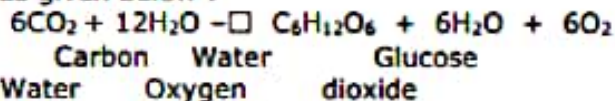


## NUTRITION IN PLANTS

### Photosynthesis:

Photosynthesis is the primary mode of food production in green plant. "The process by which green plants synthesize food from simple substances carbon dioxide and water in the presence of sunlight is called Photosynthesis"

The process of photosynthesis can be represented in the form of chemical reaction, as given below :



### Photosynthetic Pigment :

The light energy must be absorbed by a suitable pigment i.e. chlorophyll (green pigment).

- Chlorophyll is green colour pigment.

### Mechanism of Photosynthesis:

- Photosynthesis is divided in 2 main steps  
(A) light reaction      (B) dark reaction

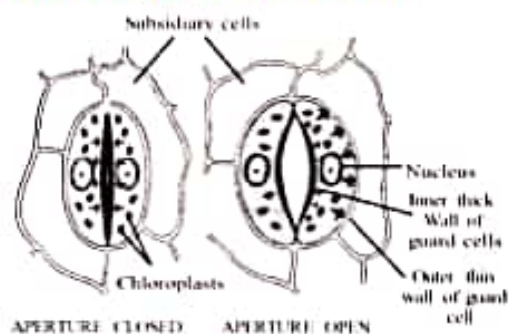
#### Light reaction:

- It is also called Hill Reaction.
- It occurs in grana of thylakoids.
- It is named as light reaction as it occurs only in presence of light.

#### Major Step:

- Absorption of light by chlorophyll.
- Photolysis of water.
- Reduction of  $\text{CO}_2$  to Carbohydrates.
- In this process ADP changes to ATP & Inorganic phosphate.
- Release of oxygen into atmosphere.

### Opening and Closing Stomata:



- The opening and closing of stomata depend upon the turgid or flaccid state of the guard cells. When guard cells are in turgid state the stomatal aperture opens and when guard cells are in flaccid state the stomatal aperture closes. The inner wall of guard cells

(towards pore) is thick and outer wall (towards other epidermal cells) is thin. When the turgor pressure of the guard cells is increased the outer thinner wall of the guard cell is pushed out (towards the periphery) due to which a tension is created on the inner thicker wall thus pulling the inner thicker wall towards the periphery thus leading to the opening of stomatal aperture. On the contrary when the guard cells are in a flaccid state the outer thinner wall of guard cells returns to original position (moves towards pore) due to which tension on the inner wall is released which also returns to its original position and stomatal aperture gets closed again.

### Dark Reaction:

- This reaction is not dependent on light. It is also known as calvin – Benson Cycle or C3 cycle as first stable product is phosphoglyceric acid (PGA) a 3 carbon compound.

### C4 Cycle or Hatch & Slack cycle:

- 4-C compound i.e. oxaloacetic acid (OAA).
- This cycle is found in many other tropical & subtropical monocots e.g.: Maize, Sorghum, Wheat, Oat, Pearl, millet etc.

In dicots also many such plants are known e.g.: Amaranthus, Chenopodium, Atriplex, Euphorbia etc. In some families of dicots Compositae, Portulacaceae, Nyctaginaceae.

### Crassulacean Acid Metabolism (CAM):

- Certain plants, especially succulents which grow up under extremely xeric (dry) condition, fix atmospheric  $\text{CO}_2$  in dark.
- Since the process was first observed in the plants belonging to family crassulaceae (eg. Bryophyllum, Kalanchoe etc.) It was termed crassulacean acid metabolism (CAM).
- The most characteristic feature of these plants is that their stomata remain open at night (in dark) but closed during the day (in light).
- Thus, CAM is a kind of adaptation in succulents to carry out photosynthesis without much loss of water.



## **NUTRITION**

The process of Intaking the food & utilization of food is called nutrition.

### **Nutrient :**

The different component of food that have distinct functions like providing energy, materials for body building, maintenance & regulation of metabolism are called nutrient.

For example - Proteins, Minerals, Vitamin, Carbohydrates, fats.

## **TYPE OF NUTRITION**

### **Autotrophic Nutrition :**

It is a mode of nutrition in which organisms are able to build up their own organic food from inorganic raw materials with the help of energy. The organism performing autotrophic nutrition are called

## **TYPE OF HETEROTROPHIC NUTRITION**

### **1. Saprophytic or Saprotrophic Nutrition:**

It is a mode of heterotrophic nutrition in which food is obtained from organic remains like dead organisms, excreta, fallen leaves, broken twigs, food articles, etc. Organisms performing saprophytic nutrition are called saprophytes.

### **2. Parasitic Nutrition :**

It is a mode of heterotrophic nutrition in which a living organism flourishes by obtaining food from another living organism. The living organisms which obtain food and shelter from another organism is called parasite. The organism which provides food and shelter to a parasite is known as host. An external plant parasite is Cuscuta (Amarbel). It is a non-green plant that sends haustoria or sucking roots into host plant for obtaining food and water.

### **3. Holozoic Nutrition :**

It is a mode of heterotrophic nutrition which involves intake of solid pieces of food. Since solid food is taken in, holozoic nutrition is also called ingestive nutrition. The food may consist of another animal, plant or its parts. Depending upon the source of food, holozoic organisms are of three types - Herbivores, carnivores, omnivores.

### **Herbivores :**

(L. herba-plant, vorare-to eat). They are holozoic organisms which feed on plants or plant parts, e.g., Cow, Buffalo, Deer, Goat, Rabbit, Grasshopper, Elephant, Squirrel, Hippopotamus.

### **Carnivores :**

They are animals which feed on other animals.

Carnivores are also called predators they hunt, kill and feed on their preys, e.g. Lion, Tiger, Leopard, Snake, Hawk.

### **Omnivores :**

(L. omnis-all, vorare-to eat). They are holozoic organisms which feed on both plant and animal materials, e.g. Cockroach, Ant, Pig, Crow, Rat, Bear, Dog, Humans.

### **Nutrition In Amoeba :**

Protozoans carry out holozoic nutrition through intracellular digestion.

#### **(i) Ingestion :**

Some protozoans can ingest food particles from any point on the surface (e.g., Amoeba) while others have fixed points for the same (e.g., Paramecium). Protozoans like Amoeba capture food with the help of temporary finger-like processes called pseudopodia. Protozoans like Paramecium have small hair-like processes called cilia. Beating of cilia creates current in water that pushes food particles through cytostome or cell mouth. The process of ingestion of solid food particles by a cell or unicellular organism is called phagocytosis.

As soon as Amoeba comes in contact with a food particle or prey, it throws pseudopodia all around the same. The tips of encircling pseudopodia fuse and the prey comes to lie in a vesicle or phagosome. This method of intake of food is called circumvallation. Amoeba can also ingest food by other methods like import, circumfluence and invagination.



## DIGESTIVE SYSTEM OF HUMAN

Digestive system is a group of organs & associated digestive glands that take part in ingestion, digestive absorption of food & egestion of undigestible matter. Digestive organs form a continuous canal called alimentary canal.

## ALIMENTARY CANAL CONTAINS FOLLOWING PARTS

Alimentary Canal in man is 9 metres long & consists of the following part

### Mouth :

Transverse slit like aperture.

### Oral Cavity :

- It is bounded by lips & has cheeks, gums, teeth & tongue.
- The food taken inside oral cavity is masticated i.e. mechanically broken into smaller particles before being swallowed.
- The floor of the buccal cavity has a tongue bearing taste buds.
- Man possesses teeth on both the jaws, there are 32 teeth of four different types, namely incisors, canines, premolars & molars.

### Dental Formula :

$$\times 2 = x$$

No. of teeth in half part of upper jaw

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

$$\text{In Man } I \frac{2}{2}, C \frac{1}{1}, Pm \frac{2}{2}, M \frac{3}{3} = \frac{8}{8} \times 2$$

= Total 32 teeth

### Pharynx :

It is short conical region that lies after the mouth cavity.

### Oesophagous :

It is a long narrow muscular tube which leads to the stomach. No digestive gland are present.

### Stomach :

It lies below the diaphragm on the left side of abdominal cavity is J-shaped.

### Small Intestine :

It is convoluted tube and differentiated into 3 regions, viz. Duodenum which is the first part of small intestine & is curved C-shaped; Jejunum, comparatively longer & more coiled and Ileum, which is the last part of small intestine whose inner surface is folded to form villi, which absorb the products of digestion.

### Large Intestine :

It is much shorter & wider than small intestine & is differentiated into three regions viz;

- Caecum which is small rounded blind sac from which vermiform appendix arises; Colon is the inverted U-shaped tube
- The rectum opens to exterior through anus.
- No digestion takes place in large intestine, only absorption of water takes place.
- In herbivores like horse, rabbit digestion of cellulose takes place in caecum.

### Absorption:

In the small intestine (Ileum) absorption of all digested materials takes place.

### Assimilation:

It is the process of utilisation of absorbed food for various body functions. The absorbed nutrients are utilised to synthesise complex molecules like carbohydrates, protein & fats inside the cells.

- Man cannot digest cellulose.

### Egestion :

It is the process of elimination of undigested food formed in the cells, or in the lumen of large intestine (colon & rectum) through the anus.

Voluntary contraction of abdominal muscles help in egestion of faeces.

**TABLE: SUMMARY OF DIGESTION ENZYMES OF VARIOUS GLANDS WITH THEIR SECRETIONS AND END PRODUCTS OF DIGESTION IN MAN**

S.No.	Name of gland	Secretion	Site of action	Enzymes	Food acts upon	End product
1	Salivary glands	Saliva	Buccal cavity	Salivary amylase	Starch	Maltose
2	Gastric glands	Gastric Juice	Stomach	Pepsin	Proteins	Peptones & proteoses
				Renin	Casein of milk	Paracasein
		HCl	Stomach	—	Pepsinogen	Pepsin
3	Liver	Bile	Duodenum	—	Fats	Emulsification of fats
4	Pancreas	Pancreatic Juice	Duodenum	Amylase Trypsin Lipase	Starch & Glycogen Proteins Emulsified fats	Maltose & Isomaltose Peptones & peptides Fatty acids & glycerol
5	Intestinal glands	Intestinal Juice	Small Intestine	Erepsin Maltase Sucrase Lactase Lipase	Peptones & Peptides Maltose Sucrose Lactose Triglycerides	Amino acids Glucose Glucose & fructose Glucose & galactose Monoglycerides & fatty acid
		Mucous	Large Intestine	—	Lubrication of faecal matter	—



## RESPIRATION

It is a biochemical process of enzyme including oxidative breakdown of organic compounds inside living cells releasing energy in the form of ATP.

