g. Pea) and if it is between flowers of the same plant then it is called **geitonogamy** (e.g. Oxalis).

(ii) **Cross pollination :-** It is the transfer of pollen grains from anther to the stigma of different plants of the same species (e.g. Mango).

(iii) **Agents of pollination :-** Transfer of pollen from one flower to another is achieved by agents like wind, water, animals, insects and birds.



Focus Point

- **Significance of bright colour of flower :-** The bright colour of flowers is meant to attract insects which help in pollination. White colour shine in dark which attracts insects at night. Similarly, bright colour day-blooming flowers attract insects.

5. FERTILIZATION

- Fertilization is the process of fusion of the male and female gametes, which takes place in the embryo sac present in the ovule.
- After pollination, pollen grains germinate on the stigma by producing pollen tube.
- The nucleus in the pollen tube divides into two male gametes.
- Pollen tube penetrates the stigma and passes through the style and enters the ovule through micropyle.
- It releases two male gametes in embryo sac.
- One male gamete fuses with egg cell and second male gamete fuses with the two polar nuclei.
- One male gamete + Egg cell $\xrightarrow{\text{Syngamy}}$ Zygote.
- Second male gamete + Two polar nuclei $\xrightarrow{\text{Triple fusion}}$ Triploid nucleus (Primary Endosperm Nucleus)

  Syngamy + Triple fusion = Double fertilization.

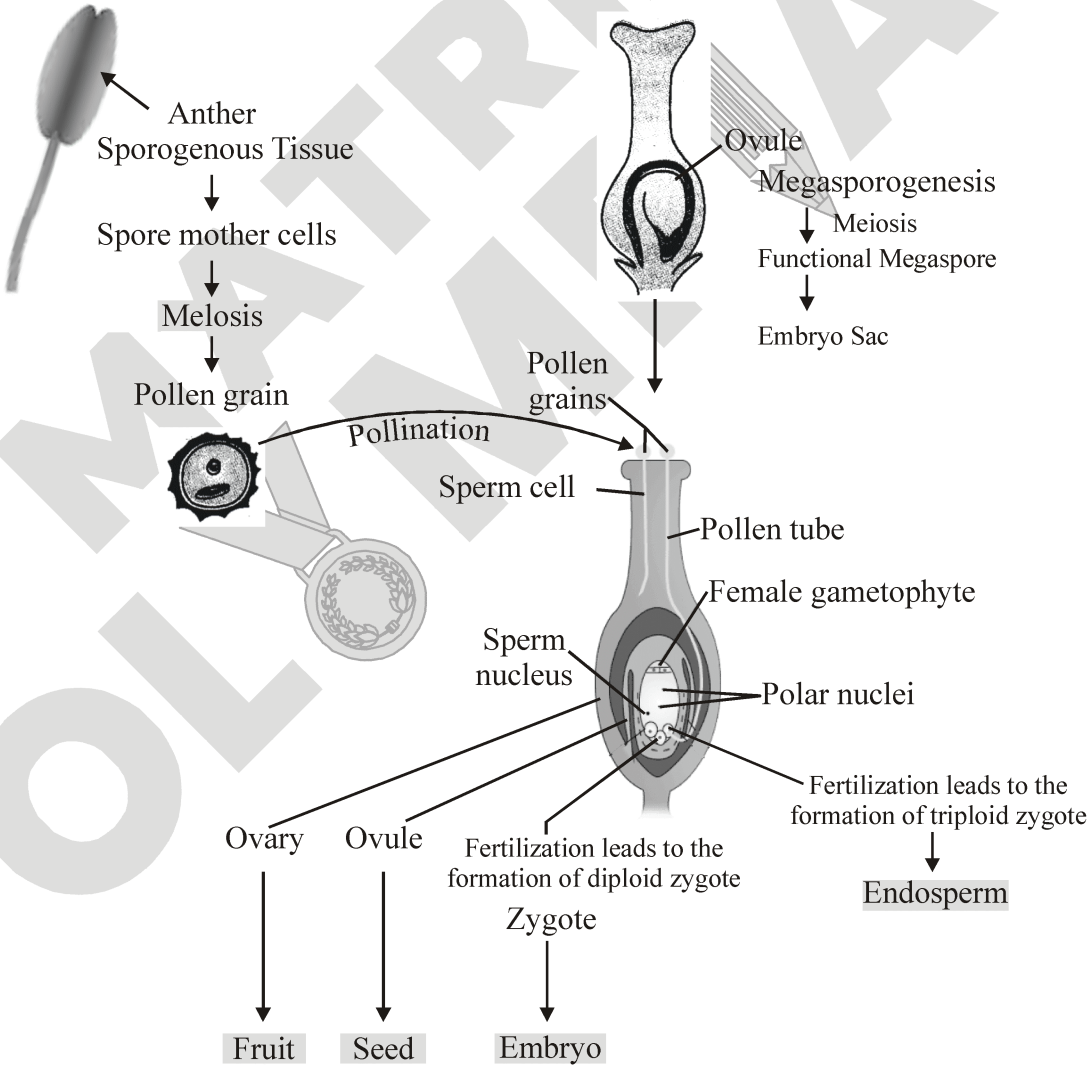
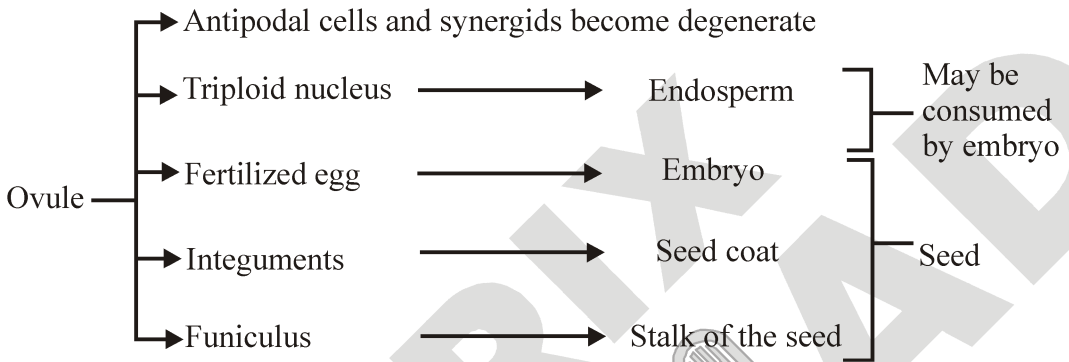


Figure : Fertilization

POST FERTILIZATION CHANGES IN THE FLOWER

- Sepals, petals and stamen withers off.
- Style and stigma degenerates.
- Ovary develops into fruit.
- Ovule grows into seed.
- The seed contains the future plant or embryo which develops into a seedling under appropriate conditions.



Focus Point

- **Endospermic seed :** If endosperm is not consumed.
- **Non endospermic seed :-** Endosperm may be consumed.

6. REPRODUCTION IN HUMANS

- **Puberty :** Beginning of sexual maturity is known as puberty. In the stage of puberty body growth is very rapid. It occurs at the age of 10 - 14 years in girls and 13-15 years in boys.

6.1 MALE REPRODUCTIVE SYSTEM

- The human male reproductive system consists of the following organs

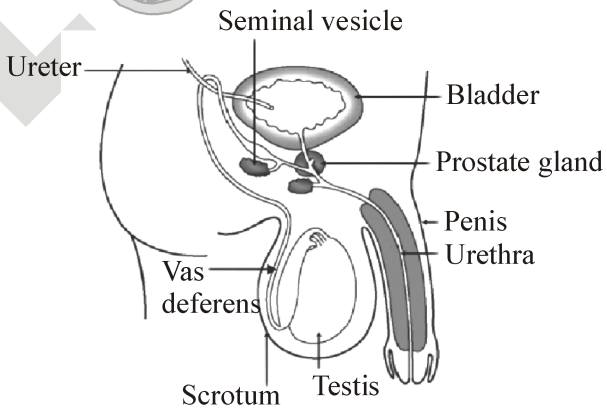


Figure : Reproductive system of a human male

(i) Testes

- A pair of testes lies in a small sac-like muscular structure outside the abdominal cavity called scrotum. The function of testes is to produce sperm and male sex hormone called testosterone. The scrotum provides the optimal temperature for formation of sperms.

(ii) Duct System

- Testis is connected to epididymis through a fine tubule called as vasa efferentia. They help in conduction of sperms. Epididymis is a coiled tube-like structure firmly attached to the testis and serves as the storehouse of sperms. Inside the epididymis, sperms become mature and develops motility.
- Sperms are carried by a long tube called vas deferens or sperm duct into organs called seminal vesicles, where the sperms get nourished and stored.
- Ejaculatory duct enters into prostate gland and joins urethra to form common urino-genital duct.

(iii) Accessory glands

- **Prostate gland :** This secretes calcium, enzymes, hormones, citric acid.
- **Seminal vesicles :** These secrete fructose.
- **Cowper's glands :** These secrete an alkaline fluid.

(iv) Copulatory Organ

- Penis is a copulatory organ at the tip of which urinogenitalductopens.It also passes urine.

Semen : sperm + secretion of accessory glands.

- Semen has chemicals for nourishment of sperms neutralizing the acidity of urethra and vagina. stimulating their movement in female tract

Spermatogenesis : This process of formation of sperm from spermatogonia is called as spermatogenesis.

- Testes lie outside the abdominal cavity as the process of spermatogenesis requires lesser temperature than the body temperature.

6.2 FEMALE REPRODUCTIVE SYSTEM

The human female reproductive system consists of the following organs :

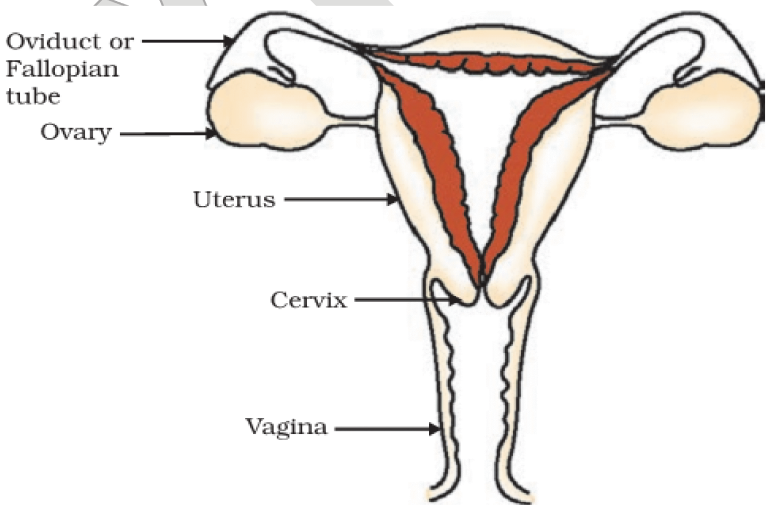


Figure : Reproductive system of a human

(i) **Ovaries :** Ovaries are a pair of small and oval-shaped organs, located in the abdominal cavity near the kideny. Ovaries are the female primary reproductive organs which perform dual functions of production of female gamete or ovum and the secretion of female sex hormones, estrogen and progesterone.

(ii) **Fallopian tube or oviduct :** are a pair of long convoluted tubes that carry ovum or eggs from the ovary to the uterus. The fallopian tube has a funnel-shaped opening near the ovary. It is about 10 cms long muscular tube. It has 4 regions.

- **Infundibulum :** It is broad, funnel shaped proximal part of fallopian tube. It's margin bears finger like processes called as fimbriae. This is meant to carry ovum by ciliary movement to the uterus.
- **Ampulla :** It is a long, wide part of the fallopian tube next to the infundibulum.
- **Isthmus :** It is the narrow part that follows ampulla.
- **Uterine part:** It is also narrow and passes through the uterine wall.

(iii) **Uterus or womb :** is a hollow, pear-shaped organ in which the embryo develops. Its upper portion is broader, while its lower portion is narrower, called cervix. Its inner linning is called endometrium. Middle is myometrium and outermost is perimetrium.

(iv) **Vagina :** The cervix opens into the vagina which is a tubular structure and also called birth canal. Vagina receives sperms from the male and also serves as the passage through which the fully developed foetus is born.

Hormones secreted by ovaries are : Progesterone during pregnancy. Relaxin at the end of pregnancy. Oestrogen is secreted by graffian follicle. It's secretion is maximum during ovulation. It is also secreted during pregnancy. Oogenesis is a process of formation of ovum. The ovum is a rounded, non-motile cell.

6.3 FERTILIZATION IN HUMANS

- It includes release of ovum from the ovary, where it remains viable for 12-24 hours.
- Only one sperm is required for fertilization of the ovum.
- The head of the sperm penetrates ovum.
- This process is facilitated by acrosome and proteolytic enzymes.
- After penetration only head enter inside the ovum.
- Here the pronuclei of sperm and ovum fuse to form a new resultant nucleus each contributing 23 chromosomes, so that the resultant structure have 46 chromosomes.
- Fusion of male and female gametes is called as fertilization. This occurs at ampulla-isthmus junction.
- Zygote starts developing in fallopian tube and forms embryo, this later on moves to uterus.
- It gets attached to uterine wall and the whole process is called as implantation.
- Placental formation occurs between uterine wall and the foetus, which provides nourishment to the foetus.
- The time period for which a developing foetus remains inside the mother's womb is called as gestation period. It extends for about 9 months or 40 weeks or 280 days.
- The process of giving birth to baby is called as parturition.

6.4 REPRODUCTIVE HEALTH

Reproductive health is the state of physical, mental and social fitness to lead a responsible safe and satisfying reproductive life.

Its knowledge provides-

- Awareness to both male and female regarding fertility regulating methods.
- Birth control and better family planning.
- Prevention from sexually transmitted disease (STD).
- Early diagnosies and treatment of genetic disorders.

Contraceptive-

- Prevention of pregnancy is called contraception.
- Techniques used in preventing the occurrence of pregnancy are called contraceptive devices.
- Nowadays following contraception methods are in use :

(i) Natural methods of contraception-

- **Rhythm method :** It is based on a fixed formula taking into consideration the timing of ovulation and the resulting likelihood of pregnancy on particular days of the menstrual cycle.
- **Lactational amenorrhea method :** It is used by a woman who is exclusively on breastfeeding and will not get her menstrual period till sixth month of childbirth.
- **Withdrawal method :** It is based on the removal of penis before insemination,
- **Abstinence method :** It refers to not having sex simply avoiding vaginal intercourse.

(ii) Barrier methods of contraception : The following barrier methods are used for contraception :

- **Condom :** It is tubular latex sheath which is worn over the male copulatory organ or penis during sex.
- **Cervical cap :** It is rubber nipple that is fitted over the cervix.
- **Diaphragm :** It is tubular rubber sheath with flexible metal or spring ring at the margin which is fitted inside vagina.

(iii) Intra uterine contraceptive devices (IUCD or IUD) :

- They are devices made of plastic, metal or a combination of the two which is inserted into uterus to prevent pregnancy generally through excessive secretion of cervical mucus.
- The most common type is copper-T for preventing implantation.
- It is functional for 3-5 years.

(iv) Chemical methods of contraception : The following chemical methods are used for contraception :

- **Oral pills :** They contain progesterone with or without estrogen. E.g. Saheli, Contron etc.
- **Morning-after pills :** They prevent contraception even after coitus. E.g. i-pill.
- **Creams :** jellies and foaming tablets (vaginal pills) which are placed in vagina for killing the sperms at the time of coitus.

(v) Surgical methods : It is of two types, vasectomy in males and tubectomy in females.

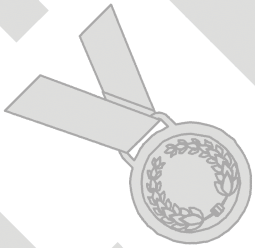
- **Vasectomy :** The two vasa deferentia of the male are blocked by cutting a small piece and tying the rest. This prevents passage of sperms from testes to penis.
- **Tubectomy :** A portion of both the fallopian tubes is excised or ligated to block the passage of ovum.

Sexually transmitted diseases (STD) : These diseases are transmitted through unsafe sexual act. e.g.:

- Gonorrhoea caused by Neisseria gonorrhoea (bacteria).
- Syphilis caused by Treponema pallidum (bacteria).
- AIDS (Acquired Immuno deficiency Syndrome) caused by human immuno deficiency virus (HIV).

Focus Point

- If a woman uses a Copper-T as method of contraception for avoiding unwanted pregnancies, then Copper-T cannot protect her from acquiring sexually transmitted diseases (if her partner has such a disease).
- **Norplant :** Hormonal implant used for birth control. It is effective for up to 5 years. These are hormone carrying rods about the size of matchsticks inserted under the skin normally in the upper arm.



NS. 1

Asexual reproduction takes place through budding in

(a) Amoeba (b) Yeast

(c) Plasmodium (d) Leishmania

Ans. (b)

NS. 2

Which of the following is not a part of the female reproductive system in human beings?

(a) Ovary (b) Uterus

(c) Vas deferens (d) Fallopian tube

Ans. (c)

NS. 3

The anther contains

(a) Sepals (b) Ovules

(c) Carpel (d) pollen grains

Ans. d

NS. 4

What are the advantages of sexual reproduction over asexual reproduction?

Ans. In asexual reproduction, the offsprings are almost identical to their parents because they have the same genes as of their parents. Thus, genetic variation is not possible or is slow in asexual reproduction.

Sexual reproduction involves fusion of male and female gametes coming from both the parents. Therefore, the offsprings receive some genes from the mother and some from the father. The mixing of these genes of mother and father in various different combinations, results in the offsprings having genetic variations.

Thus, we conclude that sexual reproduction promotes diversity of characters in the offsprings by providing genetic variations. This genetic variation leads to the continuous evolution of various species to form better and better organisms.

NS. 5

What are the functions performed by the testis in human beings?

Ans. The function of testis is to produce sperm and male sex hormone called testosterone. The scrotum provides the optimal temperature for formation of sperms.

NS. 6

Why does menstruation occur?

Ans. Menstruation occurs in human females only when the egg is not fertilised by the male sperm. Since the egg is not fertilised so, the thick and soft uterus lining having a lot of blood capillaries in it is not required. Thus, the unfertilised ovum disintegrates within a day and the uterus lining also breaks down. As the uterus lining contains a lot of blood vessels, so when it is shed, blood alongwith other tissues is released. This comes out of the vagina in the form of bleeding.

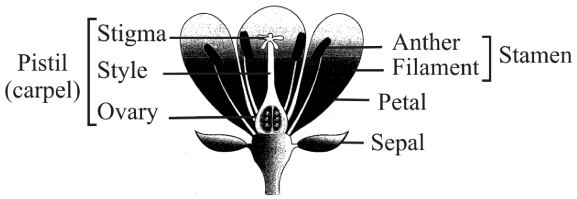
NS. 7

Draw a labelled diagram of the longitudinal section of a flower.

OR

Draw the diagram of a flower and label the four whorls. Write the names of gamete producing organs in the flower.

Ans.



Male gemete forming organ - Anther/Stamen

Female gamete forming organ - Pistil/Ovary/ Ovule

NS. 8

What are the different methods of contraception?

OR

What are the various ways to avoid pregnancy? Elaborate any one method.

Ans. A number of preventive methods or devices have been developed to prevent unwanted pregnancy. These methods are broadly categorised as:
(i) Barrier methods,
(ii) Chemical methods,
(iii) Surgical methods.

(i) Barrier methods: In these methods, physical devices such as condoms,diaphragms and cervical caps are used.These devices prevent the entry of sperm into the female genital tract, thus acting as a barrier between them.

(ii) Chemical methods: This category of contraceptives acts by changing the hormonal balance of the body so that eggs are not released and fertilisation cannot occur. Females use two types of pills for preventing pregnancies: oral pills and vaginal pills.
The oral pills contain hormones which stop the ovaries from releasing ovum into the ; fallopian tube. This is also called oral contraceptives (OC). Other contraceptive devices such as loop or the copper-T are placed in the uterus to prevent pregnancy.

(iii) Surgical methods: In males, a small portion of the sperm duct (vas deferens) is blocked by surgical operation. This prevents the sperms from coming out. Whereas in females, a small portion of the fallopian tubes (oviducts) is blocked by surgical operation. It prevents the egg to reach uterus. In both the cases, fertilisation will not take place.

NS. 9

How are the modes of reproduction different in unicellular and multicellular organisms?

Ans. The unicellular organisms have only one cell. There is no separate tissue for reproduction. So, they can reproduce asexually by the process of fission (binary or multiple) or budding as in yeast. On the other hand, the multicellular organisms, contain various cells and have separate systems for reproduction. So, they can reproduce by both sexual and asexual reproduction.

NS. 10

How does reproduction help in providing stability to the populations of species?

Ans. The consistency of DNA copying during reproduction is important for maintenance of body design features that allow the organism to live in a particular area. This consistency of DNA copying provides stability to the populations of species.
Reproduction is responsible for continuation of a species. Stability to populations of species is attained by equalising the birth and death ratio of individuals. Birth is possible only due to reproduction.

NS. 11

What could be the reasons for adopting contraceptive methods?

Ans. The reasons for adopting contraceptive methods are:
(i) Protection from sexually transmitted diseases.
(ii) Restricting the number of children in a family.
(iii) Sufficient gap between successive births.
(iv) Enjoying a good reproductive health.
(v) Controlling population.

EXERCISE – I

ONLY ONE CORRECT TYPE

1. Binary fission occurs in -
(A) Amoeba (B) Paramecium
(C) Leishmania (D) All the above

2. Multiple fission occurs in -
(A) Plasmodium (B) Paramecium
(C) Bacteria (D) Euglena

3. Bryophyllum can multiply vegetatively by -
(A) Leaves (B) Aerial stems
(C) Underground stems (D) Roots

4. Sugarcane is multiplied by -
(A) Seeds (B) Root cuttings
(C) Stem cuttings (D) Leaves

5. Potato is grown from -
(A) Cutting of aerial stems
(B) Cutting of tubers having depressions
(C) Cuttings of tubers without depressions
(D) Cuttings of roots

6. The grafted portion of a plant is called -
(A) Stalk (B) Stock
(C) Layer (D) Scion

7. Grafting is most successful in -
(A) Dicots (B) Monocots
(C) Pteridophytes (D) Bryophytes

8. Jasmine is multiplied vegetatively through -
(A) Stem cutting (B) Leaves
(C) Root cutting (D) Layering

9. Yeast multiplies by -
(A) Binary fission (B) Budding
(C) Multiple fission (D) All the above

10. Spirogyra multiplies by -
(A) Budding (B) Regeneration
(C) Fragmentation (D) Both A and B

11. Hydra cut into a number of pieces will -
(A) Die
(B) Sporulate
(C) Develop sex organs
(D) Regenerate to form new individuals

12. Budding is a method of asexual reproduction in -
(A) Planaria (B) Hydra
(C) Rhizopus (D) Amoeba

13. In flower the male organ is -
(A) Stamen (B) Carpel
(C) Sepal (D) Petal

14. Receptive part of carpel is -
(A) Placenta (B) Ovary
(C) Stigma (D) Style

15. On germination each pollen grain produces -
(A) One male gamete
(B) Two male gametes
(C) Three male gametes
(D) Four male gametes

16. Fertilization in flowering plants produces -
(A) Embryo (B) Endosperm
(C) Nucellus (D) Both A and B

17. Seed is formed from -
(A) Unfertilised ovary (B) Fertilised ovary
(C) Fertilised ovule (D) Unfertilised ovule

18. Which is shed in a fertilized flower ?
(A) Stamens (B) Petals
(C) Style and stigma (D) All the above

19. Gonads form -
(A) Sex organs (B) Gametes
(C) Sex hormones (D) Both B and C

20. Mucosal lining of uterus is -
(A) Mesometrium (B) Endometrium
(C) Epimetrium (D) Epidermis

21. Ovum is fertilized in -
(A) Vagina (B) Uterus
(C) Fallopain tube (D) Ovary

22. Gestation period in human is -
(A) 270 days (B) 290 days
(C) 200 days (D) 245 days

23. Which one is a mechanical barrier to conception ?
(A) Oral pill (B) Norplant
(C) Abortion (D) Condom

24. An IUCD device is -
(A) Copper T (B) Condom
(C) Cervical cap (D) Vasectomy

MATCH THE COLUMN TYPE

25.

Column I	Column II
(P) Calyx	(1) Ovary
(Q) Corolla	(2) Sepal
(R) Stamen	(3) Stigma
(S) Carpel	(4) Petal
	(5) Anther
	(6) Filament

(A) P → 2, Q → 4 R → 5, 6, S → 1, 3

(A) P → 1, Q → 2 R → 3, 5, S → 4, 6

(A) P → 3, Q → 1 R → 2, 5, S → 4, 6

(A) P → 2, Q → 5 R → 4, 6, S → 1, 3

Space for Notes :

EXERCISE – II

VERY SHORT ANSWER TYPE

1. What is multiple fission ?
2. Define fragmentation ?
3. What is regeneration ?
4. Define budding ?
5. Define layering ?
6. Define grafting ?
7. What is sexual reproduction ?
8. What are gametes ?
9. Define fertilization.
10. What are essential floral organs ?

SHORT ANSWER TYPE

1. Write a note on human fallopian tubes.
2. Differentiate between menarche and menopause
3. Distinguish vasectomy from tubectomy.
4. What is significance of sexual reproduction ?
5. Differentiate self pollination and cross pollination?
6. Distinguish pollination from fertilization.
7. Describe multiple fission.
8. Describe budding in yeast.
9. Describe budding in Hydra.
10. Differentiate between fission and budding.