### BREATHING

The process of Intaking  $O_2$  & releasing of  $CO_2$  known as breathing .

### RESPIRATION IN PLANTS

#### By young roots :

Air occurs in soil interspaces. Root hairs as well as epiblema cells of the young roots are in contact with them. They are also permeable to metabolic gases. Oxygen of the soil air diffuses through root hair-epiblema cells and reaches all internal cells of the young root. Carbon dioxide produced by root cells diffuses in the opposite direction.

#### By Leaves :

Leaves and Young Stems. Leaves and young stems are ideally suited to quick exchange of gases. The organs have a covering of nearly impermeable epidermis for reducing loss of water. The epidermis of leaves bears a number of aerating pores called stomata (singular stoma or stomata, Gk. stoma-mouth). Each aerating or stomatal pore is bordered a pair of guard cells. In most of the plants, the guard cells are kidney or bean shaped with inner walls being thicker and less elastic than the outer walls.

When the stomata are open, gases diffuse into and out of the leaf as per their concentration gradient. A gas which has come from outside first reaches substomatal chambers. From here, it diffuses to all the intercellular air spaces present in between the mesophyll cells. If the stomata are open during night, oxygen from outside will diffuse into the leaves and young stems while carbon dioxide will diffuse out. It is due to respiratory gas exchange.

### MAMMALIAN RESPIRATORY SYSTEM

The mammalian respiratory system consists of nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles and alveoli.

#### Nostril:

It is also called external nares.

#### Nasal Chamber :

Nasal septum divides nasal cavity into two nasal chamber by the nasal septum.

#### Internal nares :

There are posterior opening of nasal chambers that leads into pharynx.

#### Pharynx :

The pharynx provides passage to both air and food.

#### 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 also called voice box or adam's apple or pomos adami.

**Vocal cord :**

In larynx, 2 pairs of vocal cord is found outer pair is false vocal cord whereas, inner pair is true vocal cord when air is forced through the larynx it cause vibration of true vocal cords and sound is produced.

**Trachea (Wind pipe) :**

It is long, tubular structure which runs downward through the neck in front of oesophagus. It is supported by cartilage to prevent collapse.

**Primary bronchi :**

These are one pair of small thin walled tubular structure formed by the division of trachea. It further divides and end at alveoli.

**Lungs :**

Lungs are present in thoracic cavity on either side of heart. covered by pleural membrane.

**MECHANISM OF RESPIRATION**

Respiratory centre is in Medulla Oblongata.

Mechanism of breathing involves two phases

1. Expiration :
2. Inspiration

**Gaseous Exchange :**

Gaseous exchange occur in Alveoli following pressure gradient  $O_2$  from high pressure in alveoli diffuse into blood &  $CO_2$  from blood in alveoli.

**Gaseous Transport:**

$O_2$  is carried by haemoglobin (in RBC). 100 ml of blood can carry ~20 ml of  $O_2$  max,  $CO_2$  is transported in form of bicarbonates in plasma.

\*\*\*



## CIRCULATION

**Blood** : A special connective tissue that circulates in principal vascular system of man and other vertebrates consisting of fluid matrix, plasma and formed elements.

**Plasma** : The liquid part of blood or lymph which is straw coloured, viscous fluid and contains about 90-92% of water and 6-8% proteins.

**Lymph** : A clear yellowish, slightly alkaline, coagulable fluid, containing white blood cells in a liquid resembling blood plasma.

**Heart Beat** : The rhythmic contraction and relaxation of the heart, which includes one systole (contraction phase) and one diastole (relaxation phase) of the heart. Heart beat count of healthy person is 72 times per minute.

**Cardiac output** : The amount of blood pumped by heart per minute is called cardiac or heart output. The value of cardiac output of a normal person is about  $72 \times 70 = 5040$  mL or about 5L per minute.

**Electrocardiograph** : (ECG) The machine used to record electrocardiogram.

**Electrocardiogram ECG** : The graphic record of the electric current produced by the excitation of the cardiac muscles.

### Human Blood Corpuscles

Name and Number/ Percentage	Structure	Life Span and Formation	Function
(A) Erythrocytes	Yellow colour	Formed from	Transport of oxygen and
RBCs - 4.5 to 5.5 million per cubic millimetre of blood	Circular, biconcave denucleated, elastic, lack of cell organelles like ER, ribosomes, mitochondria etc.	birth onwards by bone marrow	some amount of carbon dioxide.
(B) Leucocytes	Colourless, rounded	Formed in bone	Acts as
(WBCs) 5000- 8000 per cubic mm of blood	or irregular, nucleated 12 to 20µm wide	marrow, Lymph nodes spleen and thymus	soldiers scavenger and some help in healing
(i) Agranulocytes (a) Lymphocytes	Large rounded	Lymph nodes,	Non
20-45%	nucleus	spleen, thymus	Phagocytic

		bone marrow,	secrete
		life few days to months or even even years	antibodies
(b) Monocytes	Largest of all	Bone marrow,	phagocytic,
2-10%	bean shaped nucleus	life 10-20 hours	engulf germs
(ii) Granulocytes (a) Eosinophils	bilobed nucleus,	Bone marrow,	play role in
1-6%	granules in cytoplasm	life 4 to 8 hrs	immunity
		In blood	nonphagocytic
(b) Basophils 0-1%	Three lobed nucleus	Bone marrow,	release heparin
		life 4 to 8 hours in blood	and histamin
(c) Neutrophils	Many lobed nucleus	Bone marrow,	phagocytic,
40-75%	fine granules	life 4 to 8 hours	engulf germ
		In blood	and dead cells
<u>(C) Platelets</u>	Colourless, rounded	Bone marrow	help in blood
<u>thrombocytes</u>	or oval, non	about a week	clotting
1,50,000 -	nucleated fragments		
3,50,000 mm <sup>3</sup> of blood	of cell		

### Lymph

The colourless mobile fluid connective tissue drains into the lymphatic capillaries from the intercellular spaces.

#### Composition :

It is composed of fluid matrix, plasma, white blood corpuscles or leucocytes.

#### Functions :

- (i) It drains excess tissue fluid from extra cellular spaces back into the blood.
- (ii) It contain lymphocytes and antibodies.
- (iii) It transport digested fats.



## Human Heart

It is the mesodermally derived organ situated in thoracic cavity in between the two lungs. Protected by pericardium.

Four chambers - two (left and right) atria, and two ventricles (left and right)

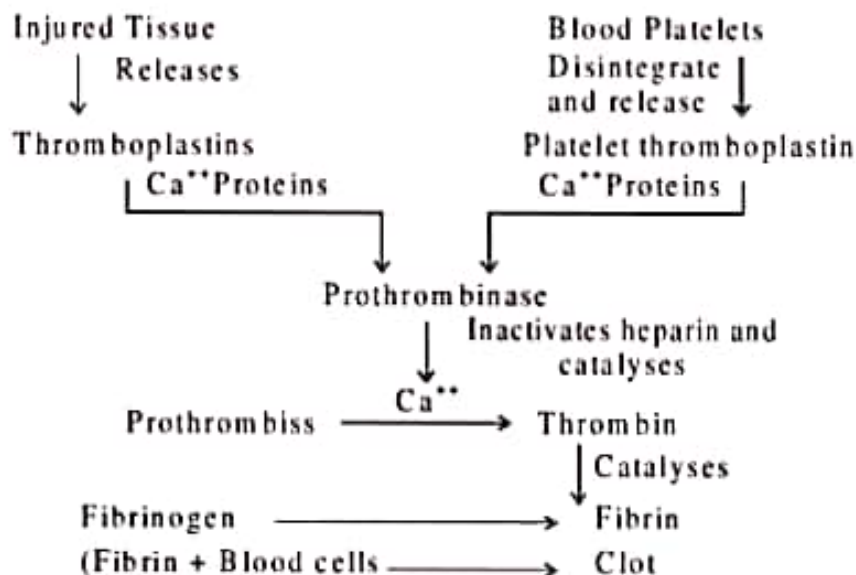
Inner- atrial septum separates the two atria and inter ventricular septum separates the two ventricles, while the atria & ventricles are separated by atrioventricular septum.

The valves between right atrium and right ventricle is tricuspid while between left atrium and ventricle is bicuspid or mitral valve.

The openings of the right and the left ventricles into the pulmonary artery and the aorta are guarded by semilunar valves.

The valves allow the flow of blood only in one direction, i.e., from atria to ventricles and from ventricles to pulmonary artery or aorta.

## Blood Clotting



## Blood Groups

Blood Group	Antigen (on the Surface of R.B.Cs)	Anti body (In plasma)	Possible recipients having blood group	Prospective donors having blood group	Remarks
A	A	Anti B	A, AB	O, A	—
B	B	Anti A	B, AB	O, B,	—
AB	A and B	None	AB	O, A, B, AB	Universal recipients
O	None	Anti A and anti B	O, A, B, AB	O	Donor

### **Rh (Rhesus) System :**

Discovered by Landsteiner and Wiener in 1940. The antigen found on the surface of RBCs. The presence of this antigen is termed as Rh - positive (Rh<sup>+</sup>) and its absence as (Rh<sup>-</sup>)

**SAN (Sino - atrial node) :** A patch of tissues present in the right upper corner of the right atrium.

**AVN (Atrio Ventricular Node) :** A mass of tissues seen in the lower left corner of the right atrium close to the atrio-ventricular septum.

### **Heart Valves**

**Tricuspid Valve :** The valves formed of three muscular flaps or cups, which guard the opening between the right atrium and the right ventricle.

**Bicuspid Valve (Mitral Valve) :**

The valves which guard the opening between the left atrium and the left ventricle, made up of two flaps.