LONG ANSWER TYPE

1. Describe male reproductive system of humans.
2. Describe menstrual cycle.
3. Describe the various methods of contraception.
4. Describe the structure of a flower
5. Write a note on pollination in flowering plants.
6. Describe the process of fertilization in flowering plants.
7. Describe the methods of asexual reproduction in multicellular organisms.
8. Describe the natural methods of vegetative reproduction. Write down its importance.

TRUE / FALSE TYPE

1. In asexual reproductions, clones are formed.
2. Stoppage of menstruation permantely is called Menarche.
3. Anthers is a trilobed structure.
4. Bird Pollination is also called as ornithophily.
5. In human males , there is the common passage for both urine and sperms.

FILL IN THE BLANKS

1. In Rhizopus asexual reproduction takes place by ..... formation.
2. In Bryophyllum vegetative propagation takes place through their .....
3. The process in which new organisms are formed by existing organism is called .....
4. In Spirogyra, asexual reproduction, takes place by .....
5. Natural vegetative propagation takes place in sweet potato by .....

Answer Key

EXERCISE–I														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	A	A	C	B	D	A	D	B	C	D	B	A	C	B
16	17	18	19	20	21	22	23	24	25					
D	C	D	D	B	C	A	D	A	A					

EXERCISE – II

TRUE/FALSE TYPE

1. T **2.** F **3.** F **4.** T **5.** T

FILL IN THE BLANKS

1. Spore **2.** Leaf **3.** Reproduction **4.** Fragmentation **5.** Root

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : REPRODUCTION)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

NOTES :

1. In the status, put "completed" only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.

Space for Notes :

LIFE PROCESS & NUTRITION

2

Concepts

INTRODUCTION

All the living organisms including human beings perform a number of activities such as nutrition, respiration, excretion, growth and reproduction. These activities are characteristics of living organisms, and through such activities they maintain their lives. These maintenance function of living organisms are known as **life processes.**

Chemical reactions which take place within cells or organisms during various vital activities are called **biochemical reactions**.

Metabolism is a word used to describe the sum total of all the chemical and physical changes that are constantly taking place in living matter and are necessary for life. The word **metabolite** refers to a substance which undergoes various changes during metabolism. For example, carbon dioxide and water are metabolites used in the process of photosynthesis.

The metabolic pathways are of two types :

1. ANABOLIC PATHWAYS OR BIOSYNTHETIC PATHWAYS

Anabolic pathways or **biosynthetic pathways** in which biosynthesis of organic compounds occurs, or in other words, complex substances are synthesized from simpler ones ; for example photosynthesis.

1.1 CATABOLIC PATHWAYS

Catabolic pathways in which the breakdown of complex organic substances into simpler ones occurs (as in respiration)

In anabolic pathways or processes of **anabolism** energy is used **(endothermic reactions)**, while in catabolic pathways or **catabolism**, energy is released **(exothermic reactions)**.

Following Criteria to define if something is alive :-

(a) Nutrition :- The processes by which the organisms obtain and utilise the nutrients (food).

(b) Respiration :- The process that involves breakdown of respiratory substrates through oxidation and release of usable energy.

(c) Transport :- The process in which the substances absorbed or synthesized in one part of the body are carried to other parts of the body.

(d) Excretion :- The process involved in removal of the excess or toxic wastes from the body.

(e) Control and coordination :- The process which helps the living organisms to receive information from the surroundings and behave accordingly in order to survive in the changing environment around them.

(f) Cellular organisation :- Body of all living organisms is made of cells. It is defining character of alive.

(g) Movement and Locomotion

(h) Consciousness :- All organisms from prokaryotes to eukaryotes can sense and respond to environmental factors.

2. NUTRITION

Nutrients are inorganic as well as organic substances which the organisms obtain from their surroundings in order to synthesize their body constituents and use them as a source of energy.

The process of intake of nutrients and its utilization by an organism in various biological activities.

OR

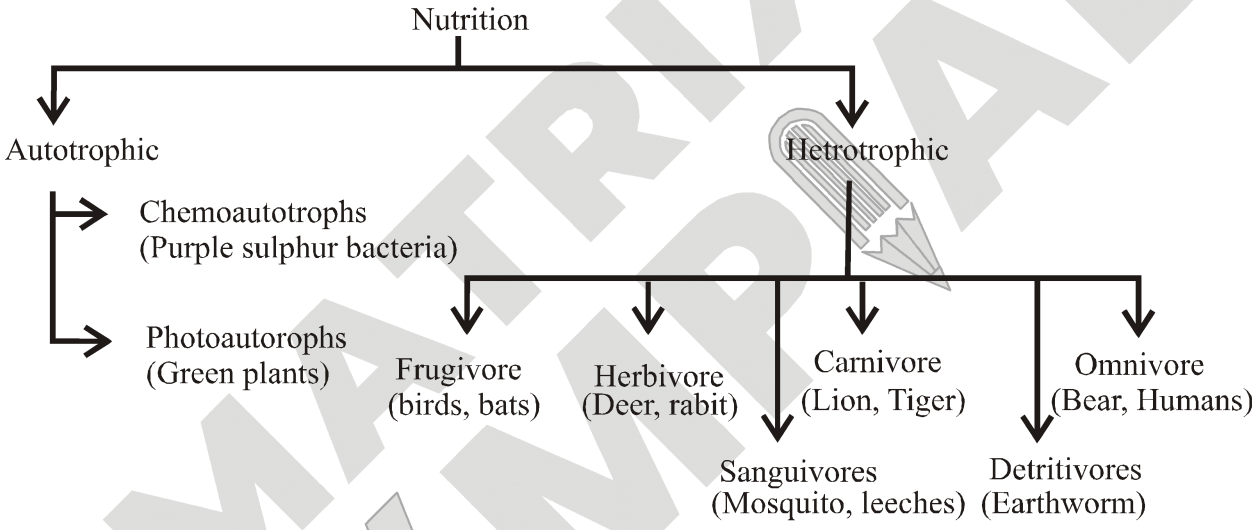
A process to transfer a source of energy from outside the body of the organism (food), to the inside is called nutrition.

Focus Point

There are various types of nutrients on the basis of function they perform :-
e.g. Energy foods :– Carbohydrates and fats.
Body building foods :– Proteins and mineral salts.
Regulating foods :– Vitamins and minerals.

2.1 MODES OF NUTRITION

Method of obtaining food by the organism is called mode of nutrition



Autotrophic nutrition

The mode of nutrition in which the organisms prepare (or synthesize) their own organic food by using inorganic raw material (CO_2 & H_2O). They are also called **autotrophs.**
e.g. Plants, Photosynthetic and chemosynthetic bacteria and cyanobacteria etc.

Heterotrophic nutrition

The mode of nutrition in which the organisms derive their nutrition from other organisms. They take ready made organic food from other dead or living plants or animals. The living organisms showing heterotrophic nutrition, are called **heterotrophs.**
e.g. All animals, fungi, many bacteria and some non-green plants (insectivorous plants) and man.

2.2 TYPES OF HETEROTROPHIC NUTRITION

Depending upon the mode of obtaining food, the heterotrophic nutrition is of following types :
(a) Holozoic nutrition (Holo-Complete + Zoon-animal)
The mode of nutrition in which all animals take in complex solid food material is called holozoic nutrition.

It contains following steps :-

→ **Ingestion :-** Taking in complex organic food through mouth opening.

→ **Digestion :-** Change of complex food into simple diffusible form by the action of enzymes.

→ **Absorption :-** Passing of simple, soluble nutrients into blood or lymph.

→ **Assimilation :-** Utilization of absorbed food for various metabolic processes.

→ **Egestion :-** Expelling out the undigested food.

e.g. All animals including vertebrates and Invertebrates.

Focus Point

✯ Depending upon the **type of the food habit**, animals are divided into three categories :-

(i) Herbivores :– Animals that depend up on green plants are known as herbivores.

e.g. Goat, Cow, Deer, Rabbit.

(ii) Carnivores :– Animals which eat flesh of other animals as food are called as carnivores.

e.g. Lion, Tiger.

(iii) Omnivores :– Animals which eat both plants and animals as food are known as omnivores.

e.g. Rat, Pigs, Crows, Cockroaches and Humans.

(b) Saprotrophic (Sapro - Rotten ; Trophos - Feeder) Nutrition :– In this type of nutrition the organisms obtain their food from decaying organic substances. Organisms are also called **saprotrophs**.

e.g. Bacteria, Fungi.

(c) Parasitic nutrition (para-other) :–

The mode of nutrition in which one organism (called parasite) derive its food from other living organism (Host) is called parasitic nutrition. e.g. Tape worm, *Ascaris*, *Plasmodium*, Liver flukes, *Cuscuta* etc.

DIFFERENCES BETWEEN AUTOTROPHIC & HETEROTROPHIC NUTRITION :-

Characters	Autotrophic Nutrition	Heterotrophic nutrition
(1) Source of Energy	Sunlight or chemical energy	Readymade food
(2) Mode of Nutrition	Photosynthesis or Chemosynthesis plants or animals	Feeding upon dead or living
(3) Occurrrence	Found in green plants, Blue-green algae, certain Bacteria	Found in Animals, fungi, Most of the bacteria

DIFFERENCES BETWEEN HOLOZOIC AND SAPROTROPHIC NUTRITION :-

Feature	Holozoic nutrition	Saprotrophic nutrition
1. Nature of food	Solid food (Whole plant or animal or their parts) is ingested	Liquid food (Dead and decaying organic matter) is ingested
2. Site of digestion	Inside the body	Outside the body as enzymes are released on the food material that convert solid food into simple soluble form
Examples	Most of the Animals	**Fungi –** Yeast

Focus Point

Animals which depend upon the blood of other animals known as **sanguivores.**
e.g. Bedbug, Mosquito, Leech etc.
Mutualistic nutrition :– The mutualistic nutrition can be defined as the interdependent nutrition in which each organism is dependent mutually on the other.
e.g. The lichens share mutualistic nutrition between a fungus and a Algae.

2.3 NUTRITION IN UNICELLULAR ORGANISMS (EXAMPLE – AMOEBA)

Food – *Amoeba* is a holozoic and omnivorous animal. It feeds upon microscopic organisms like bacteria, Paramecium, Diatoms, Algae and dead organic matter.
Mechanisms. Nutrition in *Amoeba* involves the following steps:
(i) Ingestion:– *Amoeba* has no mouth, so ingestion may occur at any point of body surface but generally it occurs at the advancing end of the body. Ingestion occurs with the **help of pseudopodia**. The opening of food cup gradually becomes narrower and narrower, and finally closes. So the food is finally enveloped and taken inside a **food-vacuole** (called **phagosome**) along with a drop of water.
(ii) Digestion:– *Amoeba* shows **intracellular** and **vacuolar digestion**. In the cytoplasm, food vacuole fuses with lysosomes containing digestive enzymes. In this , the complex and non-diffusible nutrients are changed into simple and diffusible nutrients. Medium inside the food vacuole is **first acidic but later becomes alkaline**, (as in the alimentary canal of man).
(iii) Absorption and assimilation :– In absorption, the diffusible nutrients pass through vacuolar membrane into cytoplasm by diffusion and are then distributed to all the body parts by **streaming movements** of cytoplasm called **cyclosis**. Due to this, the size of food vacuole gradually decreases.
In the cytoplasm, a part of the absorbed food is oxidised to produce energy, most of simple nutrients are combined to synthesize complex compounds.
(iv) Egestion :– *Amoeba* has no anus, so egestion may occur at any point on the body surface.

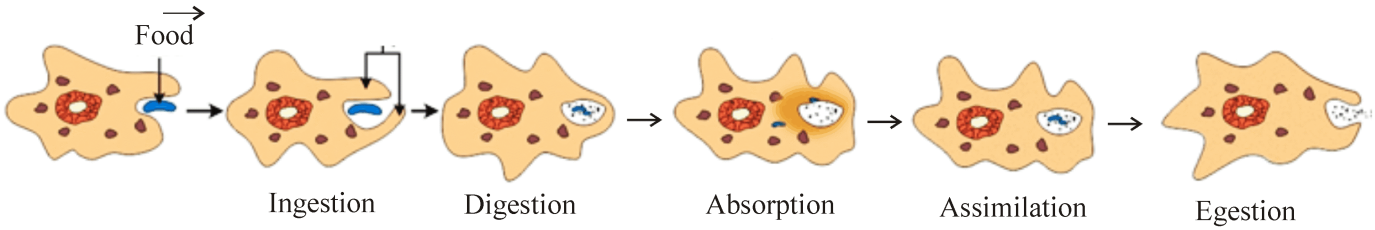


Figure : Digestion in Amoeba

Focus Point

(a) Food :- The substance which is palatable, delicious enough and energy provider is called food. Chemically food consists of six essential components :-
(i) Carbohydrates (ii) Fats (iii) Proteins (iv) Minerals (v) Vitamins (vi) Water
(b) Intracellular and Extra-cellular Digestion :-
Intracellular Digestion : This type of digestion occur inside the cell cytoplasm. The food inside the cell occurs as food vacuole. The digestive enzyme in this case are secreted inside the cell. They digest the contents of the food vacuole. So the entire process of digestion occurs inside the cell. e.g. Protozoans *[Amoeba]*, Sponges
Extracellular Digestion :- Extra cellular digestion is a process in which saprobionts feed by secrecting enzymes through the cell Membrane onto the food .The enzyme catalyze the digestion of the food into molecules small enough to be taken up by diffusion, transport and phagocytosis.
eg. Hydra and sea anemone.

3. DIGESTIVE SYSTEM OF HUMAN

Human digestive system consists of the alimentary canal and digestive glands and it involves mastication, swallowing, digestion of food and elimination of undigested matter.

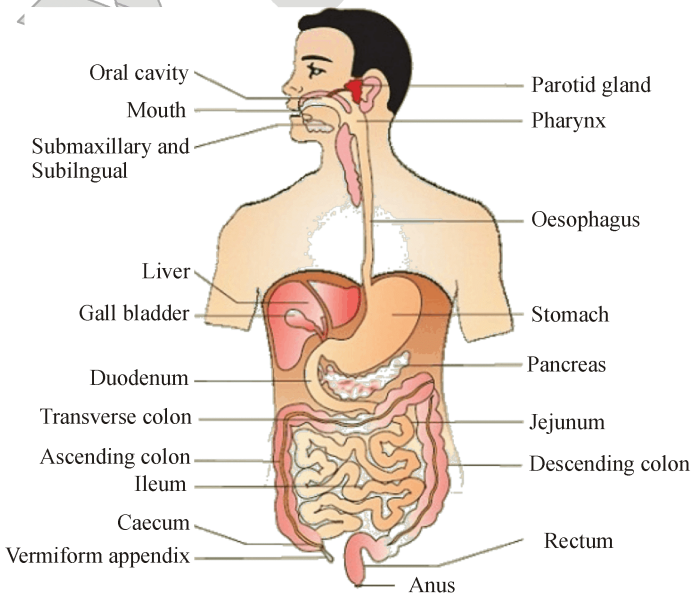


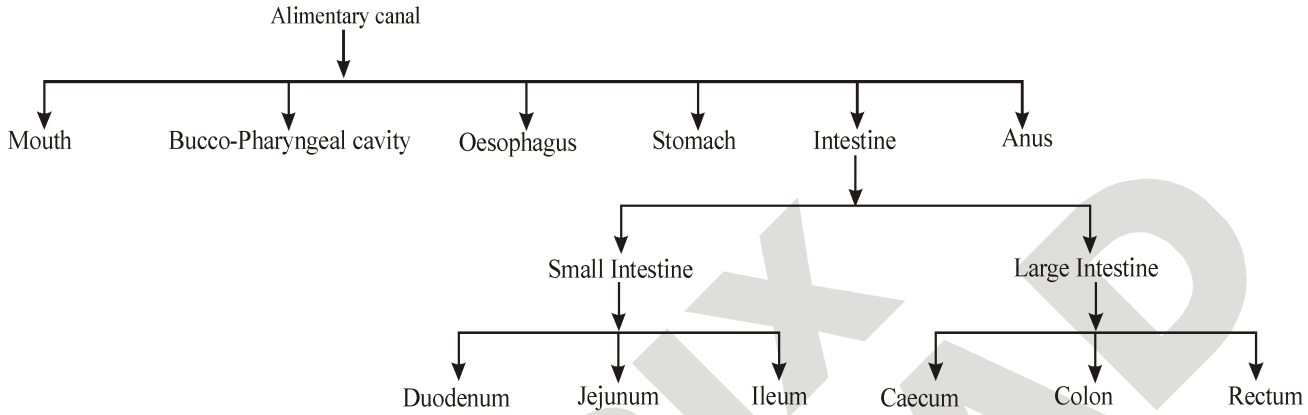
Figure : Digestive system of human

It consists two parts :-

3.1 ALIMENTARY CANAL

The alimentary canal is basically a long tube extending from the mouth to the anus.

It is differentiated into following parts.



MOUTH

It is a transverse slit bounded by movable lips. The lips serve to close and open mouth, holding the food in between and also help in speaking.

BUCCOPHARYNGEAL CAVITY / MOUTH CAVITY

Mouth leads into the **mouth cavity** or **oral** or **buccal cavity**. The roof of mouth cavity is formed by palates i.e., **hard** and **soft palate**, the floor by **tongue** and the sides by the **cheeks**. The other conspicuous structures are the **teeth** and **salivary glands**.

(a) Tongue :– The floor of the mouth cavity is occupied by muscular, large, mobile tongue. It remains attached on its under surface to the floor by fold of mucous membrane called the **lingual frenum**. The tongue is covered with mucous membrane and its upper surface is raised into **lingual papillae** which contain microscopic taste buds.

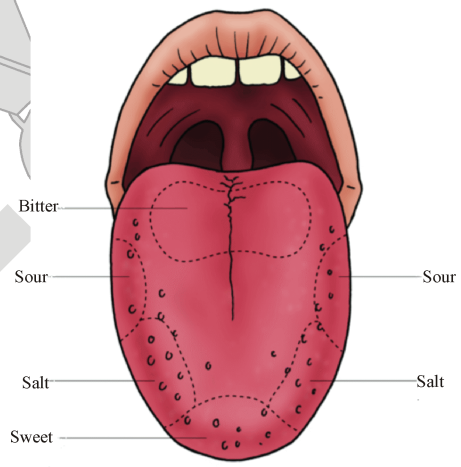


Figure : Tongue

Functions of tongue :-

- It acts like a spoon during ingestion of food.
- It brings food under teeth for mastication
- It moves food in buccal cavity for mixing of saliva.
- It helps in swallowing food.
- It cleans teeth by removing small food particles from their surface.
- It helps in speaking.
- It is the main organ of taste.
- It keeps the mouth moist by the secretion of both mucus and serous or water like fluid.
- In dogs during panting it helps in thermoregulation by quick evaporation of water of saliva.
- In some mammals tongue is used to clean skin by licking.

(b) Teeth :– Thecodont (Teeth present in bony socket), Heterodont (Teeth are of four types) and diphyodont (Teeth that come two time in life). Teeth are present in human body.

Teeth are of following types :

(i) Incisors – Biting the food.

(ii) Canines – Wearing and tearing of food.

(iii) Premolars – Crushing and grinding the food.

(iv) Molars – Crushing and grinding the food.

Dental Formula

(i) Milk teeth/ Primary

(ii) Permanent teeth

$$\frac{\text{No. of teeth in half part of upper jaw}}{\text{No. of teeth in half part of lower jaw}} \times 2 = x$$

- In child $\rightarrow I\frac{2}{2}, C\frac{1}{1}, Pm\frac{0}{0}, M\frac{2}{2} = \frac{5}{5} \times 2 = \text{Total } 20 \text{ teeth}$

- In Man $\rightarrow I\frac{2}{2}, C\frac{1}{1}, Pm\frac{2}{2}, M\frac{3}{3} = \frac{8}{8} \times 2 = \text{Total } 32 \text{ teeth}$

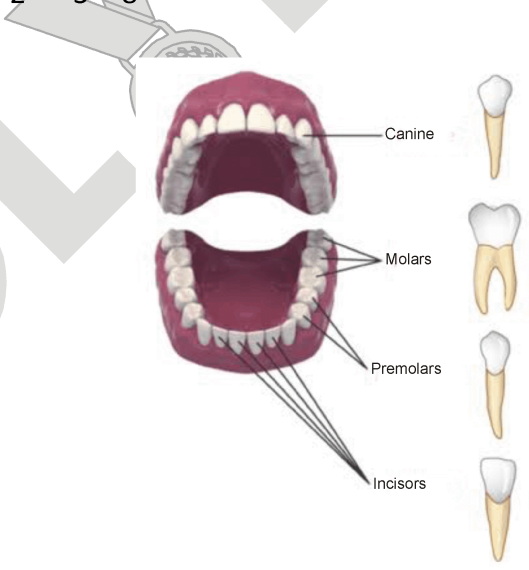


Figure : Various types of parmanent teeth of man

PHARYNX

The buccal cavity opens into a short narrow chamber called **pharynx or throat**. Pharynx is incompletely divided into three parts by soft palate – the nasopharynx dorsal to the soft palate, oropharynx below the soft palate and laryngopharynx into which both these parts communicate round the freely hanging uvula. The oropharynx and laryngopharynx are associated with swallowing. The laryngopharynx communicates with oesophagus through gullet and with larynx through glottis. The glottis is guarded by an elastic and muscular flap called epiglottis which closes glottis during swallowing to prevent food from entering into wind pipe. Thus pharynx serves two ways –

(i) as a passage between nose and wind pipe (trachea

(ii) as food passage between mouth cavity and oesophagus. Resonance of voice also occurs due to pharynx.

OESOPHAGUS (FOOD PIPE)

It conducts the food by **peristalsis** (Wave like movement).

The oesophagus is a 25-30 cm long, leading from the pharynx to stomach. It runs down the neck, behind trachea and through thorax, finally piercing the diaphragm to open into stomach. The upper 1/3rd part is composed of voluntary muscles and the lower 2/3rd of involuntary muscles. The muscular coat has a peristaltic action for driving the food towards the stomach. There are no digestive glands but only mucous glands in oesophagus.

STOMACH

It is a thick, muscular and J-shaped sac present on the left side of upper part of abdomen. Beneath diaphragm lying to the left side of abdomen is J-shaped stomach. It is the widest part of alimentary canal, size and shape of which varies according to the contents and sex. It can be distinguished into three regions – Fundic part, Body part and Pyloric parts. The exit is guarded by a pyloric sphincter. The partly digested paste like food is forced into intestine through pyloric sphincter, due to peristaltic waves of stomach.

Functions of Stomach :-

- Temporary storage of food.
- Partial digestion of food by gastric juice.
- Churning of food.
- The stomach regulates the flow of partially digested food into the small intestine.

INTESTINE

It distinguished into two parts :-

(a) Small Intestine

(b) Large Intestine

(a) Small intestine :– It is a long (about 6 meter) narrow (average diameter 4 cm), tubular and coiled part. It is differentiated into anterior duodenum, middle jejunum and posterior ileum. It is mainly concerned with completion of digestion and absorption of food.

(i) Duodenum : This proximal part starts after pyloric end of stomach. It is about 25 cm long lying against the posterior abdominal wall. It is curved like 'C' or a horseshoe and ends behind the stomach. A common bile duct and a pancreatic duct opens in middle of 'C' of duodenum by a common aperture over a raised area called ampulla of vater.

(ii) Jejunum : The Jejunum (a latin word meaning empty) is so called because it is always found empty after death.

(iii) Ileum : It is the last part of small intestine.

Small intestine designed to absorb digested food as :

- It is lengthy about 6 meters.
- Inner lining has two types of folds called villi and microvilli.
- Each villus has blood capillaries and a lymph capillary.

(b) Large intestine :–It is shorter (about 1.5 meter) and wider (Average diameter 6 cm) than small intestine. It is differentiated into caecum, colon and rectum. It is the site of aborption of water from digested food. It helps in formation and temporary storage of faeces.

ANUS

It lies at the base of trunk and is for egestion.

3.2 DIGESTIVE GLANDS

They secrete digestive juices which contain digestive enzymes. These are of following types.

SALIVARY GLANDS

In man, there are three pairs of salivary glands. These secrete saliva which contains a digestive enzyme called **ptyalin** or **Salivary amylase**.

- Parotid gland
- Submaxillary
- Sublingual glands

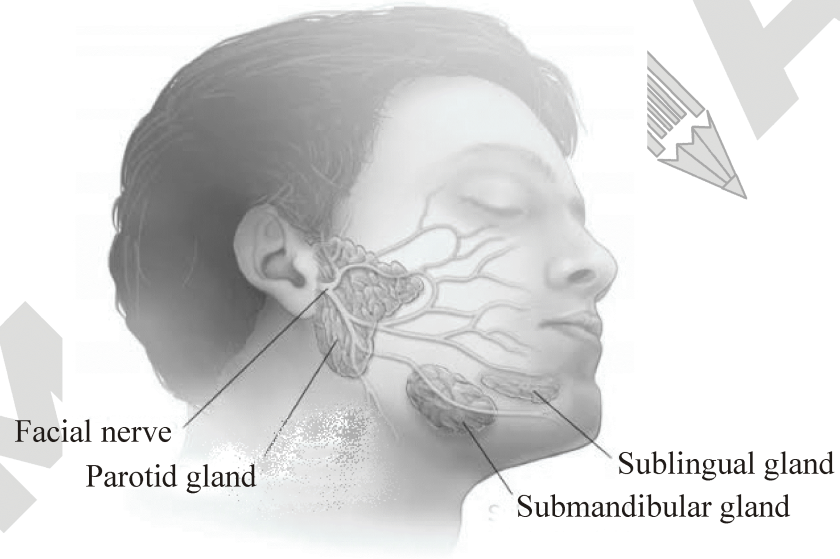


Figure : Salivary glands

Focus Point

- Saliva is an antiseptic as it kills germs and bacteria due to presence of an enzyme called **Lysozyme**. Saliva makes the food soft, slippery and helps in digestion of starch due to presence of salivary amylase enzyme.
- Our mouth starts **watering on eating** food of our interest. This water is basically the saliva secreted by the salivary gland which get activated on eating or seeing or thinking of a food.
- Involuntary contraction & relaxation movement is called **peristalsis**.