**Semilunar Valves :** The valves present at the opening of the right and the left ventricles and allow the entry of blood into pulmonary artery and the aorta respectively.

**Double circulation :** The passage of same blood twice through heart in order to complete one cycle. eg.

- (i) The blood pumped by the right ventricle (deoxygenated blood) is transported through pulmonary artery to lungs where CO<sub>2</sub> is exchanged with O<sub>2</sub> through diffusion and returns back to the heart through pulmonary vein.
- (ii) The oxygenated blood from left ventricle is transported through aorta to different body parts (cells and tissues) where O<sub>2</sub> is exchanged with CO<sub>2</sub> through diffusion and then returned back to the heart through vena-cava.

### **Disorders of circulatory System**

**Hypertension (High Blood Pressure) :** It results from narrowing of arterial lumen and reduced elasticity of arterial walls in old age. It can cause rupturing of capillaries. It is a silent killer.

**Coronary Artery Disease : (CAD) Atherosclerosis** The supply of the blood to heart muscles is affected. It is caused by deposits of ca, fat, cholesterol and fibrous tissues to make the lumen of arteries narrower.

**Angina Pectoris :** Caused due to arteriosclerosis, when not enough oxygen is reaching the heart muscle due to which the person experiences acute chest pain.

**Heart attack :** Caused when the heart muscle is suddenly damaged by an inadequate blood supply.

**Cardiac arrest :** The state in which the heart stops beating.

**Arteriosclerosis :** The state of hardening of arteries and arterioles due

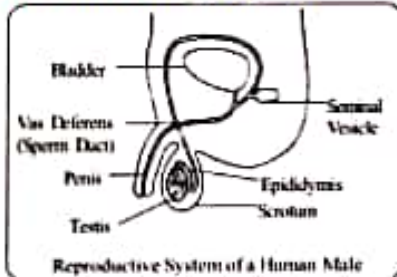


## REPRODUCTION

### Reproduction in human

#### Male Reproductive System-

The human male reproductive system consists of the following organs:



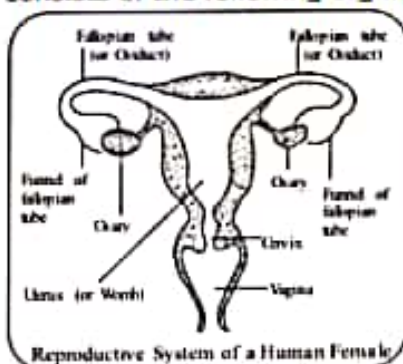
A pair of testis lies in a small sac-like muscular structure outside the abdominal cavity called Scrotum. The function of testis is to produce sperm and male sex hormone called testosterone. The scrotum provides the optimal temperature for formation of sperms. Epididymis is a coiled tube-like structure firmly attached to the testis and serves as the storehouse of sperms. Inside the epididymis, sperms become mature and develop motility. Vas deferens The 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.

Seminal vesicle is a glandular structure which joins vas deferens to form ejaculatory duct. Ejaculatory duct enters prostate gland and joins urethra to form common urino-genital duct.

Penis is a copulatory organ at the tip of which urinogenital duct opens.

#### Female Reproductive System:

The human female reproductive system consists of the following organs:



Ovaries are a pair of small and oval-shaped organs, located in the abdominal cavity near the kidney. 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.

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. These tubes from both the sides open into a muscular structure, the Uterus.

Uterus or womb - is a hollow, pear-shaped organ within which the embryo develops. Its upper portion is broader, while its lower portion is narrower, called cervix.

Vagina - The cervix opens into the vagina which is a tubular structure and also called "birth canal", or canal for menstrual flow. Vagina receives sperms from the male and also serves as the passage through which the fully developed foetus is born.

#### MENSTRUAL CYCLE

If the egg is not fertilized, it lives for one day and is then expelled. This sets in motion which is called menstrual or ovarian cycle. The first menstruation is called menarche. It stops between age 45-50 years. Stoppage of menstruation permanently is called menopause. Menstrual cycle consists of four phases.

**Menstrual Phase:** It is characterized by menstruation (= menses, GK. mensum-month) or discharge of blood, mucus and endometrial lining. Menstrual phase lasts for 3-5 days.

**Proliferative Phase:** There is repair and growth of endometrium. Under the influence of hormone FSH, a few follicles grow but only one follicle called Graafian follicle matures in the two ovaries. It secretes hormone estrogen. Proliferative phase lasts from 5<sup>th</sup> to 14<sup>th</sup> day.

**Ovulation Phase:** At about the middle of the menstrual cycle on 13<sup>th</sup> or 14<sup>th</sup> day, the growing follicle bursts and mature ovum is released from the ovary under the influence of estrogen and LH.



**Secretory Phase:** It lasts from middle of menstrual phase to end of the same, i.e., 14–28 days. During this period the uterine wall thickness further. Glands present in endometrial area become functional and begin to secrete of materials for nourishment of the egg if it happens to get fertilised.

### **REPRODUCTIVE HEALTH**

Reproductive health is the state of physical, mental and social fitness to lead a responsible safe and satisfying reproductive life. (i) It provides awareness to both male and female regarding fertility regulating methods. (ii) Reduction in the number of children to the limit of enjoying family life as well as rearing the children with better resources as and when they are available. (iii) Prevent catching up sexually transmitted disease. (iv) Manage disorders related to reproductive system by getting them treated at the earliest.

### **CONTRACEPTION**

Prevention of pregnancy is called contraception. The techniques used in preventing the occurrence of pregnancy are called contraceptive devices.

#### **Mechanical Barrier Methods of**

##### **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.

#### **Intrauterine 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 contraception generally through excessive secretion of cervical mucus. The most common type is copper for preventing implantation. It is functional for 3-5 years.

#### **Hormonal Methods of Contraception :**

##### **Oral Pills :**

They contain progesterone with or without estrogen.

##### **Implants :**

They are subdermal devices which provide long term contraception, e.g., norplant.

##### **Morning-After Pills :**

They prevent contraception even after coitus, e.g., I pill,

##### **Chemical Methods of Contraception:**

They are creams, jellies and foaming tablets (vaginal pills) which are placed in vagina for killing the sperms at the time of coitus.

##### **Reversible Sterilisation or Surgical Method:**

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 semen.

##### **Tubectomy:**

A portion of both the fallopian tubes is excised or ligated to block the passage of ovum.

\*\*\*



## EXCRETION

### **Ammonotelism :**

The animals which excrete ammonia are called ammonotelic and excretion of ammonia is known as ammonotelism eg Amoeba, sycon, hydra, liver fluke, tapeworm, Leech, Prawn, bony fishes etc.

### **Ureotelism :**

Excretion of urea is known as ureotelism and the animals which excrete urea are ureotelic animals eg. mammals, many terrestrial amphibians and marine fishes and sting rays etc.

### **Uricotelism :**

Excretion of uric-acid is known as uricotelism and the animals are called uricotelic eg. most insects, land snails, lizards and snakes and birds.

### **Nephrons :**

The structural and functional unit of kidneys. Each kidney contains about one million of nephrons.

### **Structure of Nephron :**

A nephron consists of Glomerulus, Bowman's capsule, PCT (Proximal convoluted tubule), JG A (Juxtaglomerular Apparatus) and the collecting duct.

### **Structure of Kidney :**

Size 10-12 cm in length, 5-7 cm in width, 2-3 cm thick, average weight about 120-170 g

The blood vessels, ureter and nerves enter in the kidney through hilum (a notch).

The filtration of blood in glomerulus, about 1100-1200 ml of blood is filtered by the kidney per minute.

### **Glomerular Filtration Rate (GFR) :**

The amount of filtrate formed by the kidney per minute. In a healthy individual it is about 125 ml/minute, ie 180 litres per day.

### **Micturition :**

The expulsion of urine from the urinary bladder. It is a reflex process but can be controlled voluntarily to some extent in grown up children and adults.

An adult human excretes on an average 1 to 1.5 litres of urine per day.

On an average 25-30 gram of urea is excreted out per day.

### **Role of other organs in excretion :**

**Lungs** - removes CO<sub>2</sub> (18L/day) and water.

**Liver** - secretes bilirubin, biliverdin etc. helps to eliminate these substances alongwith cholesterol, vitamins, drugs and degraded steroid hormones through digestive wastes.

**Sweat and sebaceous glands** - These glands of skin help to eliminate small amount of urea, NaCl and lactic acid etc. through sweat while sebaceous glands help to eliminate some substances like steroids, hydrocarbons and waxes through sebum.

**Saliva** - It can help to eliminate small amount of nitrogenous wastes.

### **Disorders of Excretory system :**

**Uremia** - The accumulation of urea in blood due to malfunctioning of kidney.

**Hemodialysis** - The process of removal of urea from the blood artificially. In this process the blood from an artery is passed into dialysing unit after adding an anticoagulant like heparin. The blood passes through coiled cellophane tube surrounding by dialysing fluid. The nitrogenous wastes from the concentration gradient and the blood becomes clear. This blood is pumped back to the body through vein after adding anti-heparin to it.

**Renal calculi** - The formation of insoluble mass of crystallised salts (oxalates or phosphates of calcium).

\*\*\*



## CYTOLOGY

1. All the living organisms are made up of fundamental unit of life called "cell".
2. The cell is a Latin word for "a little room".
3. The scientist Robert Hooke saw a little room in the cork (the bark of a tree) resembled the structure of a honeycomb. The use of the word "Cell" to describe these units is used till this day in Biology as "Cell Biology".
4. The Compound Microscope consist eye piece, objective lens and condenser to observe a cell after putting a drop of Safranin (for plant cell) and methylene blue (for animal cell).
5. The scientist Leeuwenhoek saw free living cells in the pond water for the first time. (father of microbiology)
6. The scientist Robert Brown discovered the nucleus in the cell.
7. The cell theory states that all the plants and animals are composed of cells, it was proposed by Schleiden and Schwann.
8. The cell theory was further expanded by Virchow by suggesting that "all cells arise from the pre-existing cells".
9. The cells differ in size, shape, structure
10. A single cell may constitute a whole organism as in Amoeba, Chlamydomonas, Paramecium and Bacteria; these are called as unicellular organisms. Whereas in multi-cellular organisms (Human beings) division of labor is seen.
11. The feature in almost every cell is same: Plasma membrane, nucleus and cytoplasm.
12. Plasma membrane: It is the outermost covering of the cell.
  - It is called as selective permeable membrane (because it prevents movement of some materials).
  - It helps in diffusion and osmosis
  - Diffusion: movement of substance from high concentration to low concentration.