GASTRIC GLANDS

Gastric glands are present in the wall of stomach and secrete gastric juice.

LIVER

It is lobed and reddish-brown coloured largest gland of body present in the right side of upper part of the abdomen. It synthesize and secretes bile juice. Gall bladder is present below the right lobe of liver. It stores and secretes bile.

PANCREAS

It is a yellow- coloured heterocrine gland present just behind the stomach. It secretes pancreatic juice. Pancreatic duct carries pancreatic juice to small intestine.

It also secretes two hormones : Insulin and Glucagon.

INTESTINAL GLANDS

These lie in the wall of small intestine and secrete intestinal juice (Succus entericus).

3.3 PHYSIOLOGY OF NUTRITION

INGESTION

Man is **omnivorous** in feeding and is **holozoic**.

Ingestion involves carrying the food to the mouth with the help of hands and cutting of food with incisors or canines depending upon the nature of food.

DIGESTION

In man, digestion is started in **buccal cavity** and completed in **intestine**.

(a) In buccal cavity :– Here, food is chewed with the help of premolars and molars which increases the rate of action of **salivary amylase**. Food is mixed with saliva of salivary gland.

$$\text{Starch} \xrightarrow[6.8\ PH, Cl^-]{\text{Salivary amylase}} \text{Maltose}$$

(b) In stomach :–

Food is mixed with gastric juice which contains mucus, hydrochloric acid, pepsin, rennin and a weak lipase enzyme.

Mucus, lubricates the food and protects the inner lining of the stomach from the action of acids.

Functions of Hydrochloric acid

- Stops the action of salivary amylase in stomach.
- Kills the bacteria present in the food.
- Activates pepsin.
- Provides acidic medium.

Pepsin hydrolyses proteins into proteoses and peptones.

Lipase enzymes hydrolyses small amounts of fats into fatty acids and glycerol.

Curdling of milk is done by the enzyme **rennin**. (Rennin is not found in human beings, it found only in cattles).

Digestion of proteins in man starts from stomach. In buccal cavity there is no digestion of proteins because saliva contains no proteolytic (protein digesting) enzyme.

(c) In small intestine :–

The small intestine is the site of the **complete digestion** of carbohydrates, proteins and fats.

Food is mixed with three **digestive juices**, bile juice, pancreatic juice and intestinal juice.

Bile juice provide **alkaline medium** and **emulsifies fats** [conversion of larger fat globules into smaller fat droplets] but is a non enzymatic digestive juice so has no chemical action on food.

Pancreatic juice contains **trypsin, pancreatic amylase and pancreatic lipase** enzymes which digest the peptones, starch and fats into peptides, maltose and fatty acids.

Intestinal juice contains **aminopeptidase, intestinal amylase, maltase, sucrase and lipase** enzymes:–

Peptides $\xrightarrow{Aminopeptidase}$ Amino acid

Maltose $\xrightarrow{Maltase}$ Two glucose

Fats $\xrightarrow{Lipase}$ Fatty acid + Glycerol

Lactose $\xrightarrow{Lactase}$ Glucose + Galactose

Sucrose $\xrightarrow{Sucrase}$ Glucose + Fructose

ABSORPTION

Absorption of the digested food occurs through the epithelial surface of the villi & microvilli of small intestine.

- Inner surface of small intestine is raised into 4 millions of finger-like folds called **villi**.
- Each cell of villus is with electron microscopic processes called **microvilli**.
- Each villus is with blood capillaries and a lymph capillary.

ASSIMILATION

It is a process by which absorbed nutrient are utilized to resynthesize complex molecules like carbohydrates, proteins and fats inside the cells.

EGESTION

Removal of waste products from the body is known as **egestion**.

Focus Point

(a) Emulsification :- Emulsification is the phenomenon of physically breaking of large sized fat globules into large number of fat droplets by the bile-salts of the bile juice. This increases the surface area for digestion of fats by the lipase enzyme.

(b) Alimentary Canal :- The digestive canal where the entire process of digestion is accomplished, called alimentary canal.

⇒ The alimentary canal of herbivores is longer than the alimentary canal of carnivores, because herbivores have to digest the cellulose, which is difficult to digest.

⇒ The harbivorous animals like cow which eat grass need a longer 'small intestine' to allow the cellulose present in grass to be digested completely.

⇒ The carnivorous animals like tigers which eat meat have a shorter small intestine.

TABLE : DIGESTIVE GLANDS, THEIR SECRETIONS & ACTION

Name of Gland	Secretion	Enzyme	Site action	Substrates	Products
Salivary Glands	Saliva	Salivary Amylase	Buccal cavity	Starch	Maltose, Isomaltose
Gastric glands	Gastric Juice	(a) Pepsin (Pepsinogen inactive)	Stomach	Protein	Peptones
		(b) Rennin (Prorennin inactive)	Stomach	Casein	Paracasein
Pancreas	Pancreatic Juice	(a) Pancreatic Amylase	Small intestine	Starch Glycogen	Maltose, Isomaltose
		(b) Trypsin (Trypsinogen inactive)	Small intestine	Proteins	Peptides
		(c) Chymotrypsin (Chymotrypsinogen inactive)	Small intestine	Casein (milk)	Paracasein
Intestinal gland (Crypts of Lieberkuhn)	Intestinal juice	(a) Enterokinase (Hormone	Small intestine	Trypsinogen (inactive)	Trypsin (active)
Amino		(b) Aminopeptidase	Small intestine	Peptides	Smaller peptides acids
		(c) Dipeptidases	Small intestine	Dipeptides	Amino acids
		(d) Isomaltase	Small intestine	Isomaltose	2 Glucose
		(e) Maltase	Small intenstine	Maltose	2 Glucose
		(f) Sucrase	Small intestine	Sucrose	Glucose, Fructose
		(g) Lactase	Small intestine	Lactose	Glucose, Galactose
		(h) Lipase	Small intestine	Triglycerides	Monoglycerides,Fatty acids
Liver	Bile (Bile + pigments)	No enzymes	Duodenum	Fats	Fat droplets

4. NUTRITION IN PLANTS

Green plants are autotrophic. They synthesize their own food by the process of photosynthesis.Autotrophic plants are able to produce food so they are known as producers.

Focus Point

First true and oxygenic photosynthesis starts in cyanobacteria (blue green algae). 90% of total photosynthesis is carried out by hydrophytes (mostly marine algae). "The process of absorption and conversion of light energy into chemical energy by green plants is called as photosynthesis". This chemical energy is stored in the form of adenosine triphosphate (ATP) and reduced nicotinamide adenine dinucleotide phosphate ($NADPH_2$).

4.1 PHOTOSYNTHESIS

Photosynthesis is a process by which green plants synthesize organic food (carbohydrate) from carbon dioxide and water using solar energy by chlorophyll pigments. The sugar produced is stored in the form of starch in plants.

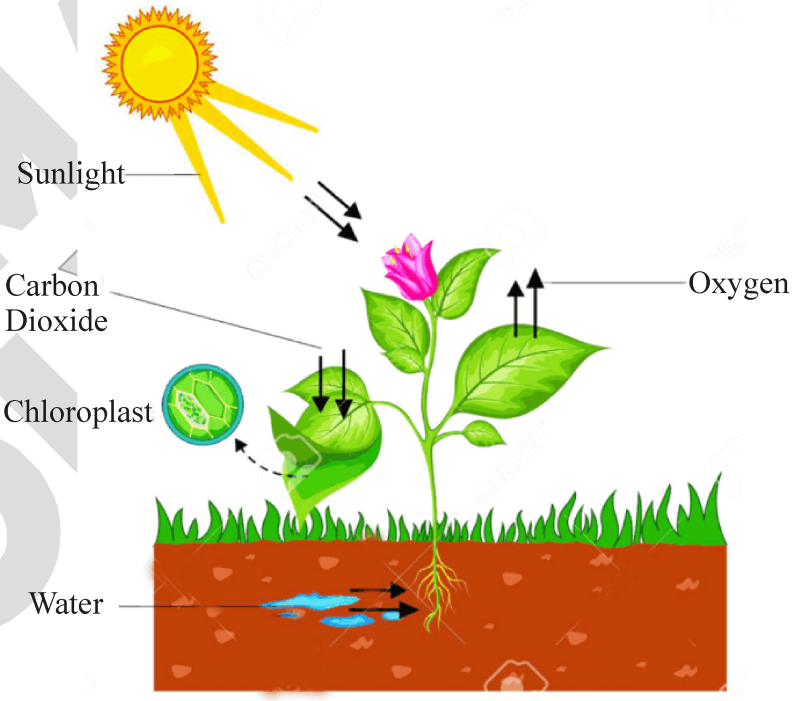


Figure : Photosynthesis

IMPORTANTCE OF PHOTOSYNTHESIS

Photosynthesis is an anabolic process in nature for providing food supply to the living organisms.

It purifies the atmospheric air, by consuming CO_2 and evolving oxygen.

The over all equation of photosynthesis is :–

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

Requirements for photosynthesis :-

⇒ **Sunlight** ⇒ **Photosynthetic pigment**

⇒ **Carbondioxide** ⇒ **water**

CO_2 and water work as raw materials which are obtained from the atmosphere and the soil respectively.

(a) Sunlight :- Sun is a natural source of light for photosynthesis. Sunlight is an electromagnetic spectrum. Photosynthetic pigments absorb only visible/white light from electromagnetic spectrum.

White light (380 nm to 760 nm) is composed of wavelength of seven different colours violet, indigo, blue, green, yellow, orange and red (VIBGYOR).

PAR (Photosynthetically Active Radiation) : 400nm to 700nm.

Focus Point

Types of chlorophyll :-

There are six different types of chlorophyll : Chl.–a, Chl.–b, Chl.–c, Chl.–d, Chl.–e and bacteriochlorophyll.

Beside chlorophyll certain other pigments are also present in plants like -

Carotenoid → Carotenes (orange colour) and xanthophylls (yellow colour).

Phycobilins : It is present in Blue- green algae and Red algae etc.

(b) Photosynthetic pigment :- These are chlorophylls carotenoids (carotenes and xanthophylls) and phycobilins. These pigments absorb only visible light. Chl-a and b absorb only blue and red light and reflect green light.

Focus Point

Compensation point

The intensity of light at which amount of CO_2 used during photosynthesis becomes equal to the amount of CO_2 released during respiration by plants is called as compensation point.

Compensation point occurs at low light intensity that is during morning and during evening hours.

The structure of guard cells in monocots is dumb-bell shaped.

(c) Carbondioxide :

All the plants need carbondioxide to form carbohydrates. The carbon dioxide is obtained by the plants from the

atmospheric air. In the terrestrial plants, the CO_2 enters into the cells of leaves through tiny pores called **stomata** which always remain present on the surface of leaves.

STOMATA

These are tiny pores or microscopic aperture guarded by two kidney shaped or bean shaped guard cells.

Functions :-

⇒ Massive amount of a gaseous exchange take place in the leaves through stomata.

Exchange of gases also occurs across the surface of stem, root and leaves.

⇒ Large amount of water is lost through stomata.

Guard cells :- These are kidney shaped cells which cover single stoma. They contain chloroplast also.

Function :- They regulate the opening and closing of the stoma and also perform photosynthesis.

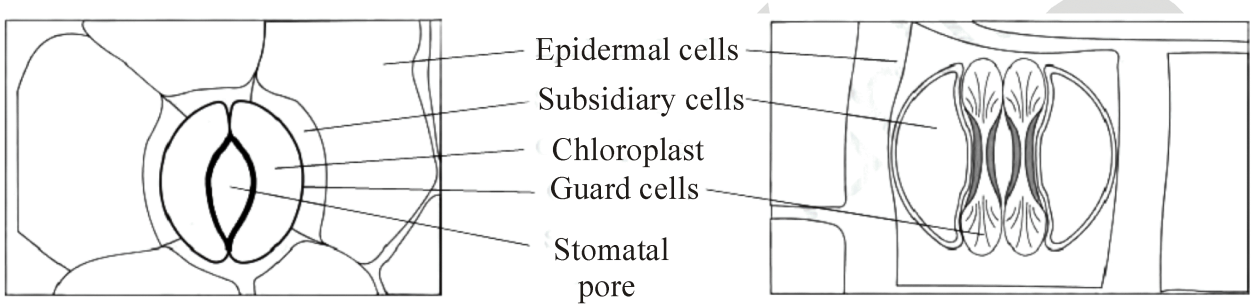


Figure : Open and Closed stomata

OPENING AND CLOSING OF STOMATA

When the guard cells swell due to the entry of water, the stomata gets opened. But when the guard cells shrink due to the loss of water, the stomata gets closed.

Focus Point

Desert plants take up CO_2 at night and prepare an intermediate which is acted upon by the energy absorbed by the chlorophyll during the day and form glucose.

In aquatic plants, CO_2 is obtained from the water where it remains present in dissolved form. Such plants absorb carbondioxide in solution form, all over their surface from the surrounding water.

(d) Water : Water is always needed by the plants for its use during photosynthesis.

Inside the chloroplasts of the leaves, the water molecules split into hydrogen and oxygen with the help of light energy of solar light.

Some mineral salts like N, P, K, Fe, Mg required by the plants are also transported to different parts of the plant along with the water.

Nitrogen is an essential element used in the synthesis of proteins and other compounds (chlorophyll, DNA and RNA).

Nitrogen is taken up in the form of inorganic nitrates or nitrites which have been prepared by symbiotic bacteria from atmospheric N_2.

4.2 SITE OF PHOTOSYNTHESIS

Green plastid (Chloroplast or Kitchen of the cell).

When we observe the cross section of a leaf under microscope, we can see the mesophyll cells full of green dots. These green dots are chloroplasts containing chlorophylls.

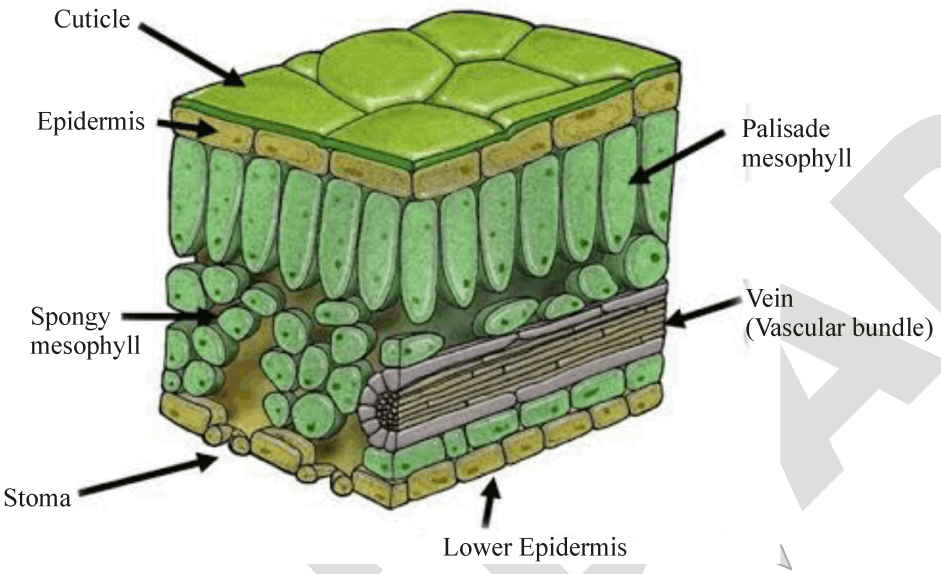


Figure : Cross section of leaf

CHLOROPLASTS

They are green coloured plastids. Their green colour is due to the presence of green pigments the chlorophylls. Each developed chloroplast has two distinct areas - grana and stroma.

⇒ **Grana (Singular-granum) :–** The light reaction of photosynthesis takes place in this part of chloroplast. In a granum large number of lamellae remain arranged like a stack of coins. These lamellae are called as **thylakoids**, which contain chlorophyll pigments.

⇒ **Stroma :–** It forms the matrix of the chloroplast. The dark reactions of photosynthesis take place in stroma.

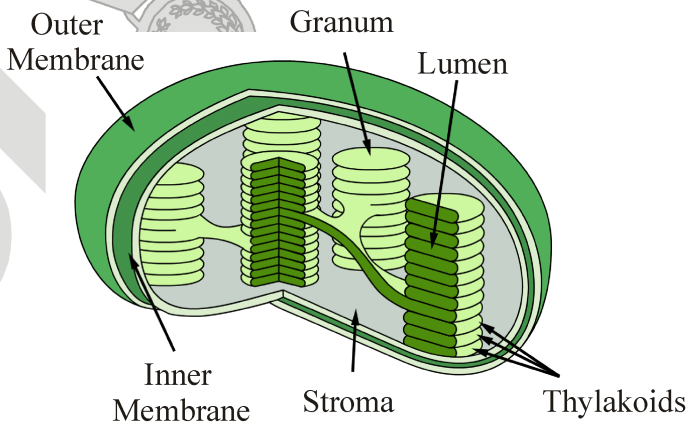
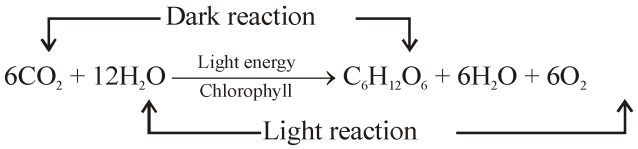


Figure : Structure of Chloroplast

4.3 MECHANISM OF PHOTOSYNTHESIS

During photosynthesis following events occur :-
(i) Absorption of light energy by chlorophyll.
(ii) Conversion of light energy into chemical energy and spliting of water molecule into hydrogen & O_2
(iii) Reduction of CO_2 to carbohydrates.
All these events can be categorised into two main phases :-
(a) Light phase (b) Dark phase



(a) Light reaction :-

- It is also called as photochemical process,
- It was discoverd by → 'Robert Hill;. Therefore it it also called as Hill's reaction
- **Site :** Grana of chloroplast.
- **Raw materials :** Light and water.
- **Products :** ATP, $NADPH_2$ and O_2
- **It consists of 3 steps :**

(i) Photo excitation of chlorophyll molecule : During this porcess chlorophyll molecule receives sunligh in the form of small energy bundles called as photons and becomes excited to higher energy level.

(ii) Photolysis of water : It is also called as photooxidation of water, this takes place in presence of Mn^{+2} & Cl^- ions.

$$4H_2O \longrightarrow 4H^+ + O_2 + 4e^- + 2H_2O$$

O_2 is librated as by product and H^+ ions are used for reduction of NADP.

(iii) Photophosphorylation : During this process ATP are produced. It takes place in quantasomes as inorganic phosphate is required to convert ADP into ATP.

$$ADP \longrightarrow ATP, \quad ADP + iP \longrightarrow ATP.$$

Focus Point

Light reaction was discovered by 'Robert Hill', therefore it is also called as Hill's reaction.
Light reaction is a photochemical process.
Photophosphorylation :-
The process of formation of ATP in the presence of sunlight is known as photophosphorylation.
Oxygen released during photosynthesis comes from water instead of CO_2 as was earlier thought.

(b) Dark reaction :– In this step synthesis of carbohydrates from carbondioxide takes place. It is not light dependent hence it is called as dark reaction. This reaction occurs inside stroma of chloroplasts where light energy is not captured.
During this reaction, the chemical energy formed during light reaction (ATP and $NADPH_2$) is utilised for the fixation and conversion of carbon dioxide into a simple carbohydrate, that is glucose.

The glucose molecules thus formed are further converted by the cellular machinery into various chemicals required by the plants.

Focus Point

Dark reaction was discovered by Melvin Calvin and Benson therefore it is also called as Calvin Cycle.
Dark reaction is a thermochemical reaction. CO_2 , $NADPH_2$, ATP, RUBP and Rubisco enzymes all are required in Dark reaction.
RUBP - Ribulose bi phosphate.
RuBisCO - Ribulose Bi phosphate Carboxylase Oxygenase.

LAB TIME
Let's Do & Learn

To prove that chlorophyll is essental for photosynthesis.
Materials required : Plant with variegated leaves, materials for starch test, test, i.e., iodine, solution.
beaker, test tubes.

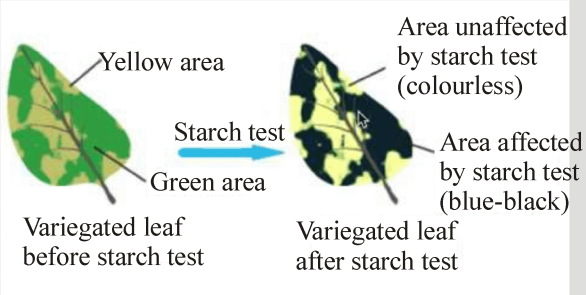


Figure : Activity to show that chlorophyll is essential for photosyntheis

Procedure :
(i) A potted plant with variegated leaf (Coleus, Croton) is kept in darkness for two days to make the leaves starch free.
(ii) A leaf is removed from the plant and tested with iodine for starch, after decolourising if first with water and then with alcohol.
Conclusion :
It is seen that the portion of the leaf which is devoid of chlorophyll remians colourless (starch-free) whereas the rest of the leaf turns blue-black due to the presence of starch.

Difference between light and dark reactions.

S. No.	Features	Light reaction	Dark reaction
1	Requirement of light	Required	Not required
2	Takes place inside	Thylakoid membranes of the chloroplast	The stroma region of chloroplast
3	ATP and $NADPH_2$	ATP and $NADPH_2$ are produced by the conversion of light energy into chemical energy	ATP and $NADPH_2$ formed during light reaction are used for the fixation of CO_2 into carbohydrate
4	Sugar formation	No sugar formation takes place	Sugar formation takes place
5	Release of oxygen	Oxygen is released	No oxygen is released

Factors affecting photosynthesis :–

(a) Light (b) Water (c) Temperature (d) CO_2 (e) Oxygen

(a) Light

The source of light for planet earth is sun, although some marine algae also utilise the light of moon.

Out of the total solar energy, only 2% solar energy is used in photosynthesis.

The quality and intensity of light also affects photosynthesis.

Quality – Red and blue lights are most effective in photosynthesis. But the rate of photosynthesis is maximum in red light.

There is no photosynthesis in presence of green light because green parts of plants reflect whole of the green light.

Intensity – The increase in intensity of light increases photosynthesis.

Intensity of sunlight $\propto$ Rate of photosynthesis

(b) Water

Water is an essential raw material in photosynthesis. Only 1% of the absorbed water is utilised in photosynthesis.

(c) Temperature

The rate of photosynthesis increases by increase in temperature upto 40°C. Above this temperature, there is a decrease in the photosynthesis. Similarly, low temperature also inhibits photosynthesis. The temperature affects photosynthesis by affecting the activity of enzymes.

(d) Carbon-dioxide

Atmosphere is the main source of CO_2 for terrestrial plants.

In atmosphere CO_2 is present at the tune of 0.03%.

The rate of photosynthesis increases by increasing the concentration of CO_2. But after a certain limit, the excess concentration of CO_2 proves to be toxic to the cells.

(e) Oxygen

Over concentration of oxygen stops photosynthesis.

Focus Point

Bacterial Photosynthesis : It is a special kind of photosynthesis in which solar energy is utilised for the synthesis of carbohydrates and H_2S is the hydrogen donor instead of water as in normal photosynthesis. So O_2 is not liberated in bacterial photosynthesis.

e.g. – Chlorobium (Green sulphur), Chromatium (Purple sulphur), Rhodospirilium, Rhodopseudomonas (Purple non sulphur)

NS. 1

What criteria do we use to decide whether something is alive?

Ans. The major criterion which is used to decide whether something is alive is movements. Movements may be that of locomotion (e.g. running of dog), movement of a part (e.g. chewing cud by cow), breathing movements, growth movements (in plants) and movement of molecules in metabolic reactions, maintenance and repair of cellular structures. Besides movements, other criteria found in living beings that distinguish them from the non-living are presence of protoplasm, self built organisation, self repair, reproduction and various life processes like metabolism, nutrition, respiration, growth, exchange of materials, transportation, excretion and irritability. All living beings have a definite life span and life cycle.

NS. 2

What are outside raw materials used for by an organism?

Ans. Outside raw materials provide energy to organisms to maintain their body processes. They are needed to prevent damage and break-down in the body.

NS. 3

What processes would you consider essential for maintaining life?

Ans. Life processes like nutrition, respiration, transportation, excretion and awareness are essential for maintaining life.

NS. 4

Where does the plants get each of the raw materials for photosynthesis?

Ans. (i) Carbon Dioxide - Air through stomata.
(ii) Water - Soil through roots,
(iii) Minerals - Soil through roots.

NS. 5

What is the role of acid in our stomach?

Ans. Hydrochloric acid (HCl) is component of gastric juice. It has five functions, (i) Softening of food, (ii) Conversion of pepsinogen and prorennin into active forms of pepsin and rennin (iii) Acidify the food for proper action of pepsin, (iv) Killing of microorganisms present in food, (v) Stoppage of action of salivary amylase.

NS. 6

What is the function of digestive enzymes?

Ans. Digestive enzymes are hydrolytic enzymes which bring about hydrolytic splitting of complex organic substances into simple, soluble and absorbable substances, e.g.,

Protein enzyme $\xrightarrow{\text{enzyme}}$ Peptides enzyme $\xrightarrow{\text{enzyme}}$ Amino acids.

NS. 7

How is small intestine designed to absorb digested food?

Ans. The inner lining of small intestine has millions of tiny finger like projections called villi. Villi are transverse folds of intestine wall that not only increase surface area but also reach deep into the lumen of intestine for absorption of digested food. Villi possess blood capillaries and lacteals (lymph vessels) for quick transport of absorbed food.

NS. 8

What are the differences between autotrophic nutrition and heterotrophic nutrition?

	Autotrophic Nutrition	**Heterotrophic Nutrition**
(1)	The process through which organisms are able to build up their own organic food from inorganic substances.	The process in which the organisms derive their nutrition by taking readymade food from other dead or living plants and animals.
(2)	The raw materials are obtained from outside, in the form of carbon dioxide and water.	The survival of heterotrophs depends directly or indirectly on autotrophs.
(3)	Chlorophyll and sunlight are essentialfor photosvnthesis.	Chlorophyll and sunlight are not required.
(4)	E.g., Green plants and some bacteria.	E.g., Animals, fungi and most of bacteria.

EXERCISE – I

ONLY ONE CORRECT TYPE

1. Chemosynthetic bacteria obtain energy from :
   (A) Sun
   (B) Infra-red rays
   (C) Organic substances
   (D) Inorganic chemicals mainly
2. A digestive enzyme, salivary amylase, in the saliva begin digestion of :
   (A) Protein (B) Nucleic acids
   (C) Fats (D) Carbohydrates
3. The visible part of electromagnetic spectrum lies in between :
   (A) X-ray and ultra-violet
   (B) Ultra violet and infra red
   (C) Infra red and microwave
   (D) X-ray and infra red
4. Partialy digested food that leaves the stomach is called :
   (A) Chyle (B) Chyme
   (C) Bolus (D) None of these
5. Peristalsis occurs in
   (A) liver (B) ureter
   (C) alimentary canal (D) hypothalamus
6. Human beings have vestigial vermiform appendix. The ancestors must have been
   (A) insectivorous (B) herbivorous
   (C) carnivorous (D) sangivorous.
7. Which one of the following lacks enzymes ?
   (A) Pancreatic juice (B) Saliva
   (C)Bile (D) Intestinal juice
8. Liver stores glucose in the form of:
   (A) Starch (B)Glycogen
   (C) Protein (D) Cholesterol
9. Gastric juice contains:
   (A) Pepsin, lipase and rennin
   (B) Trypsin, lipase and rennin
   (C) Trypsin, pepsin and lipase
   (D) Trypsin, pepsin and rennin
10. Partial removal of liver is not harmful because:
    (A) Liver being a large organ can suffice the functions even if a part is removed
    (B) Liver is not a very essential organ of the body
    (C) Liver has regenerative capacity and will grow after partial hepatectomy
    (D) The function of liver can be taken over by kidneys
11. Insectivorous plants digest insects to get an essential nutrient. Other plants generally get this nutrient from the soil. What is this nutrient ?
    (A) Oxygen (B) Nitrogen
    (C) Carbon dioxide (D) Phosphates
12. Main function of HCl present in gastric juice is
    (A) digestion of starch
    (B) emulsification of fat
    (C) conversion of pepsinogen to pepsin
    (D) detoxification of harmful constituents of food
13. What is the substrate for lipase enzyme ?
    (A) Protein (B) Carbohydrate
    (C) Lipid (D) Nucleic acid
14. Succus entericus is the other name of
    (A) gastric juice (B) intestinal juice
    (C) bile juice (D) saliva
15,. During prolong fasting, the sequence of organic compounds used by body is:
    (A) Carbohydrates, fats, proteins
    (B) Fats, carbohydrates, proteins
    (C) Carbohydrates, proteins, lipids,
    (D) Proteins, lipids, carbohydrates
16. Absorption of glycerol, fatty acids and monoglycerides takes place by:
    (A) Lymph capillaries within villi
    (B) Walls of stomach
    (C) Colon
    (D) Capillaries within villi
17. Rennin acts on:
    (A) Proteins in stomach
    (B) Milk, changing casein into paracaseinate at 7.2 - 8.2 pH
    (C) Fat in intestine
    (D) Milk, changing casein into calcium paracaseinate at 1-3 pH.
18. The human intestine is long because:
    (A) Bacteria in food can be killed gradually
    (B) It provides more surface for food storage
    (C) It increases surface area for absorption of food
    (D) None of these

19. In the lunch, you ate boiled green vegetables, a piece of cooked meat, one boiled egg and a sugar candy Which one of these foods may have been digested first ?
(A) Boiled green vegetables
(B) The piece of cooked meat
(C) Boiled egg
(D) Sugar candy

20. Glycogenesis refers to
(A) conversion of glycogen to glucose
(B) breakdown of glucose to form pyruvate
(C) breakdown of pyruvate to form glucose
(D) conversion of glucose to glycogen

21. Casein is digested in children by -
(A) Rennin (B)Renin
(C) Chymotrypsin (D)Trypsin

22. Germs entering the body alongwith food are killed in where pH is
(A) 10 (B) 7
(C) 3 (D)11

23. Which one of the following association is incorrect ?
(A) Protein -Trypsin (B) Fat - Lipase
(C) Maltose-Pepsin (D) Starch -Amylase

24. Vitamin B_6 is also called
(A)Thiamine
(B) pantothenic acid
(C) pyridoxine
(D) retinol

25. Sometimes urea is fed to ruminates to improve their health. It works by
(A) Helping growth of gut microbes that break down cellulose
(B) Killing harmful microorganisms in their gut
(C) Increasing salt content in the gut
(D) Directly stimulating blood cell proliferation

26. During phytosynthesis the oxygen in glucose comes from :
(A) Water
(B) Carbon dioxide
(C) Both from water and carbon dioxide
(D) Oxygen in air

27. A specific function of light energy in the process of photosynthesis is to :
(A) Activate chlorophyll
(B) Oxidation of CO_2
(C) Synthesis of glucose
(D) Reduce CO_2

28. Dark reaction in photosynthesis is called so because
(A) It does not require light energy
(B) Cannot occur during daytime
(C) Occurs more rapidly at night
(D) It can also occur in darkness

29. With regards to natural eating habits, a human is :
(A) An herbivore (B) A Carnivore
(C) An omnivore (D) A Granivore

30. Where is bile produced :
(A) In gall bladder (B) In blood
(C) In liver (D) In spleen

MATCH THE COLUMN TYPE

31. Match the names of the glands listed under column I with the location given under column II and select the correct option from the codes given below:

Column I	Column II
(P) Crypts of lieberkuhn	(1) Loop of duodenum
(Q) Pancreas	(2) Stomach
(R) Adrenal gland	(3) Intestine
(S) Gastric gland	(4) Kidney.

(A) P → 3, Q → 1, R → 4, S → 2
(B) P → 1, Q → 2, R → 3, S → 4
(C) P → 2, Q → 4, R → 3, S → 1
(D) P → 3, Q → 4, R → 1, S → 2

EXERCISE – II

VERY SHORT ANSWER TYPE

1. What are heterotrophs ?
2. Define saprophyte ?
3. What is carnivore ?
4. Define digestion ?
5. What is ingestion ?
6. What is the mode of nutrition of *Amoeba* ?
7. How do the guard cells regulate opening and closing of stomatal pores ?
8. Is 'nutrition' a necessity for an organism ?

SHORT ANSWER TYPE

1. Differentiate between an autotroph and a heterotroph ?
2. Differntiate beween autrophic and heterotrophic nutrition ?
3. Distinguish saprophytes from parasites.
4. Differentiate between photosynthetic and holozoic nutrition ?
5. How do saprophytic organisms obtain their nourishment ?
6. What is the importance of saprophytes ?
7. What is the action of hydrochloric acid of gastric juice ?
8. Name a digestive juice that has no enzymes. What is the role of this juice ?
9. Name the various parts of large intestine. What is the role of large intestine ?

LONG ANSWER TYPE

1. Explain the mechanism of photosynthesis ?
2. Explain the mechanism of nutrition of Amoeba with the help of suitable diagram.
3. Describe the various types of heterotrophic nutrition.
4. Briefly describe the digestive system of humans
5. What happens to food in the small intestine ?

TRUE / FALSE TYPE

1. Most of the digestion occurs in jejunum,
2. Enamel is the hardest substance of human body.
3. Pepsionogen requires alkaline medium to convert into pepsin.
4. Coprophagy is the consumption of faecal matter.
5. Bile emulsifies fat molecules.

FILL IN THE BLANKS

1. ..... is inverted U shaped tube in large intestine.
2. Liver secreates ..... which provides alkaline medium.
3. Oesophagus is also called as .....
4. Amoeba ingests its food with the help of .....
5. Dark reaction occurs in ..... of a chloroplast.

Answer Key

EXERCISE–I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	D	B	B	C	B	C	B	A	C	B	C	C	B	A
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	D	C	D	D	C	C	C	C	A	B	A	D	C	C
31														
A														

EXERCISE – II

TRUE/FALSE TYPE

1. F 2. T 3. F 4. T 5. T

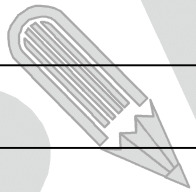
FILL IN THE BLANKS

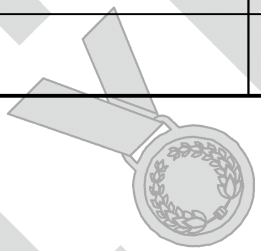
1. Duodenum 2. Bile 3. Food pipe 4. Pseudopodia 5. Stroma

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : LIFE PROCESS & NUTRITION)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			





NOTES :

1. In the status, put "completed" only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.

Space for Notes :

RESPIRATION 3

Concepts

Introduction

1. Respiration

1.1 Mechanism of Respiration

1.2 Organs of Respirations

1.3 Respiration in human

1.4 Mechanism of Breathing

1.5 Exchange of gases

1.6 Cellular Respiration

2. Respiration in Plants

2.1 Mode of Gaseous Exchange

NCERT Solution

Exercise – I (Competitive Exam Pattern)

Exercise – II (Board Pattern Type)

Answer Key

INTRODUCTION

All living organisms need energy to carry out their functions. The digested food is absorbed. The absorbed food components are subsequently assimilated in the body cells. These assimilated molecules hold energy in their chemical bonds. Their bond energy is released by oxidation in the cells. The process of oxidation is carried out with the help of oxygen.

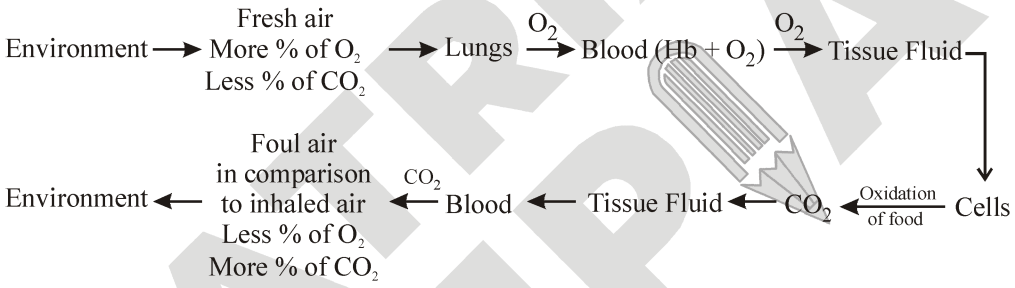
Energy is released in this process. This energy is trapped by forming bonds between ADP (Adenosine diphosphate) and inorganic phsophate (iP) to synthesize ATP (Adenosine triphosphate) molecules.

BREATHING

The process involving intake of air or oxygen [inspiration] and removal of air or carbondioxide [expiration] is called breathing. No enzymes are involved in this process.

RESPIRATION

The process of respiration involves taking in oxygen (of air) into the cells, using it for releasing energy by burning food, and then eliminating the waste products (carbon dioxide and water) from the body.



Flow chart of Respiration

Differences Between Breathing and Respiration :

BREATHING	RESPIRATION
1. It is a physical process. It involves inhalation of fresh air and exhalation of foul air.	It is a biochemical process. It involves exchange of respiratory gases and also oxidation of food.
2. It is an extracellular process.	It is both an extracellular as well as intracellular process.
3. It does not involve enzyme action.	It involves a number of enzymes required for oxidation of food.
4. It does not release energy, rather it consumes energy.	It releases energy.
5. It is confined to certain organs only	It occurs in all the cells of the body.

1. RESPIRATION

Oxidation of carbohydrates during respiration is not a single reaction because there is no enzyme that can catalyze the complete oxidation of glucose into carbon dioxide and water in a single step. Instead, the oxidation of glucose consists of a sequence of reactions. In such step wise oxidation energy is released slowly. It allows cells to capture more energy. It would not be possible if the energy is released in one big burst.

1.1 MECHANISM OF RESPIRATION

The mechanism of respiration involves following two processes :

(i) Glycolysis – a series of reactions which does not require oxygen and by which glucose molecule is broken into pyruvic acid.

(ii) Further breakdown of pyruvic acid molecules by aerobic (in the presence of oxygen) or anaerobic (in the absence of oxygen) methods.

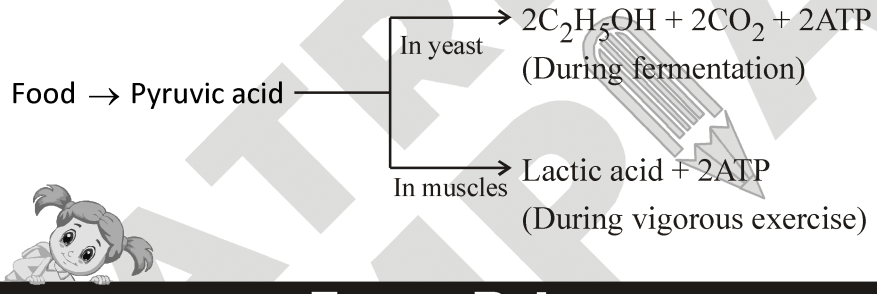
A. AEROBIC RESPIRATION :-

Breakdown of pyruvic acid in the presence of oxygen :

In the presence of oxygen the pyruvic acid is completely oxidised and CO_2 and H_2O are formed as the end products. This oxidation is carried out by a cyclic series of reactions known as **tricarboxylic acid cycle** or **citric acid cycle or Krebs cycle**. All reactions of Krebs cycle occur within mitochondria. Complete oxidation of each pyruvic acid molecule produces 15 ATP molecules, therefore, **aerobic oxidation of each glucose molecule produces** : 15 × 2 = 30 ATP (from Krebs cycle) + 8 ATP (from glycolysis) = 38 ATP

B. ANAEROBIC RESPIRATION :-

When oxidation of food material does not require oxygen or it occurs in absence of oxygen, it is called as Anaerobic Respiration.

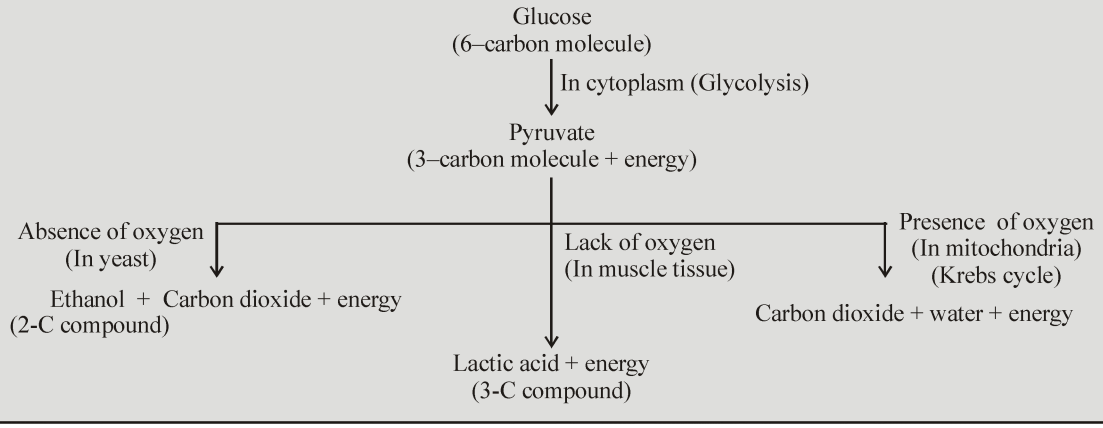


Focus Point

Fermentation : It is a kind of anaerobic respiration in which the microorganisms break down glucose into ethyl alcohol and carbondioxide and energy is released.

$$\text{Glucose} \xrightarrow[\text{(in cytoplasm)}]{\text{Glycolysis}} \underset{\text{(2 molecules)}}{\text{Pyruvate}} \xrightarrow[\text{(yeast)}]{\text{No } O_2 \text{ required}} \underset{\text{(2 ATP)}}{\text{Ethanol} + CO_2 + \text{Energy}}$$

BUILD THE CONCEPT



1.2 ORGANS OF RESPIRATIONS

(i) **Skin** or general body surface, as in earthworm.
(ii) **Air tubes** or **trachea,** as in insects (grasshopper, cockroach, housefly)
(iii) **Gills** as in aquatic animals like fish and prawn.
(iv) **Lungs** as in land animals like frog, lizard, birds, rat, humans.
⇒ Frog respires through skin as well as lungs (being amphibious).

(i)	Amoeba (Protozoa)	Diffusion : Exchange of gases takes place through general body surface.
(ii)	Earthworm (Annelida)	Cutaneous Respiration : Exchange of gases occur through moist skin.
(iii)	Fish (Pisces)	Branchial Respiration : Exchange of gases through gills.
(iii)	Grasshopper (Arthopoda)	Tracheal Respiration : Exhange of gases through spiracles.

Focus Point

It is worth noting that all respiratory organs whether skin, trachea, gills or lungs have three common features.
(a) All the respiratory organs have a large surface area so as to get enough oxygen.
(b) All have thin walls for easy diffusion and exchange of respiratory gases.
(c) All respiratory organs have moist surface.

1.3 RESPIRATION IN HUMAN

External nostrils ⟶ Nasal cavity ⟶ Pharynx ⟶ Larynx ⟶ Trachea ⟶ Bronchi ⟶ Bronchioles ⟶ Alveolar sacs.

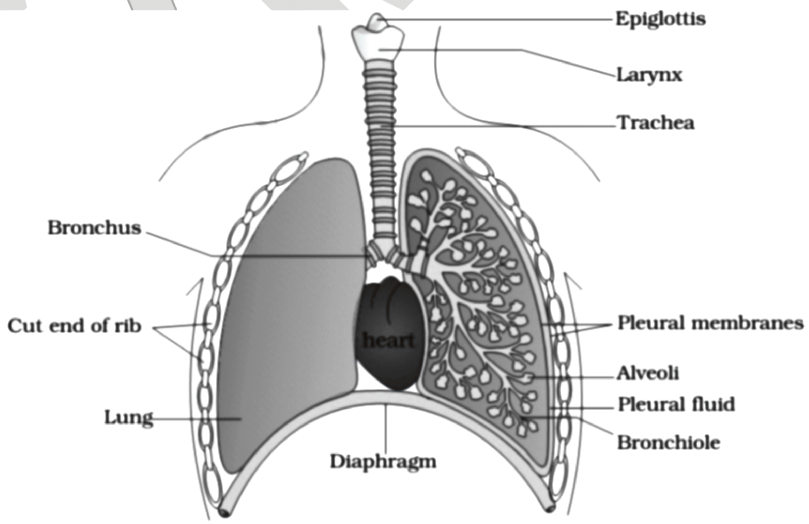


Figure. 1 . Resiparation in Humans

- **Nasal cavity :** This cavity is separated from oral cavity by means of a hard and bony palate. It is lined by ciliated columnar epithelial cells that are rich in mucus, it brings about warming, moistening and sterilization of air. It contains hair and mucus which entrap the dust particles. Nasal septum is a cartilage which divides nasal cavity into two nasal chambers.
- **Internal nares :** Nasal cavity opens into it and it leads to pharynx
- **Pharynx :** It is a common part between both alimentary canal and respiratory system.
- **Laryngopharynx :** It is the lower part of pharynx and has a slit like aperture called glottis, which can be closed by a leaf like bilobed cartilage epiglottis, during swallowing of food bolus.
- **Larynx :** It is an enlarged part of treachea which is also called as 'voice box'. It produces voice by passage of air between vocal cords. It contains four different types of cartilage among them a 'c' shaped thyroid cartilage protruding out in neck region is called Adam's apple.
- **Trachea (Wind pipe) :** It is 10-12 cm long tube. It's walls are supported by 16-20 'c' shaped cartilaginous rings which prevent them to collapse when air is absent in them.
- **Bronchi :** trachea is branched into two bronchi left and right each of which enters into the lungs.
- **Lungs :** These are two light weight spongy pouches covered by a membrane called Pleura. Bronchi are further branched into several bronchioles, at the end of bronchioles alveolar sacs or alveoli are present which are rich in blood capillaries and thin walled.
- **Diaphragm :** It is a sheet of muscles that lies below the lungs and separates thoracic cavity from abdominal cavity.

1.4 MECHANISM OF BREATHING

(a) Inhalation (Inspiration) :- Inhalation is intake of fresh air from outside into the alveoli of the lungs. It occurs by expansion of lungs which is brought about by enlargement of thoracic cavity. Inhalation involves the following steps:-

1. The diaphragm (a sheet of tissue that separates thoracic cavity from abdominal chamber) muscle contracts so that the diaphragm lowers down and becomes flat.
2. lowering of diaphragm pushes the abdominal viscera downward resulting in the enlargement of thoracic cavity vertically.
3. External intercostal muscles contract so that the ribs and sternum are pulled upward and outward. This causes enlargement of thoracic cavity.
4. Enlargement of thoracic cavity results in the expansion of lungs.
5. Expansion of lungs reduces the pressure of air inside so that the fresh air is pulled from outside into the lungs passing through nostrils, trachea and bronchi.
6. Fresh air has a rich supply of O_2 which goes into the blood passing through thin membranes of alveoli and blood capillaries. As a result the blood in the capillaries becomes loaded with oxygen and expels carbon dioxide into the alveoli for exhalation.

(b) Exhalation [Expiration] :- The mechanism of breathing out of carbon dioxide is called exhalation.

1. During exhalation, the phrenic muscle of the diaphragm relaxes so that the abdominal viscera pushes the diaphragm upward, making it convex.
2. The external intercostal muscles also relax with the result the thoracic cavity is reduced in size and lungs also contract.
3. Contraction of lungs raises the air pressure so that the foul air moves out.

An average rate of breathing in a normal adult man is 15 to 18 times per minute.

Movement involved in mechanism of respiration

Part / Parameter	Inhalation	Exhalation
Diaphragm	Contracts	Relaxes
	Flattens downwards	Becomes Dome shaped
Rib cage	Moves upwards and outwards	Moves downwards and inwards
Thoracic cavity	Increases	Decreases
Air pressure of thorax and lungs	Decreases	Increases
External intercostal muscles	Contract	Relax

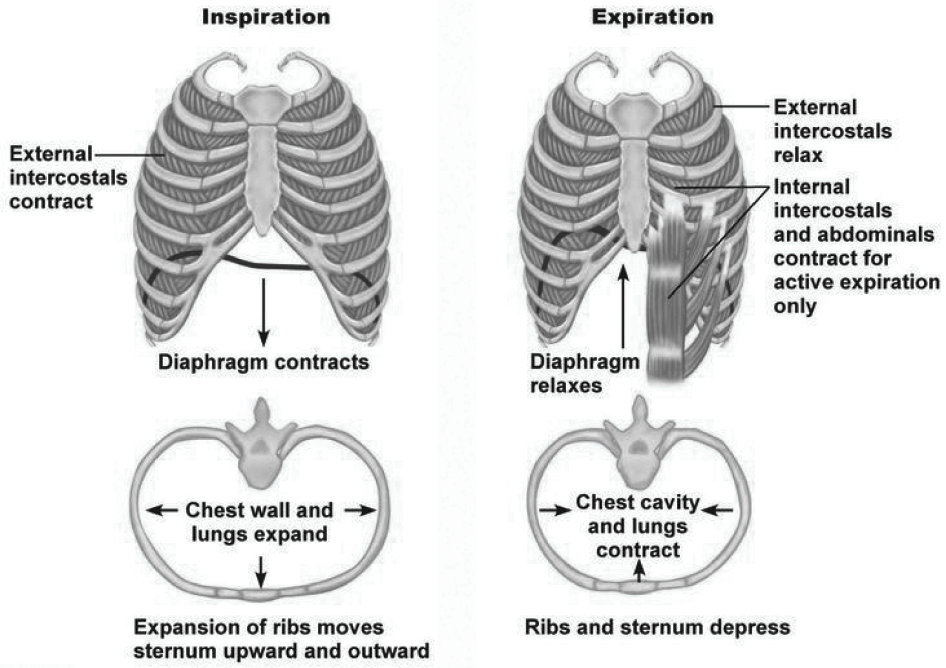


Figure : Diagram representing inspiration and expiration

1.5 EXCHANGE OF GASES

This exchange of gases in done by blood as following :

⇒ **Transportation of O_2 :** The O_2 that diffuses into the blood from the lungs is transported to body tissues in the following form :

(i) About 97% of the O_2 that diffuses into the blood combines with haemoglobin of RBCs forming an unstable compound, oxyhaemoglobin.

$$Hb + O_2 \xrightleftharpoons[\text{tissue}]{\text{lungs}} HbO_2$$

(ii) The remaining 3% O_2 dissolves into water of plasma.