Eg; exchange of carbon dioxide or oxygen with external environment.

osmosis: it is the passage of water from the region of highwater concentration to a region of low water concentration through a selective permeable membrane.

  - a) The cell gains water, if the medium surrounding the cell has a higher water concentration (Hypotonic solution) than the cell.
  - b) The cell maintains the same water concentration as the cell (Isotonic solution), water crosses the cell membrane in both directions.
  - c) The cell loses water, if the medium has lower water concentration (Hypertonic solution) than the cell.
13. The cell engulfs food is called endocytosis and ejects solid is called exocytosis. Amoeba acquires food through endocytosis and excretion of solid is called exocytosis.
14. The cell wall is a rigid outer covering composed of cellulose. It provides structural strength to plant cells. When a living cell loses water, there is shrinkage of contents of a cell away from the cell wall. This phenomenon is called as plasmolysis. The cell walls permit the cells of plants, fungi and bacteria to withstand very dilute (Hypotonic) external media without bursting.
15. The Nucleus: It is a dark colored, spherical or oval, dot-like structure near the center of a cell called Nucleus. The nucleus plays a central role in cellular activities/ reproduction. The chromatin material gets organized into chromosomes. The chromosomes contain information for inheritance of features from parents to next generations in the form of DNA (Deoxyribo Nucleic Acid) and protein molecules. The functional segments of DNA are called genes.
16. In some organisms like Bacteria nucleus is not covered by nuclear membrane. Hence it is called as prokaryote. (Pro = primitive; karyote = karyon = nucleus.) The organisms with cells having a nuclear membrane are called eukaryotes.



### 17. Differences between prokaryotes and eukaryotes

Prokaryotes	Eukaryotes
Size: generally small (1-10 $\mu\text{m}$ )	Size: generally large. (5-500 $\mu\text{m}$ )
Nuclear region: Not well defined and not surrounded by a nuclear membrane & known as nucleoids.	Nuclear region: Well defined and surrounded by a nuclear membrane
Chromosome: Single	Chromosome: More than one chromosome
Membrane-bound cell organelles absent	Membrane-bound cell organelles present
Eg- bacteria, blue green algae	Eg fungi, plant cell and animal cell.

18. **Cell organelles:** Every cell has fluid matrix (other than nucleus) is called cytoplasm. The nucleus and cytoplasm is together called as protoplasm. The protoplasm term was coined by Purkinje. It has important cell organelles: Endoplasmic Reticulum (ER), Golgi apparatus, Lysosomes, Mitochondria, Plastids, and vacuoles.
19. **Endoplasmic Reticulum (ER):** It is a large network of membrane –bound tubules and vesicles.
- There are two types of Endoplasmic Reticulum
  - **Rough Endoplasmic Reticulum (RER)** (It looks rough because Ribosomes are attached to its surface. They are the sites of protein synthesis).
  - **Smooth Endoplasmic Reticulum (SER)** (It looks smooth because Ribosomes are not attached to its surface. They are the sites of fat molecules synthesis).
1. SER; help in the functioning of enzymes and hormones to carryout biochemical activities.
  2. SER detoxifies many poisons and drugs from the cell.
  2. ER serves as channel for the transport of material between various regions of the cytoplasm and the nucleus.
  3. Proteins and fat molecules produced by ER helps in membrane biogenesis.
20. **Golgi apparatus:** It was first described by a scientist Camillo Golgi. It is a system of membrane bound vesicles called cisterns. It functions include the storage, modification and package of cell products. The complex sugars are made from simple sugars in the Golgi apparatus. It is also involved in the formation of lysosomes.
21. **Lysosomes:** They contain membrane-bound sacs with powerful digestive enzymes (enzymes are made by RER) to digest the worn-out cell organelles. When the cell gets damaged, lysosomes may burst and the enzymes digest their own cell, hence called as "Suicidal bags of a cell". It is a waste disposal system of the cell.
22. **Mitochondria:** It is covered by a double membrane. Outer membrane is very porous and the inner membrane is deeply folded. These folds create a large surface area for ATP (Adenosine Triphosphate) molecule synthesis. ATP is the energy currency of a cell; hence the Mitochondria are called as Power House of a Cell. Mitochondria have their own DNA and Ribosomes; therefore they can make their own proteins.
23. **Plastids:** They are present only in plant cells. They are two types.
- 1) **Chromoplasts (Colored Plastids:** Chloroplasts – Green pigmented and useful in Photosynthesis and also contains various other pigments like yellow or orange)

- 2) Leucoplasts (White or colorless plastids; stores materials such as oils, proteins, fats etc.) Plastids are also covered by a double membrane. The matrix is called Stroma, seat for enzymatic actions. Plastids have their own DNA and Ribosomes; therefore they can make their own proteins.
24. **Vacuoles:** Storage sacs for solid or liquid contents. They are small in size in animals while plants have large, may occupy 50-90 % of the cell volume. Helps to provide turgidity and rigidity to the cell. Many substances like amino acids, sugars, organic acids and proteins are stored in vacuoles. In Amoeba food vacuole is specialized to play an important role.
25. **Cell:** It is the fundamental structural unit of living organisms, helps in respiration, obtaining nutrition and clearing waste material or forming a new protein.

**Differences between Plant cell and Animal Cell**

ANIMAL CELL	PLANT CELL
Cell wall absent	Cell wall present
Plasma membrane is the outer layer which provides turgidity to the cell	Cell wall is the outer layer which gives rigidity and turgidity to the cell
Vacuoles are small in size	Vacuoles are big in size
Plastids are absent	Plastids are present
Nucleus lies in the centre.	Nucleus lies on one side

\*\*\*



1. Tissue is a group of cells having similar origin, structure & function. Study of tissues is called Histology
2. In unicellular organism (Amoeba) single cell performs all basic functions, whereas in multicellular organisms (Plants and Animals) shows division of labor as Plant tissue & Animal tissues.
3. Plant tissues are two types: Meristems & Permanent tissues.
4. **Meristems:** The Meristems are the tissues having the power of cell division. It is found on those region of the plant which grows.
5. **Types of Meristems;**
  1. **The Apical meristems** – It is present at the growing tip of the stem and roots and increases the length.
  2. **The lateral meristems** - present at the lateral side of stem and root (cambium) and increases the girth.
  3. **The Intercalary meristems** - present at internodes or base of the leaves and increases the length between the nodes.
6. **Permanent tissues:** Two types such as Simple permanent tissues & Complex permanent tissues.
  - a) **Simple permanent tissues:** subdivided as
    - (i) **Parenchyma:** Tissues provide the support to plants. They are loosely packed and has large intracellular space.
      - Parenchyma with chlorophyll which performs photosynthesis is called as chlorenchyma.
      - The parenchyma with large air spaces to give buoyancy is called as aerenchyma. Parenchyma also stores food and water.
    - (ii) **Collenchyma:** Tissue provides mechanical support, thickened at the corners, have very little intercellular space. It allows easy bending of various parts of a plants without breaking
    - (iii) **Sclerenchyma:** Tissue makes the plant hard and stiff, thickened due to lignin and no intercellular space. Cells of this tissue are dead and commonly seen in the husk of coconut.
    - (iv) **Guard cells & Epidermal tissue:** the tissue aids in protection and exchange of gases. Guard cells kidney shaped in dicots, dumb bell shaped in monocots to guard the stomata. The epidermal tissues of roots aid in absorption of water and minerals. The epidermal tissues in desert plants have a thick waxy coating of Cutin with waterproof quality. The epidermal tissues form the several layer thick Cork or the Bark of the tree.
  - b) **Complex permanent tissues:** The complex tissues are made of more than one type of cells. All these cells coordinate to perform a common function.

They are subdivided as;

**Xylem** - It consists of tracheids, vessels, xylem parenchyma and xylem fibers. The cells have thick walls,  
**Function** - aids in conduction of water and minerals.

**Phloem** - It consists of sieve tubes, companion cells, phloem parenchyma, and phloem fibers.  
**Function** - Phloem transports food material to other parts of the plants.