- A normal person has about 15 grams of haemoglobin per 100 ml of blood.
- If diffusion were to move oxygen in our body it would take 3 years for a molecule of oxygen to get our toes from our lungs.

⇒ **Transportation of CO_2:**

• Carbon dioxide is also transported by haemoglobin. When a respiring tissue releases carbon-dioxide it is first diffused in the plasma. From here it diffuses into the red blood cells.

• 70 %Carbon-dioxide is transported from the tissues to the lungs in the form of bicarbonates dissolve in blood plasma.

$$H_2CO_3 \rightleftharpoons H^+ + HCO_3$$

Carbonic acid

$$H_2CO_3 \rightleftharpoons H^+ + HCO_3$$

Bicarbonate ion

• About 23% of carbon dioxide entering into the erythrocytes combines with the globin (protein) haemoglobin to form carbaminohaemoglobin, which is transported to the lungs.

1.6 CELLULAR RESPIRATION

The biological oxidation of glucose in the cells is called cellular respiration.

$C_6H_{12}O_6 + 6O_2 \rightleftharpoons 6CO_2 + 38ATP$.

The oxidation of glucose is a multistep process and is completed in a series of chemical reaction. Each step is catalysed by a particular enzyme. The energy released as a result of the oxidation of glucose is stored in the form of ATP molecules. Water being an important part of the body is retained in the body. CO_2 being toxic beyond a certain limit needs to be eliminated.

• Exchange of O_2 and CO_2 between the blood and body tissues is called internal or tissue respiration The O_2 from the blood diffuses into the body tissues whereas CO_2 from tissues to the blood because of higher concentration of CO_2 in the body tissues, produced due to cellular respiration. It refers to oxidation of food taking place inside the cell. As this process is at cellular level so it is called cellular respiration. It takes place in 3 steps :

(i) Glycolysis (ii) Kreb Cycle (iii) Electron Transport System

(i) Glycolysis : Glycolysis is also called as EMP(Embden, Meyerhof, Parnas) pathway, Site- Cytoplasm of cell.

- In this cycle glucose is converted into pyruvic acid in presence of many enzymes and co-enzyme
- Oxygen is not required during glycolysis.
- There is no production of CO_2 during this process.

(ii) Kreb Cycle:

Site : Mitochondria of cell

- ♦ Also called aerobic oxidation.
- ♦ Discovered by Sir Hans Kreb.
- ♦ Another name TCA cycle (tricarboxylic acid cycle) or Citric acid cycle.
- ♦ It brings about the conversion of pyruvic acid, fatty acids, fats and amino acids into CO_2 and water by oxidation. It is the common path for oxidation of carbohydrates, fats and proteins.

(iii) Electron Transport System or ETS:

♦ In this hydrogen atoms produced during oxidation of various intermediates during kreb cycle are first broken into protons and electrons.

♦ These protons and electrons after passing through a series of coenzymes and cytochromes combine with oxygen to form water molecules.

Location, structure and function of respiratory system

Organ or region	Location	Structure and function
Nasal cavity	Above the mouth cavity	• Two external nostrils help in intake of oxygen
		• Lined by ciliated and sensory epithelial cells which help in filtering of air (by hair) and warming or cooling of the inhaled air.
		• Mucous secreted by them prevent dust particles for entry.
		• Two internal nostrils act as the end of this cavity from which the air enters into pharynx.
Pharynx	Behind the nasal cavity leading into the trachea	• Posteriorly it has two openings ; dorsal opening or gullet (leading to oesophagus) and ventral opening or glottis (aperture of trachea).
		• A cartilaginous flap (epiglottis) guards the glottis to prevent the entry of food into the trachea.
Larynx or voice box or adam's apple	Lies at the back of the neck	• A pair of membranes (called vocal cords) stretched in the internal cavity, partially close the air passage. Theses membranes can be relaxed or stretched. When the air passes over the vocal cords, they vibrate and produce sounds.
Trachea or Wind pipe	Tube running through the neck in front of oesophagus	• Its walls are supported by C-shaped cartilages to prevent it from collapsing. It divides into two bronchi (singular bronchus) which enter the respective right and the left lung.
Lungs	Present in the thoracic cavity	• Surrounded by two pleural membranes containing a fluid in between to reduce friction.
		• Spongy organ formed by the sub-divisions of the bronchus called bronchioles.
		• Each bronchiole ends in a structure like bunch of grapes or balloon-like structures called alveoli or air sacs. Alveoli provide the surface for the exchange of gases.
		• Each alveolus is surrounded by a network of blood capillaries.

2. RESPIRATION IN PLANTS

The plants do not have any special respiratory system so they have to respire in all of their individual parts like leaf, stem and root.

The plants also have to exchange gases with the atmosphere by simple diffusion process.

2.1 MODE OF GASEOUS EXCHANGE

In terrestrial plants gaseous exchange occurs through
- Stomata – In leaves and green stem
- Lenticels – In woody stem and roots.
- Root hairs – In young roots.

(a) Respriation through stomata : Stomata are small apertures found on the surface of leaf. For the process of respiration, oxygen enters stomata by the process of diffusion and then into other cells of the leaf.

When concentration of CO_2 increases inside the cells it is diffused out through stomata.

(b) Respiration through lenticels :

Lenticels are the opening in the bark of woody stems.They also serve as a place of gaseous exchange.

(c) Respiration through general surface of the roots :

Ploughing or tilling of the soil creates small air spaces around soil particles which provides the sources of oxygen for the roots.

This oxygen present between the soil particles diffuses into root hairs (these are the extensions of epidermal cell of the root), by the process of diffusion.

From the root hairs, oxygen diffuses into other cells of the root. After utilisation of oxygen, CO_2 is diffused out into the soil.

In **older roots** there are no root hairs present. Instead they have layer of dead cells which is protective in nature and encloses small opening (lenticels). These are used for gaseous exchange between soil and inner living cells.

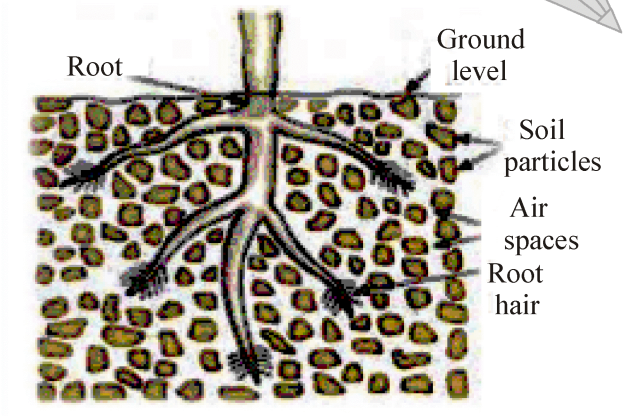


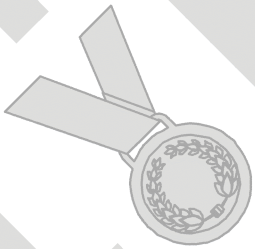
Figure : Respiration through general surface of the roots

Focus Point

- Aquatic plants can carry out gaseous exchange by diffusion over their whole surfaces.
- Direction of diffusion depends upon the environmental condition and the requirement of the plant.
- During the day time O_2 release is the major event.
- During night CO_2 release is the major event because there is no photosynthesis.

BUILD THE CONCEPT

DIFFERENCES BETWEEN RESPIRATION IN PLANTS AND ANIMALS			
S.No.	**Respiration in plants**	**S.No.**	**Respiration in animals**
1	Respiration is carried out by all parts of the plant i.e., roots, stem, leaves.	1	Respiration occurs only in the respiratory organs.
2	It occurs at slower rate.	2	It is faster in animals.
3	In plants, there is little transport of gases to various part of the plant.	3	Transport of gases to various parts is more.
4	Products of anaerobic respiration of glucose in plants are ethanol and CO_2.	4	Products of anaerobic respiration of glucose is lactic acid and no CO_2.
5	There is no special gas transport system.	5	Blood transports oxygen.
6	Green plants have additional oxygen source from photosynthesis.	6	Animals do not have any additional source of oxygen.



NS. 1

Why is diffusion insufficient to meet the oxygen requirements of multicellular organisms like humans?

Ans. Every living cell requires oxygen for performing cellular respiration. In unicellular organisms (e.g., Amoeba), the single cell is in direct contact with environment. Oxygen passes into it through diffusion. In simple multicellular organisms (e.g. Hydra), every cell may also take oxygen through diffusion from environment. This is not possible in complex multicellular organisms like humans. The body is covered by dead cells. The living cells are not in contact with external environment. Air containing intercellular spaces are absent. Therefore, quick diffusion cannot occur. Cell to cell diffusion is a very slow process. Passage of oxygen from lungs to toes through cell to cell diffusion will take about three years. Therefore, diffusion cannot meet the oxygen requirement of multicellular organisms like humans.

NS. 2

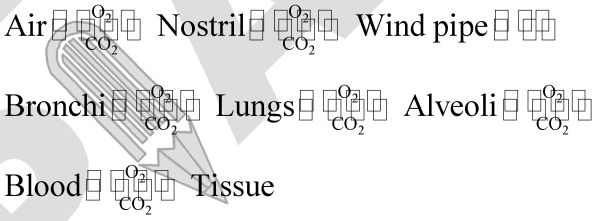
What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

Ans. Air contains about 21% of oxygen while water has less than 1% oxygen in dissolved state. A terrestrial organism is able to get several times more oxygen than an aquatic organism in one breath.

NS. 3

How is oxygen and carbon dioxide transported in human beings?

Ans. During inhalation, oxygen comes into alveoli of the lungs. The alveoli is surrounded by very thin blood vessels called capillaries. So, the oxygen is carried by blood to all the parts of body by binding it with haemoglobin present in blood. The blood passes through the tissues of the body and oxygen present in it diffuse into the cells (due to its higher concentration in the blood). This oxygen combines with the digested food present in the cells to release energy. Carbon dioxide is produced as a waste product during respiration in the cells of the body tissues. This CO_2 diffuses into the blood (due to its higher concentration in body tissues). Blood carries CO_2 back to the lungs where it diffuses into the alveoli of the lungs and pass into the trachea, nostrils and then out of the body into air. CO_2 is more soluble in water than oxygen and hence mostly transported in the dissolved form in our blood.



NS. 4

How are the lungs designed in human beings to maximize the area for exchange of gases?

Ans. Lungs are two soft spongy structures lodged in the thoracic cavity. Each lung is enclosed in a double-walled sac called pleura. In the lungs, the air passage (wind pipe) divides into smaller tubes, called bronchi which in turn form bronchioles. The bronchioles later terminates in balloon-like structures, called alveoli. The presence of alveoli in the lungs provides a very large area for the exchange of gases and this availability of large surface area maximises the exchange of gases. The alveoli have very thin walls and contain an extensive network of blood vessels to facilitate exchange of gases.

NS. 5

How are alveoli designed to maximise the exchange of gases?

Ans. Alveoli are small pouches or sacs. Large number of alveoli occur inside each lung. The whole surface of an alveolus functions as respiratory surface. Due to large number of alveoli in each lung, a very large area of respiratory surface becomes available (about 80 m^2) for exchange of gases. The walls of alveoli are very thin and they are surrounded by blood capillaries.

NS. 6

How is respiration different from breathing?

Ans.

Breathing	Respiration
It is a physical process. It involves inhalation of fresh air and exhalation of foul air.	It is a biochemical Process. It involves exchange of respiratory gases and also oxidation of food.
It does not involve enzyme action.	It invloves a number of enzymes required for oxidation of food.
It does not release energy.	It occurs in all the cells of the body.
It is confined to certian organs only	It occurs in all the cell of the body.

NS. 7

What are the differences between respiration and photosynthesis?

Ans.

Photosynthesis	Respiration
It takes place in green cell of plants.	It takes place in all living beings.
It occurs during day time only	It occurs throughout the life of an organism.
Energy is stored CO_2 and H_2O both are used up	Energy is released CO_2 and water are released
Food and oxygen are produced	Food and oxygen are used up
It is an anabolic process	It is a Catabolic process.

NS. 8

What are the differences between aerobic and anaerobic respiration? Name some organisms that use the anaerobic mode of respiration.

Ans.

Aerobic Respiration	Anaerobic Respiration
O_2 is required	Not required
It is occurs in Cytoplasm and mitochondria	It ocurs in Cytoplasm only
Complete breakdown of glucose takes place	Incomplete breakdown of glucose takes place
End products are CO_2H_2O	End products are CO_2 and ethyl alcohol or lactic acid
38 ATP produced fromone glucose molecule	2 ATP produced from one glucose molecule

EXERCISE – I

ONLY ONE CORRECT TYPE

1. Which one is anabolic process -
   (A) Respiration (B) Digestion
   (C) Photosynthesis (D) Ascent of sap
2. A catabolic process is -
   (A) Absorption of minerals
   (B) Ascent of sap
   (C) Respiration
   (D) Assimilation
3. Exchange of gasses occurs through
   (A) Stomata (B) Lenticles
   (C) Root surfaces (D) All of the above
4. Glycolysis occurs in -
   (A) Cytoplasm (B) Mitochondria
   (C) Chloroplasts (D) Golgi complex
5. Krebs cycle operates in -
   (A) Endoplasmic reticulum
   (B) Chloroplasts
   (C) Golgi bodies
   (D) Mitochondria
6. Which one is a product of glycolysis -
   (A) Oxaloacetate (B) Pyruvate
   (C) Ethyl alcohol (D) Lactic acid
7. Adam's Apple occurs in -
   (A) Buffaloes (B) Dogs
   (C) Human males (D) Human females
8. Muscular partition present between thorax and abdomen is -
   (A) Pericardium (B) Pleura
   (C) Epiglottis (D) Diaphragm
9. Covering of lungs is -
   (A) Pleura (B) Pericardium
   (C) Epiglottis (D) Capsule
10. Gaseous exchange occurs in the lungs in the region of -
    (A) Trachea (B) Bronchi
    (C) Bronchioles (D) Alveoli
11. Trachea and bronchi have -
    (A) C-shaped cartilaginous rings
    (B) Complete cartilaginous rings
    (C) Complete chitinous rings
    (D) C-shaped chitinous rings
12. Respiratory tract is lined by ciliated epithelium. The function of cilia is to -
    (A) Trap dust
    (B) Trap germs
    (C) Push out mucus with trapped germs and dust
    (D) Push in air vigorously
13. If the thoracic wall but not the lungs is punctured -
    (A) The lungs get inflated
    (B) The man dies as the lungs get collapsed
    (C) The breathing rate decreases
    (D) The breathing rate increases
14. Skin is an ideal respiratory organ in frog because it is
    (A) Highly vascular
    (B) Kept moist
    (C) Devoid of hair and scales
    (D) All the above
15. Respiration is -
    (A) Anabolic and exergonic
    (B) Anabolic and endergonic
    (C) Catabolic and exergonic
    (D) Catabolic and endergonic
16. Glycolysis occurs in -
    (A) Anaerobic organisms
    (B) Muscle cells
    (C) Prokaryotic cells
    (D) Almost all the cells
17 The blood coming out of lungs is richer than that entering into lungs in -
    (A) CO_2 (B) O_2
    (C) Both (D) None of these
18. Anaerobic respiration is likely to occur in -
    (A) Ants (B) Earthworms
    (C) Echinoderms (D) Tapeworms
19. Respiratory quotient is -
    (A) CO_2 / CO_2 (B) O_2 / CO_2
    (C) CO_2 / N_2 (D) N_2 / CO_2
20. Epiglottis guards the opening of -
    (A) Eustachian tube (B) Glottis
    (C) Lungs (D) Internal ear
21. Skin is an accessory respiration in -
    (A) Humans (B) Frog
    (C) Rabbit (D) Lizard

22. The process of respiration is -
(A) Anabolic (B) Catabolic
(C) Metabolic (D) Anaerobic

23. Lungs are covered with the covering of -
(A) Pleural membrane (B) Pericardium
(C) Peritoneum (D) Mucous membrane

24. The respiratory pigment in the mammalian blood is
(A) Haemocyanin. (B) Haemoerythrin.
(C) Haemoglobin. (D) Fucoxanthin.

25. Breakdown of takes place in
(A) Golgi bodies (B) Chloroplast
(C) Mitochondria (D) Nucleus

26. The full form of ATP is
(A) Adenosine tetra phosphate.
(B) Adenosine tri phosphate.
(C) Adenylate tri phosphate.
(D) Adenylate tetra phosphate.

27. Alveoli of lungs in human body help in the exchange of gases as they
(A) Provide a surface for the exchange of gases.
(B) Do not provide any surface.
(C) Bring gases from nostrils to the lungs.
(D) Bring gases from lungs to the nostrils.

28. Breakdown of glucose is the first step of
(A) Respiration. (B) Reproduction
(C) Excretion. (D) Digestion.

29. Breakdown of pyruvate using oxygen takes place in
(A) Golgi bodies. (B) Chloroplast
(C) Mitochondria. (D) Nucleus

30. The rate of respiration in aquatic organisms is
(A) Slower than the rate of respiration in terrestrial organisms.
(B) Faster than the rate of respiration in terrestrial organisms.
(C) Faster than the rate of respiration in aerial organisms.
(D) Lower than the rate of respiration in aerial organisms.

MATCH THE COLUMN TYPE

31.

Column I	Column II
(P) Asthma	(1) Smoking
(Q) Pneumonia	(2) Obstruction in Breathing
(R) Pleurisy	(3) Bacterial and viral infection
(S) Emphysema lung	(4) Inflammation of membrane

(A) P → 1, Q → 3, R → 4, S → 2
(B) P → 2, Q → 3, R → 4, S → 1
(C) P → 1, Q → 2, R → 4, S → 3
(D) P → 1, Q → 2, R → 3, S → 4

EXERCISE – II

VERY SHORT ANSWER TYPE

1. What is the shape of diaphragm during expiration?
2. What are stomata?
3. Name the energy currency of living system.
4. What is the shape of cartilaginous rings in trachea/
5. Name the common passage for food and air.

SHORT ANSWER TYPE

1. What is respiration? What are its types?
2. What is diaphragam? Where is it located?
3. Define glottis and epiglottis.
4. What is inspiration and expiration?
5. What are the functions of nasal passage?

LONG ANSWER TYPE

1. How respiration different from breathing?
2. Explain the processes fo 'aerobic; respiration and 'anaerobic' respiration.
3. Draw a diagram showing 'human respiratory system'. Label its following parts
(i) Larynx (ii) Trachea (iii) Lungs
4. What is breathing? How does it take place in man?
5. Describe the three pathways of glucose breakdown in living organisms.

TRUE / FALSE TYPE

1. Amoeba respires through skin.
2. Aerobic respiration does not require oxygen.
3. Respiratory centre is in Medulla Oblngata.
4 Expiration is intake of oxygen.
5. The oxidation of one molecules of glucose produces 38 ATP molecules in aerobic respiration.

FILL IN THE BLANKS

1. Nasal cavity contains ..... & ..... which entrap the dust particles.
2. Earthworm respires through ..... type or respiration.
3. Food $\xrightarrow[\text{In cytoplasm}]{(\ldots\ldots\ldots)}$ Pyruvic acid.
4. Fish respires through ..... type of respiration.
5. Breathing is a ..... phenomenon whereas cellular respiration is ..... phenomenon.

Answer Key

EXERCISE–I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C	C	D	A	D	B	C	D	A	D	A	C	B	D	C
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
D	B	D	A	B	B	B	A	C	C	B	A	A	C	B
31														
A														

EXERCISE – II

TRUE/FALSE TYPE

1. F 2. F 3. T 4. F 5. T

FILL IN THE BLANKS

1. Hair 2. Body Surface 3. Glycolysis 4. Branchial

5. Physical Gland Chemical

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : RESPIRATION (LIFE PROCESS)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

NOTES :

1. In the status, put "completed" only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.

Space for Notes :

TRANSPORTATION 4

INTRODUCTION

All living bodies need nutrients and oxygen in every cell for its various tissues to sustain life.
Transport is a life process in which a substance absorbed (or made) in one part of the body of an orgainism
is carried to other parts of its body.
Unicellular organisms e.g. Amoeba and Paramecium do not require the transport of any material. These are in direct contact with their surroundings from where they obtain these nutrients.
These substances are distributed in the cytoplasm due to the streaming movements of cytoplasm called as
cyclosis.
They exchange gases from the external environment directly by diffusion due to the difference in the concentration
in and outside their body. Special tissues and organs are needed for the transport of substances in plants
and animals because these tissues and organs can pick up the essential substances like food, oxygen, water,
etc., at one end of their body and carry them to all other parts.

1. TRANSPORTATION IN HIGHER PLANTS

The higher plants have specialized system for the transportation of materials inside the body. This system is called vascular system or vascular tissues of the plants.
Vascular tissue : The vascular tissue consists of xylem and phloem.
(A) Xylem : Xylem contains four type of cells:-
(i) Xylem tracheids
(ii) Xylem vessels
(iii) Xylem parenchyma
(iv) Xylem sclerenchyma

- **Function :** It helps in transportation of water and minerals which is called **"ascent of sap"**. It helps in providing mechanical support.
- Transportation of water-
- **Transpiration :** The evaporation of water from the leaves of a plant is called transpiration. The continuous evaporation of water (or transpiration) from the cells of a leaf creates a kind of suction which pulls up water through the xylem vessels. Only Two percent of total water absorbed is used up in various metabolic activities in the plant body. Transpiration is the loss of water from the living tissues of the aerial parts of the plant in the form of water vapours.
  There are three types of transpiration :
  (i) Cuticular transpiration (through cuticle) - 3-9% of total transpiration.
  (ii) Lenticular transpiration (through lenticels) - 0.1% of total transpiration.
  (iii) Stomatal transpiration (through stomata) - 80-90% of total transpiration.

Importance of transpiration :

- It helps in absorption of water & minerals from the soil.
- It regulates the temperature of the plant.
- Mostly water absorbed by roots is lost by transpiration without serving any purpose. The energy spent by the plants in transpiration is wasted. So transpiration is a necessary evil.

Transpiration cohesion Theory :

- The main loss of water is through stomatal transpiration.
- Water evaporates from the surface of the cells into the air spaces of the spongy tissues and then passes into the outer atmosphere through the pores or stomata.
- The cell sap of mesophyll cells becomes concentrated by losing water and causes a drop in turgor pressure. As a result water is sucked from adjoining mesophyll cells and ultimately from vascular tissues.
- This tension is transmitted all the way down to the unbroken column of water through the stem to the absorbing parts of the root.
- The molecules of the water show cohesion (mutual attraction) and molecules of water and vessel wall show adhesion (affinity for water). Due to these adhesive and cohesive forces, water column does not break but pulled upward by the force called as **"transpiration pull"**.
- The whole process can be compared with a person (transpiration pull) pulling a bucket full of water (forces on water column) from a well with a rope (column of water due to cohesion).

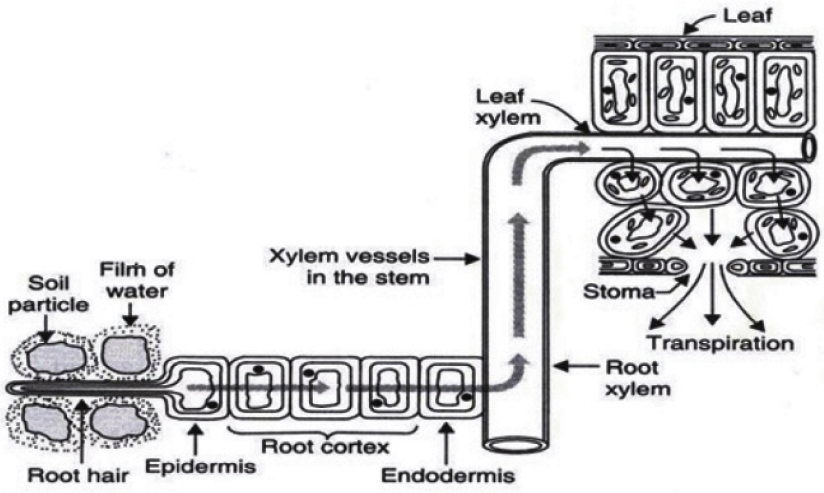


Figure : Leaf of plant

(B) Phloem : Phloem consists of four type of cells

(i) Sieve tubes

(ii) Companion cells

(iii) Phloem parenchyma

(iv) Phloem sclerenchyma

- **Function :** It helps in transportation of food.

Translocation :

Phloem translocates the manufactured food (in the form of sucrose) from the leaves to the different parts of the plant.

DIFFERENCES IN FUNCTIONING OF XYLEM & PHLOEM		
S.NO.	**XYLEM**	**PHLOEM**
1.	Xylem parenchyma only living cell remaining cells are dead.	Phloem sclerenchyma only dead cell remaining all cells are living.
2.	It carries minerals, salts and water.	An organic solution of sugars is translocated.
3.	The movement is only upward.	The movement can be upward or downward.

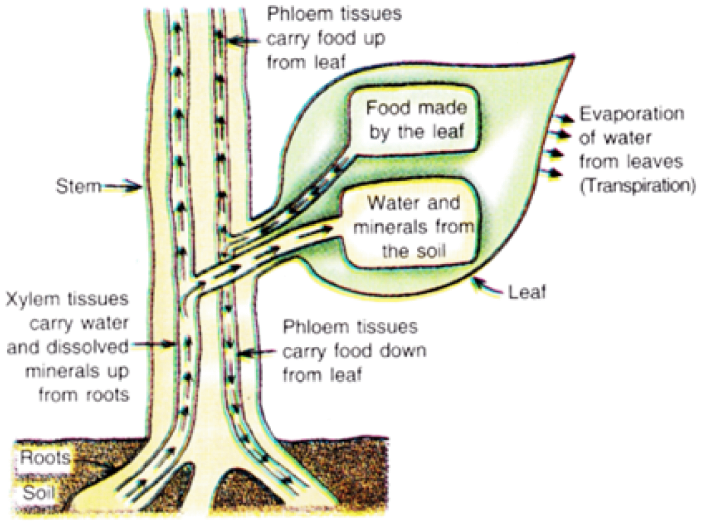


Figure : Transportation of food

2. TRANSPORTATION IN ANIMALS

In higher animal two type of Circulatory system is present :
(i) Open Circulatory system (ii) Closed Circulatory system.

S.NO.	CHARACTERS	OPEN CIRCULATORY SYSTEM	CLOSED CIRCULATORY SYSTEM
1.	Occurrence	In some annelids, most of molluscs and arthropods.	In most of annelids, cephalopods, molluscs and all vertebrates.
2.	Position of blood	Blood does not remain confined in the blood vessels and comes in lacunae or sinuses.	Blood remains confined in the blood vessels.
3.	Blood pressure	Blood flows at low pressure and cannot be regulated.	Blood flows at high pressure and can be regulated.
4.	Velocity of blood	Blood flows at a low velocity	Blood flows at a high velocity
5.	Exchange of materials	Direct exchange between blood and body cells	Exchange occurs through the tissue fluid.
6.	Respiratory pigment	When present, it is dissolved in blood plasma.	Always present and is usually present in RBCs e.g. vertebrates.
7.	Efficiency	Less efficient as blood takes more time to complete one circulation	More efficient as blood circulation is completed in short period.

Transportation in Humans :

- In humans there is a circulatory system that uses blood or lymph as carriers of materials (fluid exchange medium).
- Circulatory system consists of blood vascular system (blood as carrier) and lymphatic system (lymph as carrier).

(A) Blood Vascular System :

- Blood vascular system consists of blood, blood vessels and heart.
- The higher multicellular animals with higher metabolic rates possess a well developed blood vascular system.
- This system helps in the quicker supply of nutrients and oxygen to the body tissues and also in the rapid disposal of toxic waste materials and carbon dioxide.
- The blood acts as the circulatory fluid.

Blood : The blood is a specialized kind of living connective tissue which is made to circulate, by the muscular pumping organ called as the heart.

- In adult human beings there is 5.5 to 6 litre of blood.
- The main components of blood are :
  (I) Plasma (II) Blood corpuscles
- The formation of blood is called **"Haemopoiesis"**.

(I) Plasma : The liquid part (or fluid part) of blood is called plasma.

- **Note : Serum** is plasma from which fibrinogen is removed.

(II) Blood Corpuscles : Blood corpuscles are of three types.

(i) Red Blood Corpuscles (RBCs) or Erythrocytes :

- Mammalian RBC is a biconcave / disc-like structure devoid of nucleus.
- The number of RBCs is about 5-5.5 million per mm^3 of blood (RBC count).
- The mammalian erythrocytes (RBCs) do not possess nuclei, mitochondria and endoplasmic reticulum.The erythrocytes contain haemoglobin.
- Haemoglobin consists of globin (protein) and Fe^{2+} (haem).
- 100 ml of blood contains 15 gm of haemoglobin. if the amount of haemoglobin in blood is less, the person suffers from anaemia.
- Haemoglobin content of normal human male is 14.5 ± 2 gram percent, while it is 12 ± 2 gram percent in a normal human female.
- The haemoglobin carries oxygen to the different cells of the body.
- The life span of a RBC is 120 days.

(ii) White Blood Corpuscles (WBCs) or Leucocytes : White blood cells are called as soldiers of the body.This is because they protect the body from the attack of disease-causing germs (pathogens) and other harmful foreign materials.

- The life span of a RBC is 120 days.
- These are rounded or amoeboid-shaped, nucleated and non pigmented cells.
- These are less in number than RBCs.
- These are 5000–10000 per mm^3 of blood (WBC count).
- The number of leucocytes increases in infections like pneumonia, blood cancer (Leukaemia) etc.
- These are large in size than RBCs and contain nucleus. White blood corpuscles are of two types

(a) Granulocytes : In granulocytes the cytoplasm contains granules and the nucleus is multilobed.
Neutrophils, Basophils and Eosinophils are three different types of granulocytes.

(b) Agranulocytes : Monocytes and lymphocytes are two different types of agranulocytes. Lymphocytes secrete antibodies which destroy microbes.

(iii) Blood platelets : These are small and without nuclei. Their number varies from 0.15 to 0.45 million in 1 ml of blood. Their normal life span is one week. These help in blood clotting at the site of injury by liberating **thromboplastin**.

Blood Clotting : Blood forms a clot at the site of injury and thus prevents the further loss of blood.

- Thromboplastin changes prothrombin of blood plasma into thrombin.
- Thrombin converts soluble protein fibrinogen to insoluble fibrin.
- Fibrin forms a network which entangles RBCs and blood platelets to form plug or clot over the injured area.
- Blood clotting is usually completed within 8-15 minutes.

Injured tissue + Blood platelets $\longrightarrow$ Thromboplastin released

$$\text{Prothrombin} \xrightarrow[Ca^{++}]{\text{Thromboplastin}} \text{Thrombin}$$

$$\text{Fibrinogen (Soluble)} \xrightarrow{\text{Thrombin}} \text{Fibrin (Insoluble)}$$

Fibrin + Red blood corpuscles $\longrightarrow$ Clot of blood

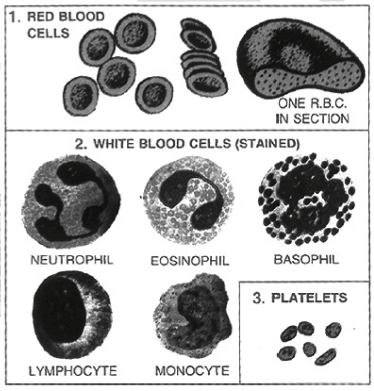


Figure : Different types of cells present in blood

Functions of Blood : Blood performs the following functions :

- **Transportation of nutrients :** The digested and absorbed nutrients like glucose, amino acids, fatty acids are first transported to the liver and then to all the tissues for their storage, oxidation and synthesis of new substances.
- **Transportation of respiratory gases :** The respiratory gases (oxygen, carbon-dioxide) are transported by the blood. Oxygen is transported from the respiratory surface (lung, skin and buccal cavity) to the tissues and carbon dioxide from the tissues is taken to the respiratory organ for its removal.

- **Transportation of excretory products :** Different wastes from the different parts of the body are collected by the blood and then taken to the organs (kidneys, lungs, skin and intestine) from where they are excreted.
- **Transportation of hormones :** Hormones are produced by endocrine glands. These hormones have target organs (place to act). These are carried by the plasma of blood and bring about the coordination in the working of the body.
- **Regulation of body temperature :** The blood flows in all the parts of body, so it equalizes the body temperature. It carries heat from one place to another place in the body.
- **Protection from diseases :** The WBCs (neutrophils, monocytes) engulf the bacteria and other disease causing organisms by phagocytosis. The lymphocytes produce antibodies to neutralize the action of toxins produced by pathogens.

Blood Groups :

- Landsteiner discovered that blood of different individuals did not match each other but there were biochemical differences.
- He discovered Antigens A and B and blood groups (ABO systems).
- Antigen (agglutinogen) is a glycoprotein present on RBCs. For each antigen there is a corresponding antibody. Thus there are two antibodies (agglutinin) a and b occurring in the blood plasma.
- There are four types of blood groups depending on the presence or absence of these antigens.

Allele from Parent 1	Allele from Parent 2	Genotype of offspring	Blood types of offspring
I^A	I^A	I^AI^A	A
I^A	I^B	I^AI^B	AB
I^A	i	I^Ai	A
I^B	I^A	I^AI^B	AB
I^B	I^B	I^BI^B	B
I^B	i	I^Bi	B
i	i	ii	O

Blood Vessels : These are hollow tubes through which the blood flows.

(1) Arteries : These are thick walled and deep seated blood vessels which generally carry the oxygenated blood away from the heart to various body parts.

(2) Veins : These are thin walled and superficially located blood vessels which generally carry deoxygenated blood from the body parts to heart.

(3) Capillaries : The capillaries are thin walled and extremely narrow tubes or blood vessels which connects arteries to veins. The exchange of various materials like oxygen, food, carbon dioxide, etc. between the blood and the body cells takes place through capillaries. Arteries are joined to veins through a network of very thin blood vessels called capillaries. Food and oxygengo from blood into body cells through capillaries. Waste materials (like carbon dioxide) go from body cells into the blood through capillaries.

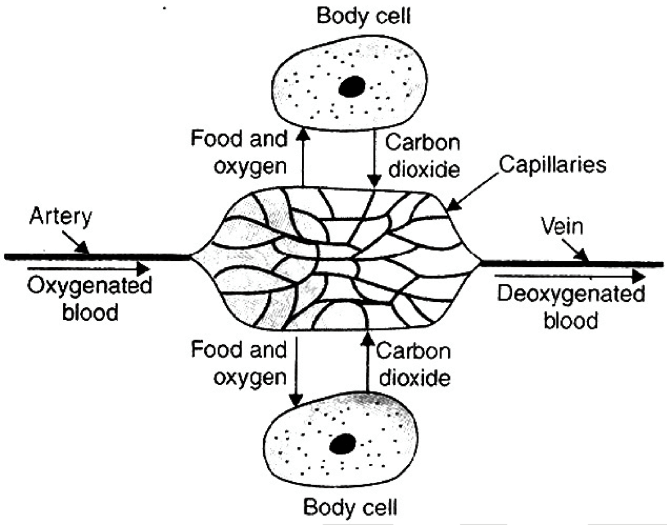


Figure : Exchange of Gases & Nutrient

S.NO.	CHARACTERS	ARTERY	VEIN
1.	Direction of blood flow	Away from the heart	Towards the heart
2.	Nature of blood	Generally oxygenated	Generally deoxygenated
3.	Position	Deep seated	Superficial
4.	Nature of wall	Thicker & more elastic	Thinner & less elastic
5.	Pressure & speed of blood	At higher pressure & faster	At low pressure & slower
6.	Valves	Absent	Present

Human Heart :

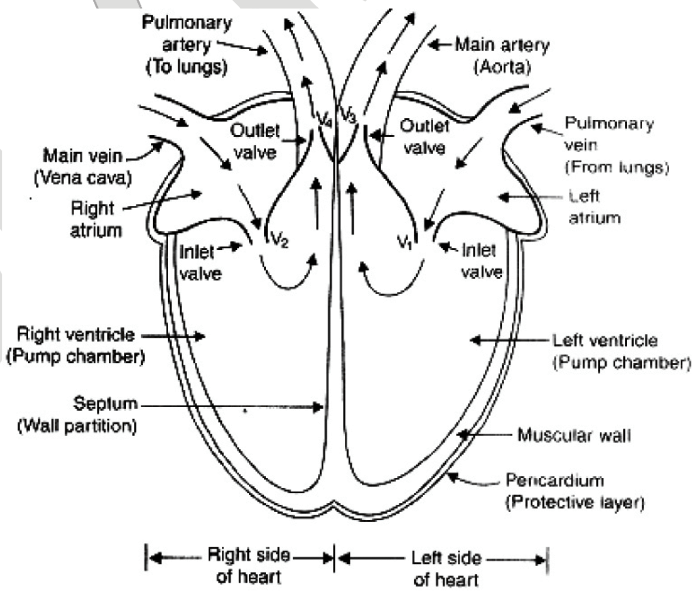


Figure : Structure of Heart

- Heart is a hollow muscular organ that lies obliquely in the thoracic region in a cavity between the two lungs that is pericardial cavity. It is lined by 2 layers outer and inner pericardial membranes. These are filled with a fluid called "pericardial fluid". It protects the heart from shock and injury. Heart is made up of 4 chambers : upper 2 chambers are auricles or atrium and the lower 2 chambers are ventricles. Auricles are the receiving chambers and ventricles are the pumping chambers. Walls of ventricles are thicker as they have to pump the blood.
- Four pulmonary veins enter into left auricle, two from each lung bring oxygenated blood. There is one auriculoventricular aperture with a bicuspid or mitral valve in left auricles which opens into left ventricle.
- Left ventricle has aortic valve having 3 semilunar cusps for large artery i.e. dorsal aorta which takes the oxygenated blood to all body parts.
- Right auricle has openings for superior venacava that brings deoxygenated blood from head, neck and upper limbs, inferior venacava receives deoxygenated blood from rest of the body and lower limbs. Blood enters in to right ventricle through tricuspid valve. A coronary sinus that drains venous blood from heart muscles.Right ventricle has semi-lunar valves for vein i.e. pulmonary vein which takes de-oxygenated blood to the lungs.
- The series of events which occur during one heart beat is called as **cardiac cycle**.

Types of circulation :

(1) Single circulation : In this, blood passes once through the heart to supply once to the body. It is found in fishes which have two chambered (one auricle and one ventricle), venous and branchial heart.

(2) Double circulation : A circulatory system in which the blood travels twice through the heart in one complete cycle of the body is called double circulation.

Double circulation involves two circulations :

Systemic circulation : Blood completes its circulation from left ventricle to right auricle through the body organs.

Pulmonary circulation : Blood completes its circulation from right ventricle to left auricle through the lungs.

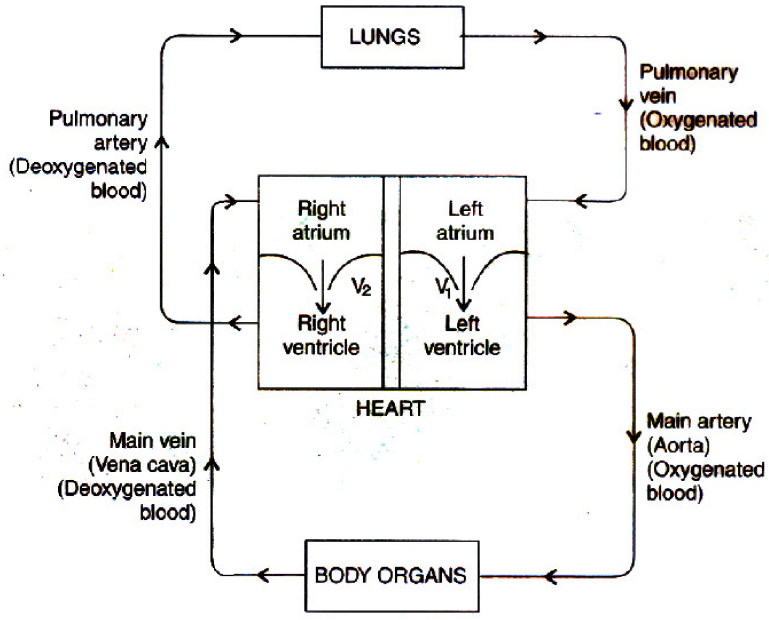
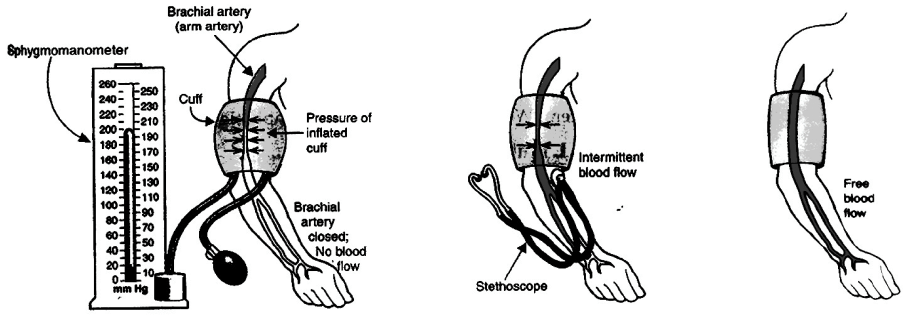


Figure : Show blood circulation in human body.

Blood Pressure : Blood pressure is the pressure exerted by the blood on the wall of blood vessel in which it is present.

- The blood pressure varies according to the contraction and relaxation of the heart.
- In the condition of contraction or systolic phase (Lubb sound) it is about 120 mm of Hg. This is called "systolic pressure".
- In the relaxation or diastolic phase (Dub sound) it is about 80 mm of Hg and is called "diastolic pressure".
- The normal blood pressure of man (20 years) is 120/80 mm of Hg.
- The blood pressure is measured by "Sphygmomanometer".



(*a*) No sound heard in stethoscope : cuff pressure is greater than systolic pressure

(*b*) When tapping sound first heard : cuff pressure is equal to systolic pressure

(*c*) When tapping sound just disappears : cuff pressure is equal to diastolic pressure

Figure : Measuring of blood pressure by using a mercury sphygmomanometer.

Pulse : Every time the heart beats, blood is forced into arteries. This blood makes the arteries expand a little. The expansion of an artery each time the blood is forced into it, is called **pulse**. Each heartbeat generates one pulse in the arteries, so the pulse rate of a person is equal to the number of heartbeats per minute. Since the heart beats about 70 to 72 times per minute, threfore, the pulse rate of an adult person while resting is 70 to 72 per minute. Thus, the pulse rate is the same as the heart rate.

Abnormal conditions of blood pressure :

Hypertension : It is an abnormal condition characterized by persistent high blood pressure, 150/90 mm of Hg. It is commonly called silent killer.

Hypotension : It is characterized by persistent low blood pressure, 100 / 50 mm of Hg.

Detection of Heart Beat :

- The muscle fibres of heart are specialized at certain parts generate tiny electrical currents which cause the normal heart beats.
- The **"electrocardiograph"** (E.C.G.) is the device to record these electrical changes.
- Electrocardiogram is a record of electrical behaviour of heart and remains constant in a normal man.

(B) Lymphatic system :

- system of tiny tubes called lymph vessels (or lymphatics) and lymph nodes (or lymph glands) in the human body which transports the liquid called lymph from the body tissues to the blood circulatory system is called lymphatic system. The lymphatic system consists of the following parts.

(a) Lymph vessels

(b) Lymph nodes (or Lymph glands)

(c) Lymph.

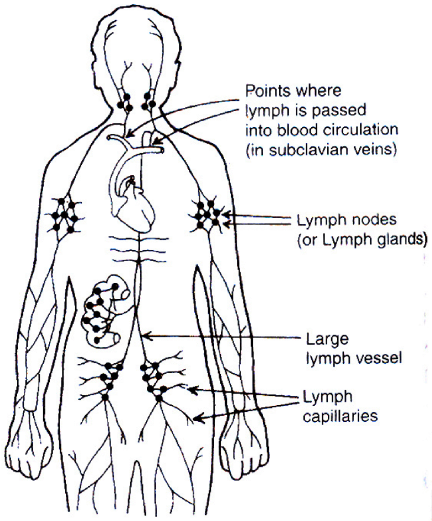


Figure : Human lymphatic system.

(d) Functions of Lymph :

- provides immunity through lymphocytes by producing antibodies.
- Fats are absorbed through lymph vessels (lacteals) in the intestine.
- It supplies digested food and oxygen to various parts of the body.
- It helps in removal of waste products like fragments of dead cells,etc.
- It returns proteins and excess tissue fluid to the blood from the tissue spaces.

Focus Point

- Polycythemia ¡V Abnormal increases in RBC count.
- Erythrocytopenia ¡V Decrease in number of RBC count.
- People living in hills have more RBCs.
- Largest Leucocytes Monocytes
- Mammalian heart Myogenic
- SA node Pacemaker
- AV node Pacesetter
- Haemolysis.It is destruction of red blood corpuscles with release of haemoglobin into plasma. It results in jaundice.
- Blue Whale has the largest heart in the whole world.
- Largest vein in human body ¡V Inferior vena cava.
- Largest Artery –V Aorta.
- RBCs fail to mature if there is a deficiency of vitamin B12 and folic acid.
- A “Blue baby” is the name given to an abnormal human baby who has a hole in the ventricular septum so that more oxygenated and less oxygenated blood mix.
- At higher altitude the blood volume increases.
- The spleen is often referred to as “Grave-yard” of RBCs.
- Angioplasty : A non-surgical procedure for treating diseased arteries.
- Biopsy : The procedure of taking a small tissue sample for examination.
- Cardiac arrest : The stopping of heartbeat.
- Cholesterol : A waxy substance that is produced in the human body, animal fats, and in dairy products and is transported in the blood.
- Cyanosis : Insufficient oxygen in the blood.

NS. 1

What are the components of the transport system in human beings ? What are the functions of these com ponents ?

Ans. The transport system (circulatory system) in human beings mainly consists of heart, blood and blood vessels.

(i) Function of heart : The heart receives deoxygen ated blood from the body parts and pumps it to lungs for enriching with oxygen. It receives purified blood from lungs and pumps it around the body.

(ii) Function of blood : Blood transports oxygen, carbon dioxide, digested food, hormones and nitrogeneous waste like urea. It also protects the body from diseases and regulates the body temperature.

(iii) Function of blood vessels : The blood pushed by the heart flows through the blood vessels (arteries, veins and capillaries) and also comes back to the heart through them.

NS. 2

Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds ?

Ans. Separation of oxygenated and deoxygenated blood allows good supply of oxygen to the body. This system is useful in animals that have high energy requirement. Mammals and birds constantly need oxygen to get energy to maintain their body temperature constant.

NS. 3

What are the components of the transport system in highly organised plants?

Ans. In highly organised plants there are two conducting tissues xylem and phloem.

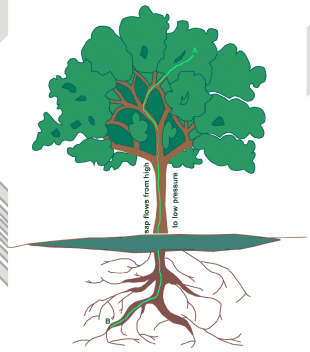
Xylem consists of vessels, tracheids and other xylem tissues. The interconnected vessels and tracheids form a continuous system of water conducting channels reaching all parts of the plant. Xylem carries water and minerals.

Phloem conducts soluble products of photosynthesis from leaves to different parts of the plant body.

NS. 4

How are water and minerals transport in plants ?

Ans. The roots of a plant have hair called root hair. The root hair are directly in contact with the film of water in between the soil particles. Water and dissolved minerals get into the root hair by the process of diffusion. The water and minerals absorbed by the root hair from the soil pass from cell to cell by osmosis through the epidermis, root cortex, endodermis and reach the root xylem.



Movement of water during transpiration in treed

The xylem vessels of the root of the plant are connected to the xylem vessels of its stem. Therefore the water containing dissolved minerals enters the root xylem vessels into stem xylem vessels. The xylem vessels of the stem branch into the leaves of the plants. So, the water and minerals carried by the xylem vessels in the stem reach the leaves through the branched xylem vessels which enter from the petiole (stalk of the leaf) into each and every part of the leaf. Thus the water and minerals from the soil reach through the root and stem to the leaves of the plants. Evaporation of water molecules from the cells of a leaf creates a suction which pulls water from the xylem cells of roots. The loss of water in the form of vapour from the aerial parts of the plant is known as transpiration.

NS. 5

How is food transported in plants ?

Ans. The movement of food in phloem (or translocation) takes place by utilizing energy. The sugar (food) made in leaves is loaded into the sieve tubes of phloem tissue by using energy from ATR Water now enters the sieve tubes containing sugar by the process of osmosis due to which the pressure in the phloem tissue rises. This high pressure produced in the phloem tissue moves the food to all parts of the plant having less pressure in their tissues. This allows the phloem to transport food according to the needs of the plant.

NS. 6

Describe double circulation in human beings. Why is it necessary?

Ans. The double circulatory system of blood flow refers to the separate systems of pulmonary circulation and the systemic circulation.

The adult human heart consists of two separated pumps, the right side with the right atrium and ventricle which pumps deoxygenated blood into the pulmonary circulation.

The oxygenated blood re-enters the left side of the heart through the pulmonary vein into the left atrium and passes to the left ventricle where it is pumped to the rest of the body. This part of the circulation is called as systemic circulation. This type of circulation is called double circulation. The advantage of a louble circulatory system is that blood can be pumped to the rest of the body at a higher pressure.

NS. 7

The xylem in plants are responsible for
(i) transport of water
(ii) transport of food
(iii) transport of amino acids
(iv) transport of oxygen

Ans. (i) transport of water

NS. 8

What would be the consequences of a deficiency of haemoglobin in our bodies?

Ans. Due to the deficiency of haemoglobin in blood, its oxygen carrying capacity decreases. As a result the production of energy by oxidation will become slower. Therefore, one would fall sick and would feel fatigue most of the time.

NS. 9

Describe double circulation in human beings. Why is it necessary?

Ans. In our heart blood enters twice and also pumped out twice from the heart. The deoxygenated blood from the body is brought to the right atrium through vena cava from where it is sent to right ventricle. From right ventricle, the blood is pumped to the lungs for oxygenation through pulmonary artery. The oxygenated blood from lungs again enters the left atrium of the heart through pulmonary veins. From left atrium it is send to left ventricle, from where this oxygenated blood is pumped to different parts of body through the arteries. In this way the blood flows through the heart twice, that's why it is called 'double circulation'.

Necessity of double circulation : The right side and the left side of the human heart are useful to keep deoxygenated and oxygenated blood from mixing. This type of separation of oxygenated and deoxygenated blood ensures a highly efficient supply of oxygen to the body. This is useful in case of humans who constantly need energy to maintain their body temperature.

NS. 10

What are the differences between the transport of materials in xylem and phloem ?