\*\*\*

## MUSCULAR SYSTEM AND SKELETAL SYSTEM

**Arthritis** : an inflamm atory joint dleaze characteresed by inflammation of joints.

**Coccyx** : tail bone formed by fusion of four coccygeal vertebrae in man.

**Endo Skeleton** : A skeleton present outside the body.

**Floating ribs** : The ribs that remain free anteriorly.

**False ribs** : The ribs whose sternal part are join to sternal part of a true rib.

**Myoglobin** : A red coloured pigment present in sarcoplasm of muscle.

**Gout** : Inflammation of joints due to accumulation of uric acid crystal.

**Suture** : immovable joints between skull bones.

**Synovial joints** : Freely movable joints between limb bones.

**Patella** : A bone acting as kneecap

### Types of Movement :

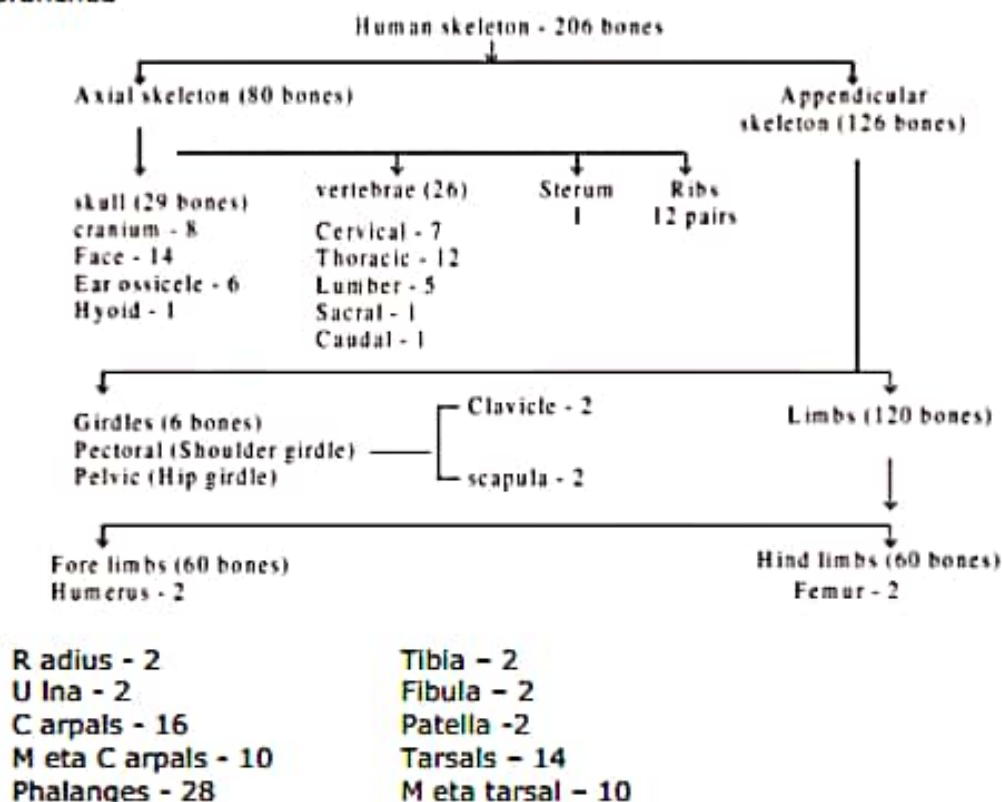
1. **Amoeboid movement** : These movement takes place in phagocytes where leucocytes and macrophages migrate through tissue. It is affected by pseudopodia formed by the streaming of protoplasm (as in amoeba)
2. **Ciliary movement** : These movement occurs in internal organs which are lined by ciliary epithelium.
3. **Muscular Movement** : This movement involve the muscle fibers, which have the ability to contract and relax.

### Types of Muscles :

**(a) Skeletal muscles or striated muscles** - These involved in locomotion and change of body postures. These are also known as voluntary muscles.

**(b) Visceral muscles or smooth muscles** - These are located in inner wall of hollow visceral organ, smooth in appearance and their activity are not under control of nervous system.

**(c) Cardiac muscles** - The muscles of heart, involuntary in nature, striated and branched



\*\*\*



## REPRODUCTION

The ability of the living organisms to produce new living beings similar to themselves is called reproduction.

### Types of Reproduction :

#### ASEXUAL REPRODUCTION

Single organism commonly multiply through asexual reproduction. Asexual reproduction is the process of formation of new individuals from specialised or unspecialised parts of a single parent without the formation and fusion of gametes. Because of the formation of new individuals from a parent, asexual reproduction is called uniparental.

#### Methods of Asexual reproduction-

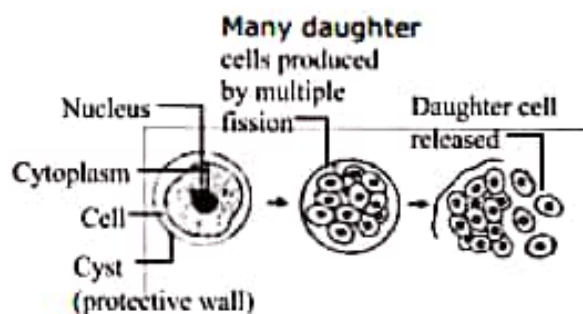
##### Fission (L. fissus-cleft)

It is a mode of asexual of asexual reproduction in which a parent undergoes division to form two or more individuals. Fission is of two types, binary fission and multiple fission.

##### Binary Fission :

It means 'splitting into two'. In binary fission, the nucleus or nuclear matter elongates and then divides into two. It is followed by cleavage of

In multiple fission, many individuals are formed from a single individual.



#### Multiple Fission in Plasmodium

The nucleus of cell divides repeatedly, producing many nuclei.

Each nucleus is surrounded by a small amount of cytoplasm & many daughter cells are produced within the cyst.

The cyst breaks up under favourable conditions & small off springs are liberated.

In plant, multiple fission is seen in many algae & in animals, a common example of multiple fission is that of the malarial parasite (Plasmodium).

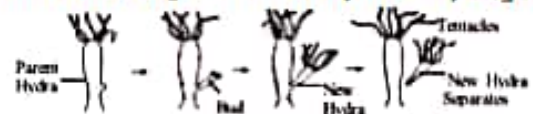
#### Budding:

In budding a small part of the body of the parent organism grows out as a "bud" which then detaches and become new organism.

The nucleus of the parent divides and one of the daughter nuclei passes into the bud.

The bud detaches itself from the parent body & becomes a new individual after growing to full size.

In plants, budding takes place in yeast and in animals budding is seen in hydra & sponges.



#### Budding in Hydra

##### Spore Formation:

In spore formation, the parent plant produces hundreds of tiny spores which can then produce new plants. During the growth of a fungus plants like. Rhizopus, tiny round bulb like structure called sporangium develops at the top of the hyphae.

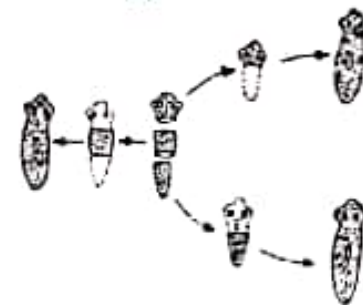


#### Spore Formation In a Fungus (Rhizopus)

Non-flowering plants like fungi (mucor, Rhizopus, penicillium) bacteria, ferns or mosses, formation of spores is method of reproduction.

#### Regeneration:

It is the ability of an organism to replace its lost body parts.





### Regeneration In Planaria

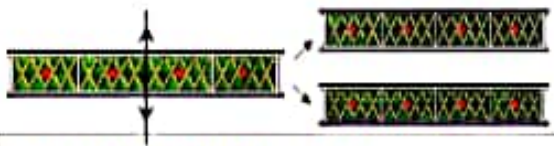
A special case of regeneration is fragmentation, in which a parent multicellular organism on maturing breaks up naturally to produce two or more daughter organisms.

Among plants, filamentous algae like Spirogyra reproduce by this method.

Hydra, Planaria & Sponges exhibit regeneration.

#### Fragmentation (1. fragmere – to break) :

It is the process of bracking up of the body of an organism into two or more parts called fragments, each of which grows into a new individual. Fragmentation is quite common in algae, fungi, bryophytes and some marine ribbon worms. It is caused by mechanical disturbance, chemicals, death and decay of older parts, emptying of intervening cells, etc. Fragmentation is common method of multiplication in green filamentous alga, Spirogyra (figure). Here all the cells are capable of photosynthesis, growth and division. Therefore, each fragment grows into a new filament.



Fragmentation In Spirogyra

#### Vegetative Propagation:

- In vegetative propagation, new plants are obtained from the parts of old plants like stems, roots & leaves, without the help of any reproduction. It can be achieved naturally or artificially.

- There are two ways of vegetative propagation.

#### (a) Natural Vegetative Propagation:

Various structure that take part in this type of reproduction are roots, stem, leaves.

##### Natural Vegetative Propagation by Roots:

In some plants like Dahlia, sweet potato, etc., the adventitious roots become thick, swollen and tuberous due to storage of food.

##### Natural Vegetative Propagation by Stems:

Some plants reproduce by means of stems. They may be aerial like runners, suckers or underground like ginger (rhizome), potato (tuber), and sugarcane.

### Natural Vegetative Propagation by Leaves:

The fleshy leaves of Bryophyllum bear adventitious buds in the notches along the leaf margin.

#### (b) Artificial Vegetative Propagation :

Some plant growers have developed artificial methods of vegetative propagation like cutting, layering and grafting which are used in agriculture and horticulture.

### SEXUAL REPRODUCTION

Sexual reproduction is a mode of multiplication in which the young ones are produced through the process of formation & fusion of gametes.

#### Significance of sexual reproduction :

##### Variation:

Due to reshuffling of chromosomes and crossing over, sexual reproduction brings about variations in almost all characters so that no two individuals are similar.

##### Vigour and Vitality:

It maintains the vigour and vitality of the individuals.

##### Uniformity of Population:

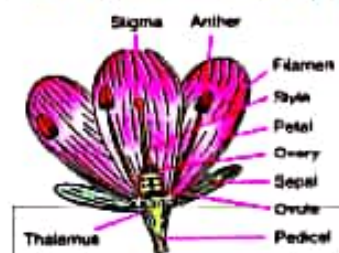
Due to the flow of genes amongst individuals during sexual reproduction, the uniformity of population is maintained where there is a broad resemblance of all the individuals with one another.

##### Evolution:

Genetic changes brought about by sexual reproduction play an important part in evolution of new forms.

#### Sexual reproduction in flowering plants:

A flower has following parts.



#### Parts of a flower in longitudinal section

##### Sepals :

Sepals are green outermost leaf-like floral organs which protect the flower in the bud stage. In the mature stage they provide support to other floral organs.

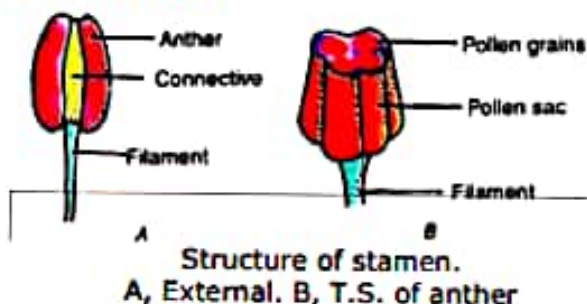


### Petals :

Petals are coloured accessory floral organs which lie above the sepals. Petals attract insects to flowers for pollination.

### Stamens :

Stamens are the male reproductive organs of the flowers. Each Stamen has a slender stalk called filament.



Each anther lobe has two long pollen sacs so that there are four pollen sacs in an anther. They produce yellowish coloured powder of haploid pollen grains.

**Carpels :** Carpels form the central female reproductive organs of the flowers.

### Pollination :

Pollen grains from the anther are transferred by air, water, insects, and other animals, to the stigma of a pistil.

"The process of transfer of pollen grains from the anther of a flower to the stigma of same or other flower, is called as pollination". On the basis of transfer of pollen grains to the stigma of same or other flower, pollination is of two types. (A) Self pollination (B) Cross pollination

**Self Pollination :**

The process of transfer of pollen grains from the anther of a flower to the stigma of same flower, is called as "Self-Pollination" or autogamy. e.g. Pea, Chinrose, Rice, Wheat. Self-pollination in bisexual flowers ensures continuity of the race.

It helps to preserve the parental characters, as the gametes from the same flower are involved.

### Cross Pollination:

The process of transfer of pollen grain from the anther of a flower to the stigma of other flower, is called as "Cross-pollination" or allogamy. e.g., mustard, rose.

Seeds produced by cross pollination have much better germinating capacity.

Variations are introduced by cross pollination.

### Fertilization in Plants:

Pollination is followed by fertilisation in plants. After reaching the stigma, the pollen grain develops the pollen tube.

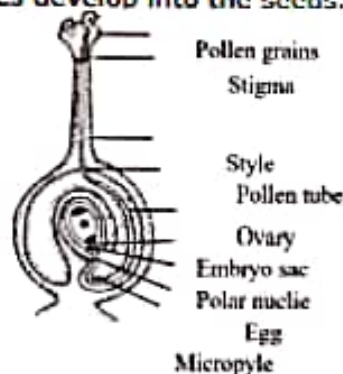
This pollen tube grows through the style and reaches the ovary where ovules are located.

The pollen tube enters the ovule through a small opening called micropyle, where it releases two male gametes into the embryo sac.

One male gamete fuses with the egg contained in the embryo sac of the ovule; and this fusion of male and female gametes is called syngamy and its product is the zygote. The other male gamete fuses with the two polar nuclei and this process is called triple fusion, where three nuclei are involved in the fusion process, one male gamete and two polar nuclei.

The process of double fertilisation occurs inside each embryo sac, in which two fusions, syngamy and triple fusion take place.

After fertilisation, ovary develops into the fruit and ovules develop into the seeds.

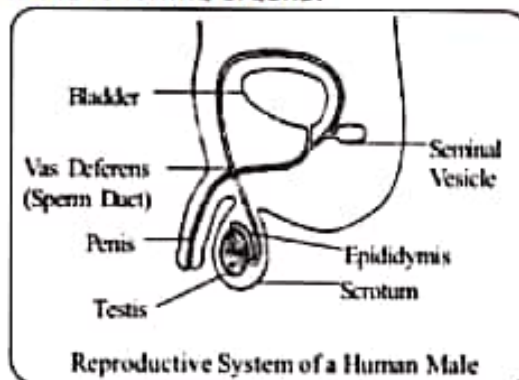


Fertilisation in a Flowering Plant

### Reproduction in human

#### Male Reproductive System-

The human male reproductive system consists of the following organs:





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

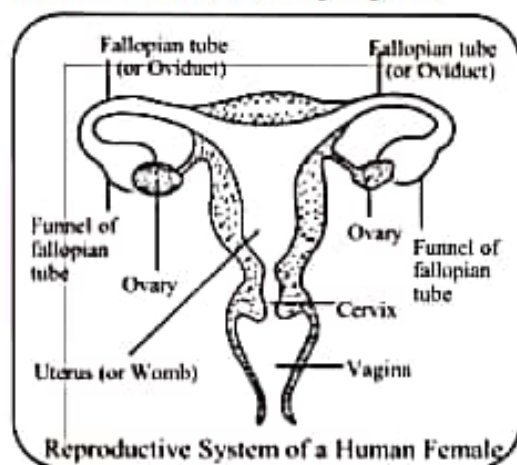
Seminal vesicle is a glandular structure which joins vas deferens to form ejaculatory duct.

Ejaculatory duct enters prostate gland and joins urethra to form common urino-genital duct.

Penis is a copulatory organ at the tip of which urinogenital duct opens.

### Female Reproductive System:

The human female reproductive system consists of the following organs:



Ovaries are a pair of small and oval-shaped organs, located in the abdominal cavity near the kidney. 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.

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.

These tubes from both the sides open into a muscular structure, the Uterus.

Uterus or womb - Is a hollow, pear-shaped organ within which the embryo develops. Its upper portion is broader, while its lower portion is narrower, called cervix.

Vagina - The cervix opens into the vagina which is a tubular structure and also called "birth canal". or canal for menstrual flow. Vagina receives sperms from the male and also serves as the passage through which the fully developed foetus is born.

### MENSTRUAL CYCLE

If the egg is not fertilized, it lives for one day and is then expelled. This sets in motion which is called menstrual or ovarian cycle. The first menstruation is called menarche. It stops between age 45-50 years. Stoppage of menstruation permanently is called menopause. Menstrual cycle consists of four phases.

**Menstrual Phase:** It is characterized by menstruation (= menses, GK. mensum-month) or discharge of blood, mucus and endometrial lining. Menstrual phase lasts for 3-5 days.

**Proliferative Phase:** There is repair and growth of endometrium. Under the influence of hormone FSH, a few follicles grow but only one follicle called Graafian follicle matures in the two ovaries. It secretes hormone estrogen. Proliferative phase lasts from 5<sup>th</sup> to 14<sup>th</sup> day.

**Ovulation Phase:** At about the middle of the menstrual cycle on 13<sup>th</sup> or 14<sup>th</sup> day, the growing follicle bursts and mature ovum is released from the ovary under the influence of estrogen and LH.

**Secretory Phase:** It lasts from middle of menstrual phase to end of the same, i.e., 14-28 days. During this period the uterine wall thickness further. Glands present in endometrial area become functional and begin to secrete of materials for nourishment of the egg if it happens to get fertilised.

### REPRODUCTIVE HEALTH

Reproductive health is the state of physical, mental and social fitness to lead a responsible safe and satisfying reproductive life. (i) It provides awareness to both male and female regarding fertility regulating methods. (ii) Reduction in the number of children to the



limit of enjoying family life as well as rearing the children with better resources as and when they are available. (iii) Prevent catching up sexually transmitted disease. (iv) Manage disorders related to reproductive system by getting them treated at the earliest.

### **CONTRACEPTION**

Prevention of pregnancy is called contraception. The techniques used in preventing the occurrence of pregnancy are called contraceptive devices.

#### **Mechanical Barrier Methods of 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.

#### **Intrauterine 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 conception generally through excessive secretion of cervical

mucus. The most common type is copper for preventing implantation. It is functional for 3-5 years.

#### **Hormonal Methods of Contraception :**

##### **Oral Pills :**

They contain progesterone with or without estrogen.

##### **Implants :**

They are subdermal devices which provide long term contraception, e.g., norplant.

##### **Morning-After Pills :**

They prevent conception even after coitus, e.g., I pill,

#### **Chemical Methods of Contraception:**

They are creams, jellies and foaming tablets (vaginal pills) which are placed in vagina for killing the sperms at the time of coitus.

#### **Reversible Sterilisation or Surgical Method:**

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 semen.

##### **Tubectomy:**

A portion of both the fallopian tubes is excised or ligated to block the passage of ovum.

\*\*\*

### Diseases Caused by Microorganisms

Disease	Causative agent	Mode of Transmission	Type of Organism Affected	Symptoms/Details
---------	-----------------	----------------------	---------------------------	------------------

#### Diseases Caused by Bacteria

<b>Anthrax</b>	<b>Bacillus anthracis</b>	Contact with infected meat infection	Most animals including humans that are fatal.	Causes skin infections and Gastrointestinal (GI)
<b>Cholera</b>	<b>Vibrio cholera</b>	Water/food	Human	Affects small intestine. The classic symptom is large amount of watery diarrhoea that lasts a few days.
<b>Diphtheria</b>	<b>Corynebacterium diphtheria</b>	Air/ direct contact	Humans	Sore throat and fever. Myocarditis may result in an abnormal heart rate, and inflammation of the nerves may result in paralysis.
<b>Pneumonia</b>	<b>Streptococcus pneumonia</b>	Air borne droplets of sneeze	Humans	Inflammatory condition of the lung affecting primarily the microscopic air sacs known as alveoli.
<b>Peptic ulcers</b>	<b>Helicobacter pylori</b>		Humans	Ulcers in the lining of stomach
<b>Plague</b>	<b>Yersinia pestis</b>  <b>Unhygienic</b>	Air/direct contact.  condition is the main cause		bubonic plague in lymph nodes, septicemic plague in blood vessels, pneumonic plague in lungs.
<b>Tuberculosis</b>	<b>Mycobacterium</b>	Air	Humans	The classic symptoms of active TB are a chronic cough with blood-tinged sputum, fever, night sweats, and weight loss.

Tuberculosis



<b>Typhoid</b>	<b>Salmonella typhi</b>	<b>Water</b>	<b>Human</b>	Weakness, abdominal pain, constipation, and headaches also commonly occur.
----------------	-------------------------	--------------	--------------	--

### Diseases Caused by

<b>AIDS</b>	Human Immunod-primates	Blood Exchange way for a number of other pathogens.	Human and	Severely weakens immunity and efficiency Virus (HIV)
<b>Chicken Pox</b>	Varicella zoster virus (VZV)	Air/ contact	Humans	Skin rash that forms small, itchy blisters. Less severe than small pox. Almost eradicated from the world After the invention of vaccination.
<b>Small Pox</b>	Variola major and minor	Air/contact/ water	Humans	One of the highly dreaded diseases that is highly contagious. Almost eradicated after the invention of vaccination.
<b>Chikungunya</b>	Chikungunya virus	Aedes Mosquitoes		Causes severe joint pains. Animal reservoirs of the virus include monkeys, birds, cattle, and rodent. This is in contrast to dengue, for which primates are the only hosts.
<b>Dengue fever</b>	Flavivirus	Female Aedes mosquito	Humans	High fever, headache, vomiting, muscle and join pains, and a characteristic skin rash.
<b>Ebola</b>	Ebola virus	Animal to man mosquito	Human and other mammalian	Ebola infection shows a sudden onset of the disease resulting initially in full -like symptoms: fever, chills and malaise. As the disease progresses, it results in multisystem involvements indicated by the person experiencing lethargy, nausea, vomiting, diarrhea, and headache.
<b>Foot and Mouth Disease</b>	Picornavirus (Genus Aphovirus	Close-contact animal-to-animal spread	Animals	Serious problem to animal farming in India.
<b>Hepatitis B</b>	Hepatitis B virus (HBV)	Blood Exchange STD (Sexually transmitted disease)	Humans	Affects the liver. Acute as well as choronic
<b>Measles</b>	Measles virus	Air	Humans	Complications occur in about 30% and may include diarrhoea, blindness, inflammation of the brain, and pneumonia among others.
<b>Polio or Poliomyelitis</b>	Poliovirus	Water/Faecal-mouth	Humans	Weak muscles leading to deformations
<b>Zika</b>	Zika Virus	Aedes mosquitoes, such as A, aegypti and A, albopictus	Humans	A birth defect that is associated with a small head and incomplete brain development in newborns.