Xylem	Phloem
Xylem conducts water and dissolved minerals from roots to leaves and other parts.	Phloem conducts prepared food material from leaves to other parts of plant in dissolved form.
In xylem, the transport of material takes place through vessels and tracheids which are dead tissues.	In phloem, transport of material takes place through sieve tubes with the help of companion cells, which are living cells.
In xylem upward movement of water and dissolved minerals is mainly achieved by transpiration pull. It is caused due to suction created by evaporation of water molecules from the cells of a leaf.	In translocation, material is transferred into phloem tissue using energy from ATP. This increases the osmotic pressure that moves the material in the phloem to tissues which have less pressure.

NS. 11

Which changes occur when a person breathe in deeply?

	Diaphragm Muscle	External Intercostal Muscles
(a)	Contracts	Contract
(b)	Contracts	No change
(c)	Relaxes	Contract
(d)	Relaxes	Relax

Ans. (a) When a person breathes deeply the external in tercostal muscles contract causing the rib cage to swing up and out. Also, the diaphragm contracts and flattens causing the thoracic cavity to increase in volume and decrease in pressure.

EXERCISE – I

ONLY ONE CORRECT TYPE

1. Translocation means :
   (A) Conduction of food by phloem
   (B) Conduction of food by xylem
   (C) Conduction of water by phloem
   (D) Conduction of water by xylem
2. Transpiration is helpful in -
   (A) Cooling
   (B) Loss of Water
   (C) Transportation of water & minerals in plant body
   (D) Loss of nutrients
3. A girdled tree (upto) may survive for some time but it will eventually die, because
   (A) water will not move upwards
   (B) water will not move downwards
   (C) sugars and other organic materials will not move upwards
   (D) sugars and other other organic materials will not move downwards
4. Active transport of minerals in a plant requires
   (A) a carrier protein
   (B) a supply of energy
   (C) a molecule against its concentration gradient
   (D) all of these
5. Transpiration is helpful in -
   (A) Cooling (B) Loss of Water
   (C) Ascent of sap (D) Loss of nutrients
6. Prepared food in plants is translocated by -
   (A) xylem from leaves to root
   (B) phloem from leaves to whole plant
   (C) xylem from roots to leaves
   (D) phloem from roots to whole plant
7. Bast fibre is a woody stem belongs to
   (A) cork (B) cortex
   (C) xylem (D) phloem
8. Companion cells are usually seen to be associated with
   (A) fibres tissue (B) parenchyma tissue
   (C) xylem tissue (D) sieve tissue
9. The path of water and minerals in plants during 'transpiration pull' is.
   (A) root hair → root xylem → endodermis → root cortex → stem xylem → leaf xylem
   (B) root hair → root cortex → endodermis → root xylem → stem xylem → leaf xylem
   (C) endodermis → root hair → root xylem → root cortex → stem xylem → leaf xylem.
   (D) root hair → endodermis → root xylem → root cortex → stem xylem → leaf xylem.
10. Which of the following is used in measuring blood pressure ?
    (A) Potometer
    (B) Sphygmomanometer
    (C) Barometer
    (D) Goneometer
11. An artery is a vessel that carries blood
    (A) with high concentration of oxygen
    (B) with high concentration of CO_2
    (C) away from the heart
    (D) both A & C
12. Valves are found in veins to check the backflow of blood flowing under
    (A) high pressure
    (B) low pressure
    (C) no pressure
    (D) atmospheric pressure.
13. In the cardiac cycle, diastole is
    (A) the number of heart beats per minute
    (B) the relaxation period after contraction of the heart
    (C) the forceful pumping action of the heart
    (D) the contraction period after relaxation of the heart
14. One of the difference between blood and lymph is that
    (A) blood has RBCs and platlets while lymph have WBCs and lymphocytes
    (B) blood has RBCs while lymph has no WBCs
    (C) blood has WBCs while lymph has RBCs
    (D) blood has dissolved organic salts while lymph has no such inorganic salt

15. Blood vessel carrying blood from lung to heart through
(A) Pulmonary artery
(B) Pulmonary vein
(C) Coronary artery
(D) None of these

16. Mammals are said to have double circulation, it means
(A) Blood vessels are paired
(B) There are two types of blood vessels attached to every organ
(C) There are two systems,
(D) The blood circulates twice through the heart

17. The first heart sound is produced when :
(A) intraventricular pressure decreases
(B) semilunar valve snaps shut
(C) bicuspid and tricuspid valve close quickly
(D) diastole begins

18. A transport system is needed to transport
(i) Nutrients, oxygen and hormones from the place, they are absorbed or received to the cells.
(ii) Waste products from the place they are formed to the place from where they are eliminated outside.
(iii) Nitrogen transport from lungs to organs
(A) (i) and (ii) correct
(B) (i) and (iii) correct
(C) (ii) and (iii) correct
(D) (i), (ii) & (iii) correct

19. Pulmonary vein carries -
(A) impure blood always
(B) pure blood always
(C) impure blood sometimes
(D) mixed blood

Space for Notes :

EXERCISE – II

VERY SHORT ANSWER TYPE

1. What is the advantage of having four chambered heart ?
2. What will happen if platelets were absent in the blood?
3. Explain the importance of transportation.
4. What is double circulation ?
5. What is lymph ?

SHORT ANSWER TYPE

1. Describe the functions of artery.
2. Why is blood circulation in human heart called double circulation ?
3. Differentiate between artery and vein.
4. Describe the flow of blood through the heart of human beings
5. Distinguish between transpiration and translocation.
6. Explain various components of xylem and phloem.
7. How does blood help in transportation ?
8. Explain the composition of blood. Also give functions of all it's components.
9. Distinguish between open and closed circulatory system.
10. What is 'clotting of blood' ? Write a flow chart showing major events taking place in clotting of blood.

LONG ANSWER TYPE

1. Why do veins have thin walls as compared to arteries ?
2. Why is transpiration important for plants ?
3. (a) Draw a sectional view of the human heart and label on it Aorta, Pulmonary arteries, Vena cava, Left ventricle.
   (b) Why is double circulation of blood necessary in human beings ?
4. Write one function each of the following components of the transport system in human beings.
   (a) Blood vessels (b) Blood platelets (c) Heart

Answer Key

EXERCISE–I														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	C	D	D	C	B	D	D	B	B	D	B	B	A	B
16	17	18	19											
D	C	A	B											

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : TRANSPORTATION)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

NOTES :

1. In the status, put "completed" only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.

Space for Notes :

CONTROL AND COORDINATON

5

1. NERVOUS COORDINATION IN ANIMALS

There are two systems to control and coordinate various activities in animals –
(a) Nervous system (b) Endocrine system

1.1 NERVOUS SYSTEM

NEURON

- The structural and functional unit of nervous system.
- Neuron (nerve cell) is the longest cell of human body (up to 100 cm)
- Neuron is made up of –
  (i) Cell body
  (ii) Cell processes (axon and dendron)

(i) Cell body or **Cyton** or **Soma** or **Perikaryon**

- It contains granular cytoplasm which is called neuroplasm.
- Many small fibrils are present in the neuroplasm called neurofibrils for the conduction of nerve impulses.
- Rough endoplasmic reticulum coils around the ribosome and form a granule like structure called as **Nissl's granule**.
- Nissl's granule is the centre of protein synthesis.
- Energy for conduction of nerve impulses is provided by numerous mitochondria.
- Except centriole, all other cell organelles are found in neuroplasm.

(ii) Cell process :–

(a) Axon :

- It is longest cell process of cyton, its diameter is uniform and it contains axoplasm.
- Axoplasm of axon contains only neurofibrils and mitochondria.
- Nissl's granules are absent.
- Axon is covered by axolemma.
- Axolemma may be covered by a layer of phospholipids which is called as **myelin sheath**.
- Myelin sheath acts as insulator and prevents leakage of ions.
- Myelin sheath is discontinuous around the axon. These interruptions where axon is uncovered by myelin sheath are called **nodes of Ranvier**.
- Axon produces centrifugal conduction i.e. nerve impulse travels away from the cell body.
- The terminal ends of axon are branched which are called **telodendria**.
- Each telodendron ends in a swollen knob called **synaptic knob**.
- Nerve fibres in which myelin sheath is present, are called **myelinated nerve fibres** and nerve fibres without myelin sheath, are called **non-myelinated nerve fibres**.

Axon is functional part of nerve cell, therefore term "nerve fibre" usually refer to axon.

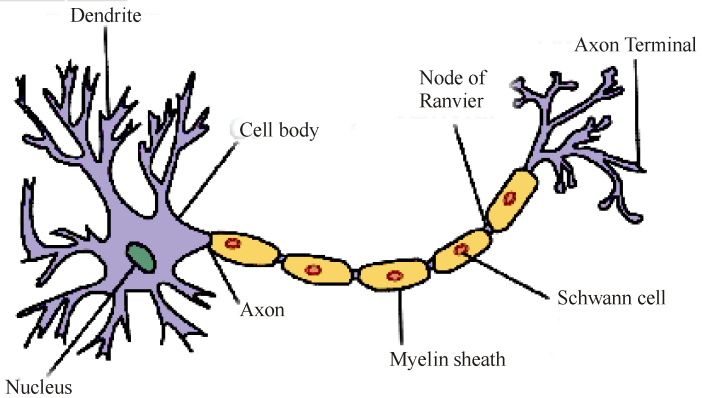


Figure : Neve cell

(b) Dendron :–

- It is small cell process.
- It's fine branches are called '**dendrites**'
- Dendron receive the stimuli and produce **centripetal conduction** i.e. nerve impulse travels towards the cell body.
- It is not covered by myelin sheath.

Differences between Axon and Dendron –

S.No.	Features	Axon	Dendron
1	Size	Long	Small
2	Number	Either absent or one	Either absent or one, mostly many.
3	Diameter	Uniform	Non-uniform
4	Branching	Generally	Branched
5	Terminal knobs (Telodendria)	Present	Absent
6	Nissl's granule	Absent	Present
7	Myelin sheath	Present	Absent
8	Direction of nerve impulse	Away from cyton	Towards cyton

Differences between myelinated and non-myelinated nerve fibre.

S.No.	Features	Myelinated nerve fibre	Non-Myelinated nerve fibre
1	Occurrence	White matter	Grey matter
2	Node of Ranvier	Present	Absent
3	Speed of nerve impulse	Faster	Slower

1.2 TYPE OF NEURONS

On the basis of number of cell processes

- **Non-polar** – No definite dendron and axon
- **Unipolar** – Single process i.e. one axon
- **Bipolar** – Two processes i.e. one axon and one dendron
- **Multipolar** – One axon and many dendrons
- **Pseudounipolar** – Axon is one but appears two

On the basis of function

- Sensory or Afferent neuron – Sensory organ to CNS
- Association or Inter-neuron – Joins Sensory to motor neuron
- Motor or Efferent neuron – CNS to effector organ

1.3 SYNAPSE

The junction between two adjacent neurons i.e. between the axon ending of one neuron and dendrites of the next.

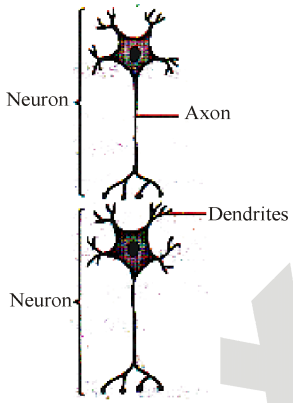


Figure : A synapse

Focus Point

Neurotransmitters – Chemical substances which either transmit or inhibit the message from one neuron to another.

Neurotransmitters

Stimulatory Neurotransmitters
Stimulate impulse at synapse
e.g. - Acetyl choline (Ach)

Inhibitory Neurotransmitters
Inhibit impulse at synapse
e.g. - GABA (Gamma Amino Butyric Acid)

Nerve impulse : It is an electro-chemical information (signal) passing through neuron.

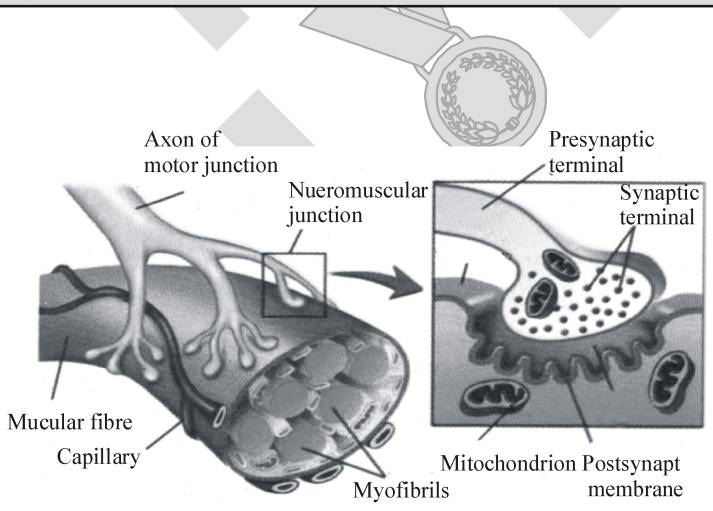


Figure : Neuro Muscular Junction

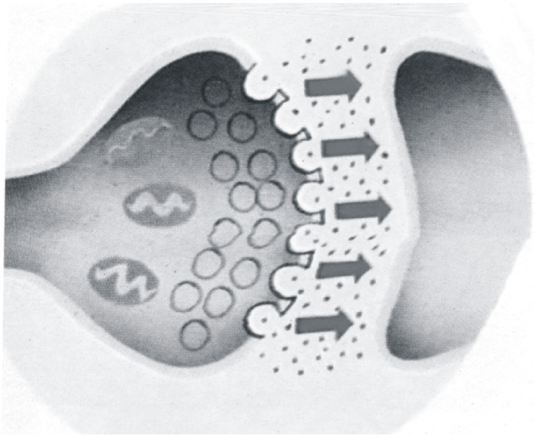


Figure : Transmission of nerve impulse across synapse

1.4 TRANSMISSION OF NERVE IMPULSE

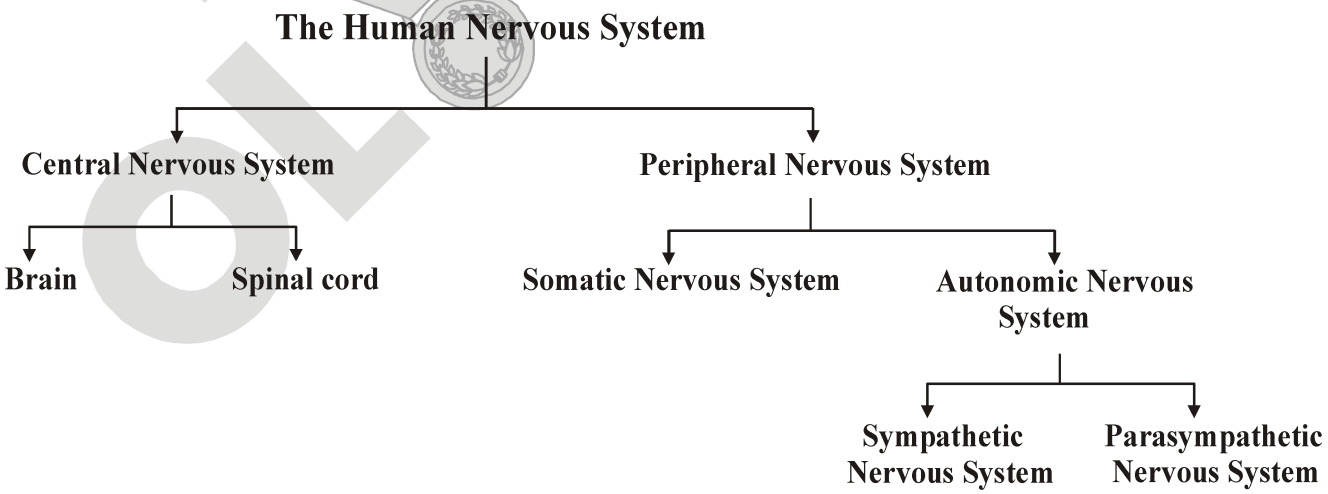
- Stimuli are detected by dendrites of receptor nerve cells located at our sense organs i.e. ear, eyes, nose, tongue and skin.
- A chemical reaction occurs and creates **electric impulse**.
- Impulse travels from dendrites and finally reaches axon endings (synaptic knobs)
- Impulse releases some chemicals like **acetylcholine** from synaptic knob.
- By these chemicals, impulse transmits across synapse.
- This initiates similar electric impulse in a dendrite of next neuron and thus impulse is transferred from one nerve cell to another.
- Message is sent to CNS (brain and spinal cord) via sensory nerves.
- CNS sends message to muscles via motor nerves
- Muscles of effector organ show response.

Receptors	Stimuli	Location
Olfactoreceptors	smell	nasal chamber
Gustatoreceptors	taste	taste buds on tongue
Tangoreceptors	touch	skin

Physiology of Nerve Impulse

- At resting stage : in this stage, anions (negative ions) are present on inner surface of neuron membrane and cations (positive ions) are present on outer surface of neuron.
- This neuron membrane is said to be **polarised.**
- At exciting stage : As the neuron receive external stimuli, undergoes **depolarisation**.
- The anions are now on outer surface and cations on inner surface.
- At this point, nerve impulse is **initiated**.
- **Repolarisation** : As the impulse conducts forward, repolarisation occurs at previous point.
- As the impulse reaches the nerve synapses acetyl choline is secreted by terminal end. Through this, impulse is transmitted to dendrites of the next nerve. Thus, the impulses are transmitted.

2. THE HUMAN NERVOUS SYSTEM



2.1 CENTRAL NERVOUS SYSTEM (CNS)

- CNS consists of the brain and the spinal cord.

(A) BRAIN

- Brain is the most important part of human body.
- Brain is situated in a cranial box (cranium) which is made of bones.
- **Meninges** : Brain is covered by three membranes of connective tissue, termed as meninges.

(i) Dura Mater : It is the first and the outermost membrane which is thick, very strong and nonelastic.

(ii) Arachnoid Mater : It is middle, thin, delicate and non-vascular membrane found only in mammals.

(iii) Pia Mater : It is innermost, most vascular, thin and transparent membrane.

- The space between the arachnoid and pia mater is filled with a fluid called cerebrospinal fluid (CSF). It protects the brain from mechanical shocks.

Meningitis : Any inflammation of meninges is called meningitis.

Weight of brain : In adult male 1400 gm, female 1250 gm.

Parts of Brain		
(1) Fore brain	(2) Mid brain	(3) Hind brain
(a) Cerebrum	(a) Crura cerebri	(a) Cerebellum
(b) Diencephalon	(b) Corpora quadrigemina	(b) Pons
		(c) Medula oblongata

(1) Forebrain (Prosencephalon) :

(a) Cerebrum (Telencephalon) :

- It is the most developed and the most complex part of brain.
- It makes 2/3 part of total brain.
- Cerebrum consists of two cerebral hemispheres (Left and right cerebral hemispheres).
- Outer part of cerebral hemispheres is known as **cerebral cortex**.
- Both cerebral hemispheres are connected by a thick nerve band called **corpus callosum**.
- Many ridges and grooves are found on dorsal surface of cerebral hemisphere.
- Ridges are known as **gyri**, whereas grooves are known as **sulci**.
- These gyri and sulci increase the surface area of brain.
- Each cerebral hemisphere is divided into 4 lobes :-

(i) Anterior : Frontal lobe for intelligence, knowledge, reasoning,creative ideas and memory.

(ii) Middle : Parietal lobe for taste, writing, pain, touch and pressure.

(iii) Lateral : Temporal lobe for language, hearing and smell.

(iv) Posterior : Occipital lobe meant for vision.

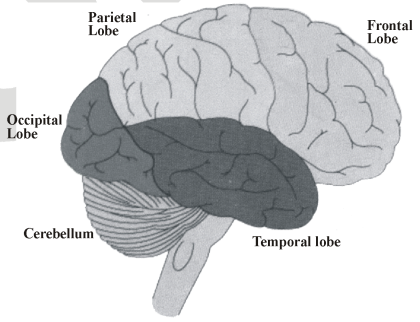


Figure : Various lobes of Cerebrum

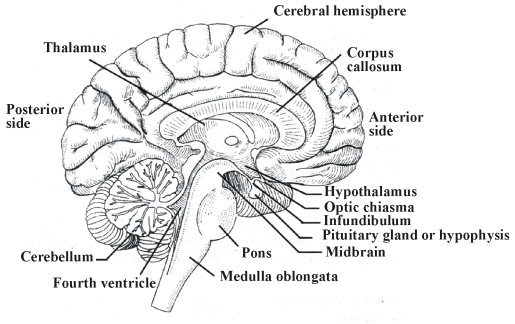


Figure :Sagital (median) section of human brain

(b) Diencephalon :

- It is small and posterior part of fore brain.
- It is covered by cerebrum.

(i) Thalamus :

- They act as relay station.
- They receive all sensory impulse from all parts of body and these impulses are send to the cerebral hemispheres.

(ii) Hypothalamus :

- It forms lower lateral wall of diencephalon.
- Pituitary body is attached to middle part of hypothalamus by infundibulum.
- **Functions :** (i) Thermoregulation (ii) Behaviour and emotion
  (iii) The centres of hunger and thirst are present in it.

(2) Mid brain (Mesencephalon) :

- It is small and contracted part of brain.

(a) Cerebral peduncles (Crura cerebri) :

- Anterior part of mid brain contains two longitudinal myelinated thick nerve fibres, called **crura cerebrai**.
- They connect the medulla oblongata of hindbrain to cerebrum of fore brain.
- It controls the limb muscle movement.

(b) Optic lobes (Corpora Quadrigemina) :

- On the posterior part of mid brain, four spherical projections are found, called **optic lobes**.
- Four optic lobes are collectively called **corpora quadrigemina**.
- These mainly control vision.

(3) Hind Brain (Rhombencephalon) :

(a) Pons :

- It is small, spherical projection, which is situated below the mid brain and upper side of medulla oblongata.
- It regulates the breathing action.

(b) Cerebellum :

- It is made up of 3 lobes (2 lateral lobes and 1 vermis).
- Lateral lobes are also called **cerebellar hemisphere**.
- **Function :** To maintain body balance and posture. It is responsible for percision of voluntary actions.

(c) Medulla oblongata :–

- It is the posterior-most, tubular and cylindrical part of brain.
- The lower end medulla extends in the from of spinal cord.
- **Functions:**
  (i) It controls all the involuntary activities of the body. **e.g.** heart beats, respiration, blood pressure salivation.
  (ii) It also concerned with some reflexes- sneezing reflex, coughing reflex and vomiting reflex.

Difference between cerebrum and cerebellum

S.No.	Features	Cerebrum	Cerebellum
1	Part of	Forebrain	Hindbrain
2	Size	Largest part of brain	Second largest part of brain
3	Function	Associated with intelligence, memory	Associated with body balance and posture

(B) SPINAL CORD

- It is a downward continuation of the medulla oblongata, which lies in the vertebral column.

Functions of spinal cord –

(i) Spinal cord regulates and conducts the reflex actions.
(ii) It acts as bridge between brain and organs of the body.
(iii) It also provides relay path for the impulses coming from brain.

2.2 REFLEX ACTIONS

- "**Marshal Hall**" first observed the reflex actions.
- Reflex actions are spontaneous, automatic, involuntary and mechanical responses produced by specific stimulating receptors.
- Reflex actions are completed very quickly as compared to normal action
- The path of completion of reflex action is called "**reflex arc**".

A typical reflex action has the following pathway –

Stimulus → Receptor organ → Sensory nerve → Spinal cord → Motor nerve → Muscle action of effector organ

REFLEX ARC

Examples :– (i) Withdrawal of hand when pinched with a needle.
(ii) Blinking of eyelids and coughing.

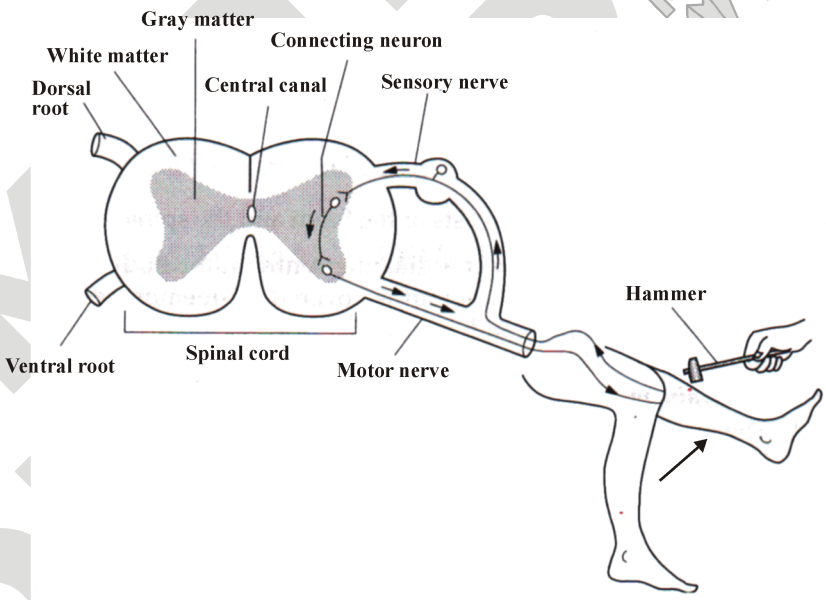


Figure : An example of reflex action (Knee jerk reflex)

2.3 PERIPHERAL NERVOUS SYSTEM

- All the nerves arising from brain and spinal cord are included in peripheral nervous system.
- PNS consists of two sets of nerves :

(A) Cranial Nerves :

- Nerves arising from brain are called cranial nerves.
- Nerves may be sensory, motor or mixed.