### Diseases Caused by Protozoans

<b>Amoebiasis (amoebic dysentery)</b>	<b>Entamoeba histolytica</b>	Contaminated water/ food	Humans	Symptoms may include abdominal pain, mild diarrhoea, blood diarrhoea or severe colitis with tissue death and perforation. This last complication may cause peritonitis. People affected may develop anaemia due to loss of blood.
<b>Dysentery Kala-Azar or Visceral leishmaniosis</b>	<b>Leishmanial Leishmaniosis genus</b>	Sandflies	Humans	This disease is the second largest parasitic killer in the world (after malaria). Signs and symptoms include and substantial swelling of the liver and spleen.
<b>Malaria</b>	Different species of Plasmodium 1. P. vivax 2. P. malaria 3. P. falciparum 4. P. oval	Female Anopheles mosquito	Humans	Malaria causes symptoms that typically include fever, fatigue, and headaches. In severe cases, it can cause yellow skin, seizures, coma, or death.
<b>African Sleeping Sickness</b>	<b>Trypanosoma</b>	Tsetse fly	Humans	fevers, headaches, itchiness, and joint pains. This begins one to three weeks after the bite. Weeks to months later, the second stage begins with confusion, poor coordination, numbness, and trouble sleeping.

### Diseases Caused by Fungi

<b>Ringworms</b>	<b>Trichophyton and Epidermophyton</b>	Skin-Skin contact	Humans	The fungi that cause parasitic infection, collectively dermatophytes, feed on keratin, the material found in
		the outer layer of skin		

\*\*\*



1. **Tissue** is a group of cells having similar origin, structure & function. Study of tissues is called **Histology**

2. In unicellular organism (Amoeba) single cell performs all basic functions, whereas in **multi-cellular organisms** (Plants and Animals) shows **division of labor as Plant tissue & Animal tissues**.

3. **Animal tissues**: Sub divided as **epithelial tissue, connective tissue, muscular tissue and nervous tissue**.

i. **Epithelial tissue**: It is a protective covering forming a continuous sheet. Simple epithelium is the one which is extremely thin in one layer, whereas stratified epithelium are arranged in pattern of layers.

Depending on shape and function they are classified as:

a) **Squamous epithelium** in the lining of mouth and esophagus.

b) **Cuboidal epithelium** in the lining of kidney tubules and salivary glands.

c) **Columnar epithelium** in the Intestine & Columnar epithelium with cilia in the lining of respiratory tract.

d) **Glandular epithelium** in the Glands aids in a special function as gland cells, which can secrete at the epithelial surface.

ii) **Connective Tissue: Five Types, such as;**

a) **Blood**: The Blood is a fluid connective tissue. Blood plasma has RBCs (Red Blood Cells) WBCs (White Blood Cells) and platelets. Blood plasma contains proteins, salts and hormones. Blood flows and transports gases, digested food, hormones and waste materials.

b) **Bone**: The bone is a connective tissue with hard matrix, composed of calcium and phosphorus. A bone is connected by another bone with another connective tissue called ligaments. A bone is connected by muscle with another connective tissue called tendon.

c) **Cartilage**: The cartilage is a connective tissue with solid matrix composed of proteins and sugars. It is commonly seen in nose, ear, trachea, and larynx.

d) **Areolar Connective Tissue**: It is found between the skin and muscles, around the blood vessels. It supports internal organs and aids in repair of tissues.

e) **Adipose Connective Tissue**: It is filled with fat globules for the storage of fat. It acts as insulator.

**Muscular tissues**: They have special contractile proteins responsible for movements. Three types, such as;

**Striated muscles/skeletal muscles/voluntary muscles:**

They are cylindrical, un-branched and multinucleated. They have dark bands and light bands.

**Unstriated muscles/smooth muscles/involuntary muscles:**

They are commonly called as Smooth muscles, having no striations (dark bands/ light bands are absent). Commonly found alimentary canal, uterus, Iris of an Eye. They are spindle shaped. Involuntary in nature

**Cardiac Muscles**: They are commonly called as Heart muscles, cylindrical, branched and uni-nucleate. Involuntary in nature

**Nervous Tissue**: The tissue responds to stimuli. The brain, spinal cord and nerves are composed of nervous tissue or neurons. A neuron consists of Cell Body, cytoplasm, Nucleus, Dendrite, Axon, nerve ending. The neuron impulse allow us to move our muscles when we want to respond to stimuli.

\*\*\*

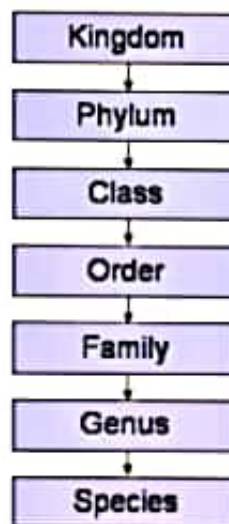


## CLASSIFICATION OF LIVING ORGANISMS

### ANIMAL KINGDOM AND PLANT KINGDOM

1. Each **organism** is different from all other organisms.
2. In this activity, we decide which **characteristics** (we can run, but the Banyan tree can't run is a characteristic) are important in forming the desired **category**.
3. **Greek thinker Aristotle classified animals according to whether they lived on land, in water or in air.** This classification is a landmark in ideology, but has limitations. For example, animals that live in the sea include Corals, Whales, Octopus, Starfish, and Shark. In fact they are different from each other.
4. **Classification and Evolution:** organisms are classified based on body design, hierarchy in developing, relation to evolution. Charles Darwin first described the idea of evolution in 1859 in his book "The Origin of Species"
5. The Biologists, such as Haeckel, Whittaker & Carl Woese tried to classify all living organisms into broad Kingdoms. The Whittaker proposed five kingdoms: **Monera, Protista, Fungi, Plantae and Animalia.** Carl Woese introduced by dividing Monera into Archaeobacteria and Eubacteria.
6. **Hierarchy of Classification:**

#### Linnaeus's System of Classification



7. **Monera:** They have **unicellular, Prokaryotic organisms** (do not have defined nucleus or organelles). The cell wall may or may not be present. The mode of nutrition is **autotrophic** (synthesizing food on their own) **(or) heterotrophic** (getting food from environment). **Ex. Bacteria, Anabaena.** (Please refer to Fig. 7.1 Monera NCERT Book Page-83)
8. **Protista:** They have **unicellular eukaryotic organisms** (do have well defined nucleus or organelles). The body is covered by **cilia, flagella for locomotion.** The mode of nutrition is **autotrophic or heterotrophic.** **Ex. Diatoms, protozoans.**
9. **Fungi:** These are multi-cellular **eukaryotic organisms with cell wall, made up of Chitin.** They do not perform Photosynthesis (**heterotrophic**), **Saprophytic** (derive nutrition from decaying material). **Ex. Aspergillus, Penicillium, Mushroom, Rhizopus.** The fungi living with algae forms Lichen (Symbiotic Association). (Please refer to Fig. 7.3 NCERT Book Page-84).
10. **Plantae:** These are multi-cellular eukaryotic organisms with cell wall, made up of Cellulose. Able to perform photosynthesis (autotrophic). **Ex. Rice, wheat.**
11. **Animalia:** These are multi-cellular eukaryotic organisms without cell wall. They are not able to perform photosynthesis (heterotrophic).  
**Ex Human beings, Peacock.**



## DETAILS OF KINGDOM PLANTAE

**1. The kingdom Plantae is further classified as Thallophyta, Bryophyta, Pteridophyta, Gymnosperms, Angiosperms.**

**2. Thallophyta:** The plants do not have well defined body design, commonly called as "Algae", mostly aquatic. Ex. Spirogyra, Ulothrix.

**3. Bryophyta:** These are commonly called as the "Amphibians of Kingdom". The plant body is differentiated into roots like, stem like and leaf like structures. No specialized tissues for the conduction of water and food. Ex. Marchantia, Funaria.

**4. Pteridophyta:** These are commonly called as the "First vascular land plants". The plant body is differentiated into root, stem and leaf. Specialized tissues for the conduction of water and food are developed in these plants. The reproductive organs are inconspicuous. Ex. Marsilea, Fern. (Please refer to Fig. 7.7 NCERT Book Page-87).

**Special Note:** The reproductive organs are inconspicuous in Thallophyta, Bryophyta, Pteridophyta are can't develop seeds. They are together called as "Cryptogamae (Non-Flowering Plants)". The plants with well differentiated reproductive organs and that ultimately make seeds are called "Phanerogams (Flowering Plants)". This group is further classified Gymnosperms (Bare naked Seeds) & Angiosperms (Bears seeds inside Fruit).

**5. Gymnosperms:** These are commonly called as "Naked seed bearing plants". They are usually perennial, evergreen and woody. Ex. Pinus, Cycas

**6. Angiosperms:** These are commonly called as "Enclosed seed bearing plants". Plants with seeds having a single cotyledon are called as "Monocotyledons or Monocots". Plants with seeds having two cotyledons are called as "Dicots". Ex. Ipomoea, Paphiopedium.