- 12 pairs of cranial nerves are found in reptiles, birds and mammals but amphibians and fishes have only 10 pairs.

(B) Spinal Nerves :–

- Nerves arising from spinal cord.
- Each spinal nerve is mixed type and arises from the roots of the horns of grey matter of the spinal cord.
- In human only 31 pairs of spinal nerves are found.

2.4 AUTONOMIC NERVOUS SYSTEM (ANS)

- The autonomic nervous system is that part of the peripheral nervous system which controls activities inside the body that are normally involuntary.
- ANS plays an important role in maintaining the constant environment (Homeostasis).
- There are the two divisions of the ANS **:–**

(a) Sympathetic nervous system **(b) Para sympathetic Nervous system**

(a) Sympathetic Nervous System :–

- It is related with such visceral reactions, which increase the protection of body in adverse atmospheric conditions.

(b) Para sympathetic Nervous System :

- It is related with those reactions in which energy is conversed.
- In this way, ANS controls the activities of visceral organs double side i.e. **antagonistic** to each other.

2.5 SOMATIC NERVOUS SYSTEM

It is a part of Peripheral Nervous System which controls activities inside the body that are voluntary.

Effects of sympathetic and parasympathetic nervous system

S.No.	Organs involved	Sympathetic effect	Parasympathetic effect
1	Eyes	Dilation of pupil	Constriction of pupil
2	Bronchi	Dilates	Constricts
3	Heartbeat rate	Increases	Decreases
4	Blood pressure	Increases	Decreases
5	Blood vessels	Constricts	Dilates
6	Gastric secretion	Inhibits	Stimulates
7	Urinary bladder	Relaxes	Contracts

Focus Point

- **Cerebrospinal Fluid (C.S.F) :–** This fluid is clear and alkaline in nature just like lymph. C.S.F is present in ventricle of brain, subarachnoid space between arachnoid and piamater and spinal cord. It acts as shock absorbing medium.
- **Grey matter :** It is composed of cytons and non-myelinated nerve fibres.
- **White matter :** It is composed of myelinated nerve fibres.

3. ENDOCRINE GLANDS

The various endocrine glands in humans are hypothalamus, pituitary gland, thyroid gland, parathyroid glands, Thymus, pancreas, adrenal glands, ovary (in female) and testis (in males).

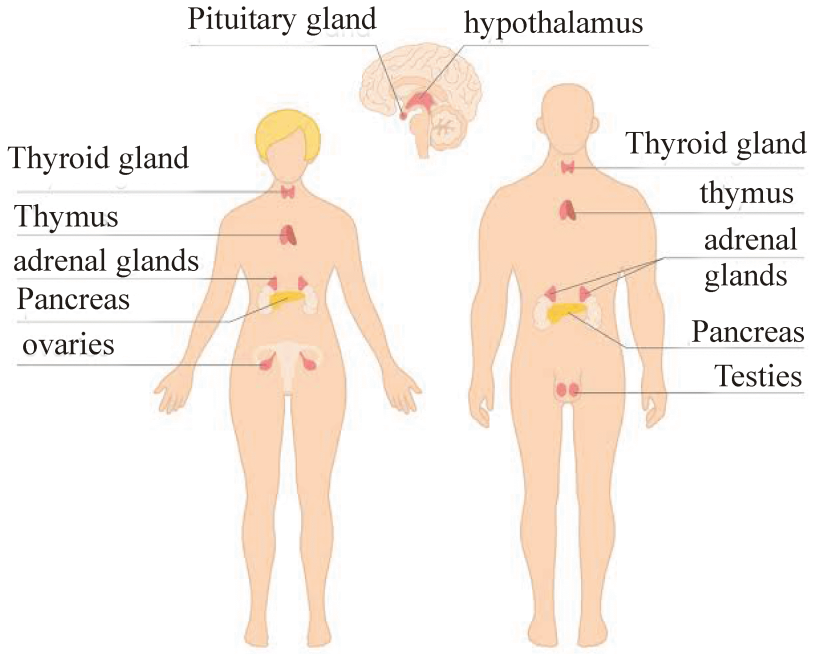


Figure : Endocrine glands in human beings.

Endocrine Gland	Hormone	Function	Deficiency may cause
Pituitary	Growth Hormone	Regulates growth and development of body	Dwarfism
	ADH	Regulates the concentration of urine	Diabetes insipidus
Thyroid Gland (Largest endocrine gland)	Thyroxine	Controls carbohydrate, protein and fat metabolism. It regulate BMR [Basal metabolic rate]	Goitre
	Calcitonin	Regulates blood calcium levels	
Adrenal gland	Adrenaline	Prepares the body to deal with emergency situations	
Pancreas	Insulin	Decrease blood sugar levels	
	Glucagon	Increase blood sugar levels	Diabetes mellitus
Testes	Testosterone	Causes development of sexual organs and secondary sexual characteristics in males	
Ovary	Oestrogen	Causes development of sexual organs and secondary sexual characteristics in females	
	Progesterone	Maintains pregnancy	

Note : There are two heterocrine glands found in humans – Pancreas and Gonads (Testes in males and ovaries in females).

4. COORDINATION IN PLANTS

Plants have neither a nervous system nor muscles. But they give response to stimuli. The higher plants are fixed to the substratum by means of roots. They can not move from one place to another. They therefore show movement of their parts only.

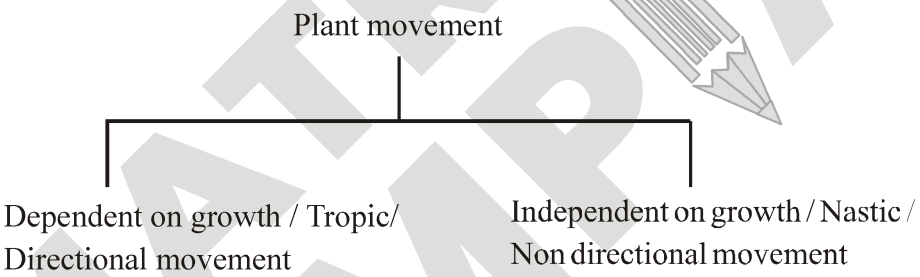
The plants coordinate their behaviour against environmental changes by using hormones. These hormones affect the growth of a plant. Which may result in movement of shoot and root of plant.

4.1 MOVEMENT IN PLANTS

Plants show two different types of movement. The plants may either respond to various stimuli very slowly by growing e.g. when a seed germinates the root goes down and the stem comes up into the air or they can show rapid movements like leaves of sensitive plant move very quickly in response to touch by folding and drooping without growing.

4.2 CLASSIFICATION OF PLANT MOVEMENTS

These are of two types



Both tropic and nastic movement can be either due to differential growth or due to change in turgidity. Movement due to differential growth are irreversible while movement due to change in turgidity are reversible.

4.3 TROPIC MOVEMENT

Tropic movement is the directional movement of the part of a plant caused by its growth. The growth of a plant part in response to the stimulus can be towards the stimulus (positive tropism) or away from the stimulus (negative tropism).

Types of tropic movements

(1) Phototropism (2) Geotropism (3) Chemotropism
(4) Hydrotropism (5) Thigmotropism

(1) Phototropism

The movement of a part of the plant in response to light is called phototropism. If the plant part moves towards light is called positive phototropism and if the plant part moves away from light then it is called negative phototropism.

(2) Geotropism

The movement of a part of the plant in response to gravity is called geotropism. Roots of a plant move downwards in the direction of gravity it is called positive geotropism and stem of a plant moves upwards against the direction of gravity it is called negative geotropism.

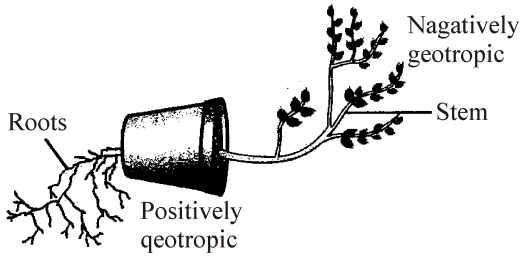


Figure : Plant showing geotropism

(3) Chemotropism

The movement of a part of plant in response to a chemical stimulus is called chemotropism. e.g. Growth of pollen tube towards the ovule during the process of fertilization in a flower.

(4) Hydrotropism

The movement of a part of plant in response to water is called hydrotropism. Roots of seedling show positive hydrotropism.

(5) Thigmotropism

The movement of a part of plant in response to contact or support is called thigmotropism. e.g. Pea plant climb up other plants or fences by mean of tendrils. Tendrils are sensitive to touch. When tendrils come in contact with any support, the part of the tendril in contact with the object does not grow as rapidly as the part of tendril away from the object. This causes the tendril to circle around the object and thus cling to it.

Movement	Stimulus	Example
Phototropism	Light	Bending of shoot towards light.
Geotropism	Earth's gravity	Bending of roots towards ground.
Chemotropism	Chemicals	Growth of pollen tube towards ovule.
Hydrotropism	Water	Movement of roots towards ground water.
Thigmotropism	Contact	Movement of tendril towards support.

4.4 NASTIC MOVEMENT

Movement which is neither towards nor away from the stimuli is called nastic movement. It is growth independent movement.

Seismonastic/Thigmonastic movements

Such movements occur in response to touch (shock). These movements are very quick and are best seen in 'touch-me-not' plant (Mimosa pudica), also called 'Chhui-mui' or 'Lajwanti' or 'sensitive plant'.

If we touch the leaves of the chhui-mui plant with our finger, the stimulus is transmitted to its base and then to other parts through the xylem sap, probably in the form of a chemical. Due to which all its leaves immediately fold up and drop. After sometime, the leaves regain their original status. Here, no growth is involved. Instead, plant cell change shape by changing the amount of water in them (turgor changes), resulting in folding up and drooping of leaves.

Figure: Response to touch in Mimosa pudica

Difference between tropic and nastic movement

Tropic movements	Nastic movements
Direction of movement is in the direction of the stimulus or against it.	Movement are non directional.
Growth takes place.	Growth does not take place.
Movements are slow.	Movements are fast.
E.g. Growth movement of shoot towards light.	E.g. The folding up and drooping of leaves in the sensitive plants.

5. CHEMICAL COORDINATION IN PLANTS

It takes place by the plant hormones or phytohormones. They help to coordinate growth, development and response to the environment. They are synthesized in minute quantity in one part of the plant body and simply diffuse to another part, where they influence specific physiological processes.

Types of phytohormones or growth regulators

Growth promoter
1. Auxins
2. Gibberellins
3. Cytokinins

Growth inhibitor
1. Abscisic acid
2. Ethylene

5.1 GROWTH PROMOTERS

(1) Auxins

Auxin was the first plant hormone discovered by Went. It promotes cell elongation, apical dominance and help in root initiation in cutting or in callus differentiation.

Role of auxin in phototropism

When growing plants detect light, a hormone called auxin, synthesized at shoot tip, helps the cells to grow longer.

When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot.

This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light.

Thus, the plant appears to bend towards light.

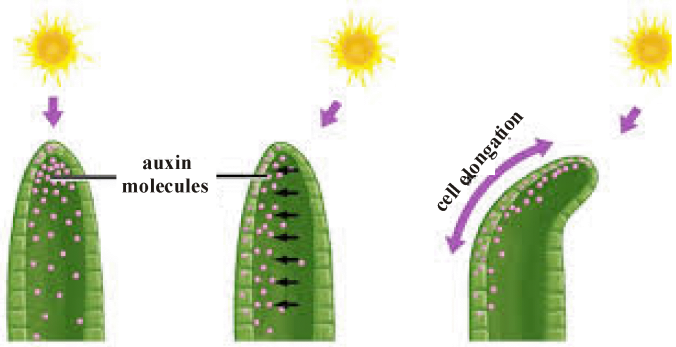


Figure : The role of auxin in phototropsim

(2) Gibberellins

It is found in various plant parts such as root, stem, leaves, fruits and immature seeds. It stimulate stem elongation or help in growth of the stem. It helps in breaking dormancy in seeds and buds. It promotes growth in fruits and increases size and number of fruits.

(3) Cytokinins

Cytokinins promote cell division, and they are present in greater concentration in areas of rapid cell division such as in fruits and seeds. It promotes opening of stomata.

Cytokinins suppress apical dominance (promotes lateral branches in the presence of apical bud). Help in secondary growth (growth in thickness). It helps in breaking the dormancy of seeds and buds.

5.2 GROWTH INHIBITORS

(1) Abscisic acid (ABA)

It is called stress hormone which inhibit the growth. It promotes the closing of stomata under water stress condition thus effects wilting of leaves.

It cause dormancy of seeds and promotes falling of leaves.

(2) Ethylene

It is a gaseous hormone which promotes fruit growth and ripening.

It prevents elongation of stem and roots in longitudinal direction. It promotes yellowing and senescence of leaves.

NS. 1

Which of the following is a plant hormone ?
(A) Insulin (B) Thyroxine
(C) Oestrogen (D) Cytokinin

Ans. (D)

NS. 2

The gap between two neurons is called a
(A) Dendrite (B) Synapse
(C) Axon (D) Impulse

Ans. (B)

NS. 3

The brain is responsible for
(A) Thinking
(B) Regulating the heartbeat
(C) Balancing the body
(D) All of the above

Ans. (D)

NS. 4

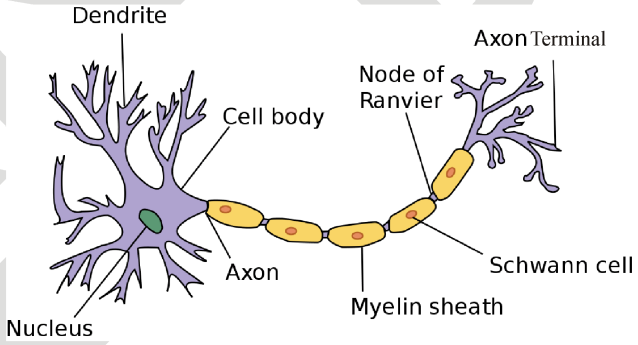
What is the function of receptors in our body ? Think of situations where receptors do not work properly. What problems are likely to arise ?

Ans. The receptors in our body collect information about changes in the environment around us in the form of stimuli, e.g., photoreceptors, gustatoreceptors, olfactory receptors. These receptors then passes the information in the form of nerve impulses to central nervous system (spinal cord and/or brain) where message is interpreted and appropriate instructions are sent to effectors (glands or muscles) which reveal responses. When receptors do not function normally, the environmental stimuli are not able to create nerve impulses and body does not respond. For example, if our gustatory receptors located in the tongue do not work properly we will not perceive the taste of food such as sour, sweet, salty or bitter.

NS. 5

Draw the structure of a neuron and explain its function.

Ans. Neuron or nerve cell is a structural and functional unit of the nervous system that is specialised to receive, conduct and transmit nerve impulses.
A neuron (nerve cell) has three components :
(i) Cell body (cyton)
(ii) Dendrites
(iii) Axon



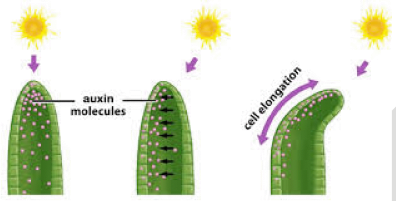
Functions : The information acquired at the end of the dendritic tip of a neuron sets off a chemical reaction which creates an electrical impulse. This impulse travels from the dendrite to the cyton along the axon of its end. At the end of axon, the electrical impulse sets off the release of some chemicals, which cross the synapse and start as similar electrical impulse in a dendrite of the next neuron. In this way, nerve impulses travel in the body, from one neuron to another till it reaches the brain or the target organ. Thus, a nervous tissue is made up of an organised network of nerve cells or neurons which are specialised in conducting information via electrical impulse from one part of the body to another.

NS. 6

How does phototropism occur in plants ?

Ans. The directional movement of a plant part/plant in response to light is called phototropism. The shoot responds by bending towards light while roots respond by bending away from the light. We know that the plant stem responds to light and bend towards it due to the action of auxin hormone. This happens as follows.

(i) When sunlight falls on the plant, the auxin hormone present at the tip of the stem spreads uniformly down the stem. Due to the equal presence of auxin, both the sides of the stem grow straight and with same rapidity.



The role of auxin in phototropsim

Experiment to show the effect of auxin on the growth of a plant in response to light (phototropism)

(ii) When the light falls only on the right side of the stem, then the auxin hormone collects in the left side of the stem, away from the light. This is because auxin hormone prefers to stay in shade, i.e., moves away from the light. Thus, more auxin hormone is present in the left side of stem as compared to the right. The left side of stem, grows faster than its right side and therefore, the stem bends towards the right side (direction of light).

The effect of auxin on the growth of a root is exactly opposite to that on a stem. Auxin hormone increases the rate of growth in stem but it decreases the rate of growth in a root. The side of root away from light will have all the auxin concentrated in it. Due to this, the side of root which is away from light will grow slower than the other side and make the root bends away from light.

NS. 7

Which signals will get disrupted in case of a spinal cord injury ?

Ans. In case of a spinal cord injury, reflex actions and involuntary actions will get disrupted.

NS. 8

How does chemical coordination occur in plants ?

Ans. In plants, chemical coordination occurs with the help of plant hormones (phytohormones). Different plant hormones help to coordinate growth, development and responses to the environment. They are synthesised at places away from where they act and simply diffuse to the area of action, for example, auxin. Another example of plant hormones are gibberellines which help in growth of the stem. Cytokinins promote cell division. Abscisic acid is a plant hormone which inhibits growth and its effects include wilting of leaves.

NS. 9

What is the need for a system of control and coordination in an organism ?

Ans. The body of a multicellular organism consists of a number of components and sub-components and each is specialised to perform a particular function. Therefore, it is necessary that various organs of the body of an organism work together in a proper manner to carry out various functions and respond to stimuli. In human beings, nervous system and endocrine system work together to control and coordinate.

EXERCISE – I

ONLY ONE CORRECT TYPE

1. A plant placed near a window bends outward because-
(A) its tip is able to obtain more light
(B) its tip is able to receive necessary warmth
(C) the auxin content on the shaded side is higher than that on the lighter side and as a result the shaded side elongate more than the cells on the illuminated side and the tip bends outward.
(D) its tip is able to get more oxygen

2. Phototropic and geotropic movements in plants have been traced to be linked with
(A) enzymes (B) starch
(C) gibberellins (D) auxins

3. Phototropic movements of roots and stems are due to
(A) action of gravity
(B) effect of light
(C) differential hormonal effect
(D) epinasty and hyponasty

4. Bending of growing shoot towards sunlight is called
(A) heliotropism (B) hydrotropism
(C) photonasty (D) phototropism

5. Clinostat is the apparatus, which is used to
(A) measure growth of stem
(B) eliminate the effect of gravity causing geotropism
(C) identify the chemicals present in stem tip
(D) measure growth rate

6. Thigmotropism is best exhibited by
(A) tendrils (B) stem apex
(C) root apex (D) leaf apex

7. Pneumatophores are
(A) positive geotropic (B) negative phototropic
(C) thigmotropic (D) ageotropic

8. Indian telegraph plant commonly known as
(A) Desmodium gyrans
(B) Crotolaria juncea
(C) Butea monosperma
(D) Malva indica

9. The closure of lid of pitcher in pitcher plant is
(A) a paratonic movement
(B) a tropic movement
(C) a turgor movement
(D) an autonomous movement

10. Auxanometer is meant for
(A) photosynthetic activity
(B) growth activity
(C) the amount of auxins
(D) respiratory activity

11. Movements of leaves of the sensitive plant Mimosa pudica is due to
(A) thermonasty
(B) seismonasty
(C) photonasty
(D) nyctinasty

12. Which of the following movements in plants is NOT related to changes in auxin levels?
(A) Nyctinastic leaf movements
(B) Movement of roots towards soil
(C) Movement of sunflower tracking the direction of sun
(D) Movement of shoot towards light

13. Movement of hairs in Drosera is
(A) photonastic
(B) thermonastic
(C) thigmonastic
(D) seismonastic

14. Leaves of many grasses are capable of folding and unfolding because they
(A) are isobilateral
(B) have specialised bulliform cells
(C) have parallel vascular bundles
(D) are very thin

15. Agent orange is a herbicide that contains synthetic
(A) auxin (B) cytokinin
(C) gibberellins (D) pigments

16. Islets of Langerhans produce:-
(A) insulin and secretin
(B) glucagon and adrenaline
(C) insulin and glucagon
(D) ACTH and noradrenaline

17. The type of behaviour in which a substitute stimulus evokes the same response as the original stimulus is called :-
(A) reflex action
(B) conditioned reflex action
(C) operon
(D) habit

18. The gland whose hormones affects the functions of many other endocrine glands is
(A) thyroid gland (B) pituitary gland
(C) pancreas (D) parathyroid

19. A man suddenly sees a tiger. His heartbeat goes up, blood pressue increases, etc. Which hormone is released at this time in his body:-
(A) Parathormone (B) Adrenaline
(C) Corticoid (D) Thyroxine

20. The first hormone to be isolated was:-
(A) thyroxine (B) testosterone
(C) epinephrine (D) secretin

21. According to the accepted concept of hormone action, if receptor molecules are removed from target organs :-
(A) the target organ will continue to respond to the hormone without any difference
(B) the target organ will continue to respond to the hormone but will require higher
(C) the target organ will not respond to the hormone
(D) the target organ will continue to respond to the hormone but in the opposite way.

22. In an accident the anterior pitutary of a four year old boy was severely damaged but the boy survived. What is likely to happen:-
(A) High levels of thyroxine will be released
(B) Spermatogenesis will be released
(C) The boy will not grow much in height
(D) The growth of mammary glands will be stimulated

23. A gorilla like man with huge hand and legs. This is due to the abnormal secretion of :-
(A) pituitary FSH
(B) pituitary LH
(C) pituitary GH
(D) thyroid

24. LH and FSH are called :-
(A) antistress hormones
(B) gonadotropic hormones
(C) emergency hormone
(D) neurohormones

25. FSH is to estrogen as LH is to :-
(A) vasopressin (B) testosterone
(C) progesterone (D) LTH

26. Failure of insulin production results in :-
(A) addison's disease
(B) cushing's disease
(C) diabetes insipidus
(D) diabetes mellitus

27. Deficiency of the thyroxine / hypothyroidism in adults results in
(A) diabetes mellitus
(B) diabetes insipidus
(C) myxodema
(D) exopthalamic goitre & adrenal

28. Which of the following process occurs only in animals-
(A) Hormonal control (B) Respiration
(C) Nervous control (D) Nutrition

29. Diabetes is due to -
(A) Hormonal deficiency
(B) Sodium deficiency
(C) Iodine deficiency
(D) Enzyme deficiency

30. Which hormone when secreted increases heart beats-
(A) Insulin (B) Adrenalin
(C) Cortisone (D) Testosterone

MATCH THE COLUMN

31.

(P) Ovary	(1) Testosterone
(Q) Master gland	(2) Diabetes insipidus
(R) Emergency hormone	(3) Pituitary
(S) ADH	(4) Adrenaline
(T) Testis	(5) Estrogen

(A) P → 5, Q → 3, R → 4, S → 2, T → 1
(B) P → 4, Q → 3, R → 2, S →1, T → 5
(C) P → 1, Q → 2, R → 3, S → 4, T → 5
(D) P → 5, Q → 4, R → 3, S → 2, T → 1

EXERCISE – II

VERY SHORT ANSWER TYPE

1. Write the function of hormone thyroxine in our body.
2. Name the part of hind brain which takes part in regulation of respiration.
3. Which hormone helps in lowering the level of blood Calcium in human beings.
4. Which hormone is responsible for the development of moustache and beard in man ?
5. Which type of glands in human body secrete hormones ?
6. Name the structural and functional units of human nervous system.
7. What is neuron ?
8. Name the largest cell present in human body.
9. What is the function of the hormone secreted by the endocrine gland pituitary ?

SHORT ANSWER TYPE

1. Name hormones produced by Neurohypophysis.
2. Name four hormones produced by pituitary gland with function.
3. Why is pituitary gland called master gland ?
4. What is the role of oxytocin ?
5. Which hormone is called emergency hormone ?
6. Name any four receptor along with the organ in which they occure ?
7. Where is medulla oblongata ? situates ?
8. Wrtie a note on ABA.
9. What is reflex action ?

LONG ANSWER TYPE

1. Draw a labelled diagram of brain.
2. Describe the structure of neuron.
3. What is reflex action ? Describe the types of reflex action with a suitable diagram.

TRUE / FALSE TYPE

1. Axon endings of a neuron receive the stimuli.
2. Tangoreceptors detect touch.
3. Medulla oblongata controls involuntary functions.
4. All the voluntary actions of the body are coordinated by the cerebrum.
5. Cranial nerves arise from brain and they are 12 in number.

FILL IN THE BLANKS

1. ..... tissue is made up of an organised network of neurons.
2. ..... is the part of a neuron where information is acquired.
3. Through the neuron, information travels as an ..... .
4. ..... is the functional and structural unit of nervous system.
5. Main part of a neuron are ..... and ..... .

Answer Key

EXERCISE–I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C	D	C	A	B	A	D	A	A	B	B	A	C	B	A
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
A	D	B	B	A	B	C	A	A	B	D	D	D	D	C
31														
A														

EXERCISE – II

TRUE/FALSE TYPE

1. F 2. T 3. T 4. T 5. F

FILL IN THE BLANKS

1. Nervous **2.** Dendrite **3.** Electric impulse **4.** Neuron **5.** Cyton

SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : CONTROL AND COORDINATION)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

NOTES :

1. In the status, put "completed" only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.

Space for Notes :