**These are Eukaryote, multicellular and hetero-tropic.**

They are further classified as **Non- Chordates** (Porifera, Coelenterata, Platyhelminthes, Nematoda, Annelida, Arthropoda, Mollusca, Echinodermata) and **Chordates** {Protochordata, Vertebrata (Pisces, Amphibians, Reptilia, Aves, Mammalia)}.

Vertebrata (Pisces, Amphibians, Reptilia, Aves, Mammalia)}.

### I. Non- Chordates

**1. Porifera:** The word Porifera" means organisms with holes". The canal system helps in circulating water, food, oxygen. They are non-motile with cellular level of organization and mainly marine organisms with hard outer coat called as **Skeleton**. They are commonly called as Sponges. Ex. Spongilla, Sycon

**2. Coelenterata:** The word Coelenterata" means organisms with body cavity called **Coelenteron**". They are radially symmetrical, **Diploblastic** (two layers of cells), commonly called as Cnidarians (Stinging cells for protection are present in the body). Ex. Hydra, Sea Anemone

**3. Platyhelminthes:** The word Platyhelminthes means organisms with **flatworms (dorsocentrally flattened)**". They are bilaterally symmetrical **Triploblastic** (three layers of cells), either free-living or parasitic. No true Coelom is present - **Acoelomates**. Ex. Planaria (Free living), Tape worm (Parasitic)

**4. Nematoda:** The word Nematoda "means organisms with roundworms". They are bilaterally symmetrical **Triploblastic** (three layers of cells), familiar with parasitic worms. The false Coelom is called as **Pseudocoelome**. Ex. Ascaris, Wuchereria (Filarial worm causes elephantiasis).

The word **Annelida** "means organisms with metameric-segmented". They are bilaterally symmetrical **Triploblastic** (three layers of cells) with closed circulatory system, familiar with earth worms. The Coelom is called as true Coelom. Ex. Nereis, Earth worm, Leech

**6. Arthropoda:** The word Arthropoda "means organisms with jointed legs" They are bilaterally symmetrical **Triploblastic** (three layers of cells), familiar with cockroaches. The Coelom is blood filled called as **Haemo Coelom**. Ex. Prawn, Scorpion, Housefly

**7. Mollusca:** The word Mollusca "means organisms with soft body" They are bilaterally symmetrical, **Triploblastic** (three layers of cells), familiar with Octopus, Pila. Foot is for moving, kidney like organ for excretion, with open circulatory system. Ex. Unio, chiton



**8. Echinodermata:** The word Echinodermata "means organisms with spiny skinned". Exoskeleton is with calcium carbonate. They are radially symmetrical Triploblastic (three layers of cells) with coelomic cavity, familiar with Star fish. They are exclusively free-living marine animals. Ex. Sea Cucumber, Feather Star

**II. Chordates:** They are further classified as two major groups such as **Protochordata & Vertebrata**

**(A). Protochordata:** Notochord present in at least larval forms, but very rudimentary. It is a rod like supporting structure, runs along with nervous tissue from the gut of animal. They are bilaterally symmetrical, triploblastic (three layers of cells) with a Coelom, familiar with **Amphioxus**. Ex. **Balanoglossus**

**(B). Vertebrata:** Notochord is replaced by vertebral column and internal skeleton. They are bilaterally symmetrical, triploblastic, coelomic and segmented having paired gill pouches. Vertebrates are grouped into five classes.

**1. Pisces:** These are commonly called as "fishes", exclusively aquatic. Body is streamlined and a tail for locomotion. Gills for respiration, heart is two chambered, cold blooded, skin is covered with scales, plates. They are cold-blooded animals. Skeleton of bone (Rohu) / cartilage (Shark). They lay eggs. Ex. Lion Fish, Dog Fish

**2. Amphibians:** These are commonly called as "Amphibians" because they can live on land and in water". Body is streamlined and a webbed foot/ foot for locomotion. Gills or lungs or skin for respiration, heart is three chambered, cold blooded, skin is lack of scales, plates. They are coldblooded animals. They lay eggs. Ex. Rana, Hyla

**3. Reptilia:** These are commonly called as "Reptilians". A lung for respiration, heart is three chambered (Crocodile heart is four chambered), skin have scales. They are cold-blooded animals. They lay eggs. Ex. Snakes, Turtles

**4. Aves:** These are commonly called as "Birds". A lung for respiration, heart is four chambered, fore limbs are modified for flight, skin has feathers. They are warm-blooded animals. They lay eggs. Ex. Ostrich (Flightless Bird), Pigeon, Sparrow

**5. Mammalia:** These are commonly called as "animals with mammary glands for producing milk to nourish their young ones". A lung for respiration, heart is four chambered, skin has hairs, sweat or oil glands. They are warm-blooded animals. They lay eggs (Platypus, Echidna), give birth to young ones poorly developed (Kangaroo) & give birth to developed young ones (Human beings). Ex. Lion, Whale, Bat

### DETAILS OF NOMENCLATURE

**NOMENCLATURE:** The system of scientific naming or nomenclature was introduced by Carolus Linnaeus. It is unique to identify in the world. We limit ourselves to writing the names of the Genus and Species of that particular organism. The world over, it has been agreed that both these names will be used in Latin forms. When printed is given in italics and when written by hand, the Genus and Species name have to be underlined separately.

Ex. Ostrich (Common name): **Struthio Camelus** (scientific name with two parts namely the Genus and Species).

\*\*\*



## ENDOCRINE SYSTEM

**Endocrine glands:** These are ductless glands which secrete hormones directly into the blood stream.

**Hormones:** Non-nutrient chemicals, synthesised in trace amounts, acts as intracellular messengers and are specific in their action.

### Hypothalamus:

- It is basal part of diencephalon.
- Has neurosecretory cells called nuclei which produce hormones to regulate the synthesis and secretion of pituitary gland hormones.
- Two types of hormones released are :

**Releasing hormones:** Stimulate secretion of pituitary hormones, e.g., Gonadotropin releasing hormone stimulates pituitary gland to synthesise gonadotrophins.

**Inhibiting hormones:** Inhibit secretions of pituitary hormones, e.g., Somatostatin inhibits secretion of growth hormone.

### Pituitary Gland:

- It is found in brain
- It is also called master gland

#### (a) PITUITARY GLAND:

##### Hormones

- **Growth hormone (GH):** Oversecretion leads to gigantism and low secretion causes dwarfism.
- **Prolactin (PRL):** Growth of mammary glands and formation of milk in them.
- **Thyroid stimulating hormone (TSH):** Stimulates synthesis and secretion of thyroid hormones from thyroid gland.
- **Adrenocorticotrophic hormone (ACTH):** Stimulates synthesis and secretion of steroid hormones called glucocorticoids from adrenal cortex.
- **Luteinizing hormone (LH):** Synthesis and secretion of hormones called androgens in males, and helps in ovulation and maintenance of corpus luteum in females.
- **Follicle stimulating hormone (FSH):** Regulate spermatogenesis in males, and growth and development of ovarian follicles in females.
- **Oxytocin** helps in contraction of uterus during child birth and milk ejection from mammary gland in females.
- **Vasopressin:** Acts on kidney and stimulates reabsorption of water and electrolytes by distal tubules to reduce water loss through urine. It is also called as Anti Diuretic Hormone (ADH).

#### (b) PINEAL GLAND:

- Located on dorsal side of forebrain.
- Secretes melatonin to regulate 24-hour rhythm, sleep-wake cycle, menstrual cycle, pigmentation etc.

#### (c) THYROID GLAND:

- Has two lobes on either side of trachea

- Follicular cells synthesise thyroxine ( $T_4$ ) and triiodothyronine ( $T_3$ ).
- Iodine is necessary for normal functioning in of thyroid.
- **Goitre (Hypothyroidism):** Enlargement of thyroid gland. Hypothyroidism may lead to mental retardation and stunted growth (cretinism) in the baby if it occurs during pregnancy.
- **Hyperthyroidism:** Occurs due to cancer or due to development of nodules in thyroid glands. Effects body physiology as abnormal high levels of thyroid hormones is synthesised.
- Also secretes a protein hormone called Thyrocalcitonin (TCT) which regulates blood calcium level.

**(d) PARATHYROID GLAND:**

- Present on back side of thyroid gland. Each lobe of thyroid gland has its one pair.
- Secrete peptide hormone called parathyroid hormone (PTH) which increases calcium levels in blood so called **hypercalcemic** hormone.
- PTH stimulates bone resorption, and reabsorption of calcium from blood and reabsorption of calcium by renal tubules.

**(e) THYMUS GLAND:**

- Found below the neck or upper part of the chest
- Secrete peptide hormones called thymosins which play role in differentiation of T-lymphocytes (help in cell mediated immunity).
- Thymosins also produce antibodies and provide humoral immunity.
- Immunity of old people usually becomes weak as thymus gets degenerated with age.

**(f) ADRENAL GLAND:**

- Located at anterior part of each kidney.
- Has centrally located adrenal medulla and at periphery is adrenal cortex.
- Adrenal medulla secretes adrenaline (epinephrine) and nor adrenaline (norepinephrine), commonly called as catecholamines or emergency hormones or hormones of flight and fight.
- These hormones increase heart beat, rate of respiration, breakdown of glycogen thus into glucose

**(g) PANCREAS:**

- Has both exocrine and endocrine function.
- Contains about 1-2 million islets of Langerhans which has glucagon secreting  $\alpha$ -cells and insulin secreting  $\beta$ -cells.
- **Glucagon:** Peptide hormone
- **Function**
- It converts glycogen into glucose
- **Insulin:** Peptide hormone
- **Function**
- It converts glucose into glycogen and stored in liver
- Deficiency of insulin causes diabetes mellitus in which loss of glucose occurs through urine.



**(h) TESTIS:**

- A pair of testis composed of seminiferous tubules and interstitial cells is present in the scrotal sac of males.
- Leydig cells (interstitial cells) produce androgens (mainly testosterone)

**(i) Ovary:**

- A pair of ovaries which produce one ovum in each menstrual cycle are present in abdomen in females.
- Hormones secreted by ovary
  - Estrogen
  - Progesterone
- Functions
  - Growth and development of female secondary sexual characters
  - Growth and development of female reproductive organs
  - During child birth ovary also secretes a hormone called Relaxin

\*\*\*