BLOOD

- Study of blood – Haematology
  Study diseases of blood circulation – Angiology
- Blood circulation, character of blood, heart function described by - William Harvey (1628).
- Blood is a fluid connective tissue (Living) and composed of blood cells, plasma & lymph.
- It differs from connective tissue in following manner

1. Are not formed by pre existing Blood cell
2. Do not divide like cells of connective tissue
3. Fibres are absent

Characterise/Properties

- Blood is salty in taste
- pH 7.30 - 7.40
- Heavier than water (2.5 times)
- Blood volume in an adult 5 - 8 litres
- Blood volume in males 5 - 6 litres
- Blood volume in females 4 - 5 litres

Components : Blood is made up of 2 main components

Liquid Component - 55%

- Plasma

Solid Component - 45%

1. Red Blood Corpuscles (RBC)
2. White Blood Corpuscles (WBC)
3. Blood Platelets

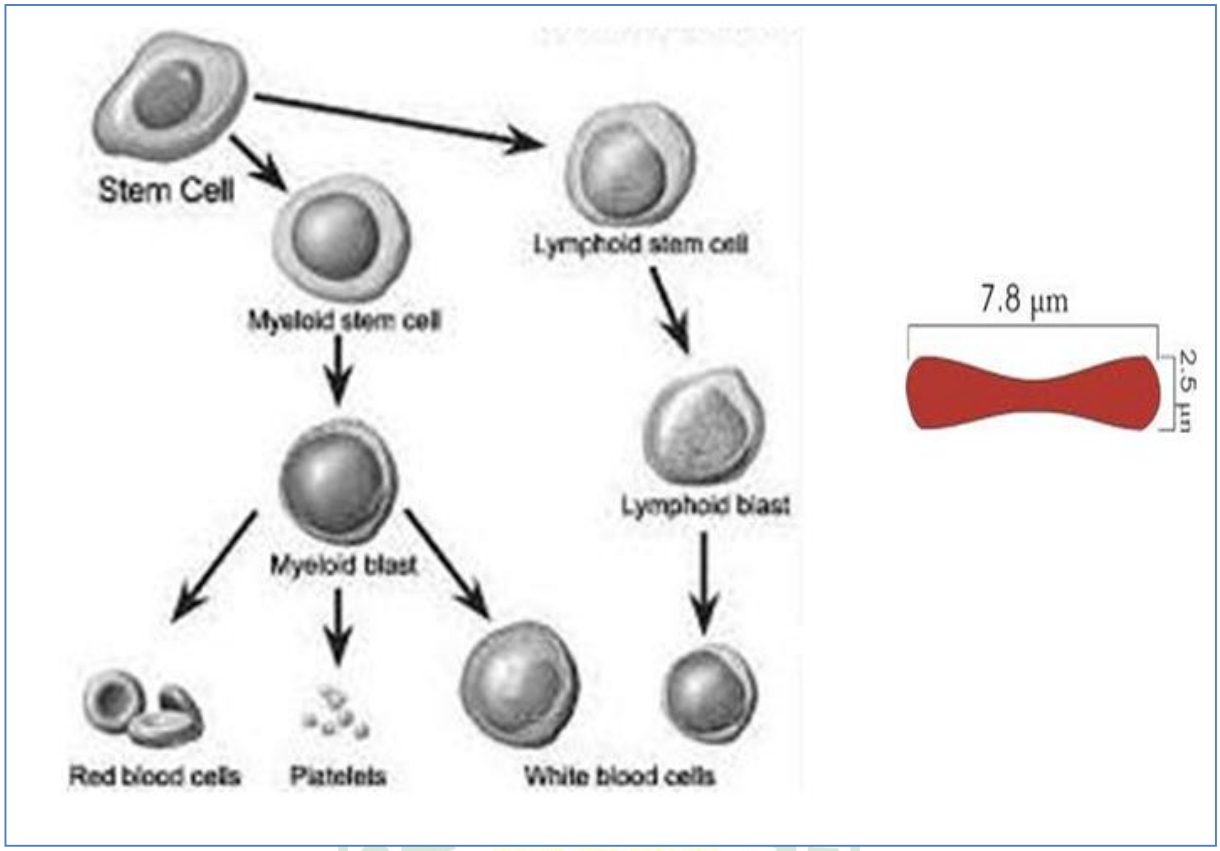
PLASMA

- Transparent straw yellow in colour
- Slightly alkaline
- It forms 55% by volume of blood
- It contains 80-92%, water 0.9%, proteins and 0.1% salt and respiratory gases

Plasma proteins

- Albumin - 4.4 % - maintains osmotic pressure
- Globulin - 2.3 % - transport of hormones, ions formation of antibodies
- Fibrinogen - 0.3 % - helps in blood clotting

Water – as a solvent and suspending medium for blood components.



IONS – Na, K, Ca, Mg, Cl2, Fe, PO4, H & HCO3 – Osmosis, acid – base balance, buffer, etc.

Nutrients – Glucose, amino acids, triglycerides, Cholesterol, vitamins – source of energy, building blocks.

Regulating substances – Hormones & enzymes – body functions.

RED BLOOD CORPUSCLES

- Erythrocytes / Oxygen boats
- In developing stages nucleus is present, while maturity it will looses its nucleus.
- RBC in healthy man 5 - 5.5 millions of RBC mm^{-3}
- RBC in healthy in woman - 4.5 – 5 millions of RBC mm^{-3}
- Infant – 6.5 Million / 1 cubic millimeter
- Embryo - 8.5 Million / 1 cubic millimeter
- Biconcave discoidal in structure
- 7mm in diameter
- Structure described by KENDREW & PERUTZ
- 2.5 micron in thickness
- Outer membrane is Donnan's membrane

- Its Red in colour because of Hameoglobin, pigmented, protein present inside. Its also known as respiratory pigment
- Haemoglobin combines with oxygen and forms oxyhaemoglobin

  1 mol Hb + 4 mol of O_2 → HbO_5

  Haemoglobin transport O_2
- Its measured by : Shali's Haemometer
- In Male - 15.8 mg / 100 ml
- In Female - 13.7 mg / 100 ml
- In child - 16.5 mg / 100 ml
- Molecular weight of Hb : 68000 Daltons
- Formula of Hb : C_{3032} H_{4816} O_{872} N_{780} S_8 Fe_4
- 4 molecular Haeme + 1 molecular globin = Haemoglobin
- One RBC contains about 280 haemoglobin molecule.

Formation of RBC (Erythropoiesis)

- Erythropoietin is a hormone secretes by kidneys in response to low oxygen & helps.
- Production in Bone marrow (ribs & vertebrae)

Bone marrow	After Birth	Child	Aged
volume	70 ml	2000 ml	4000 ml
colour	Pink	Red	Yellow

Haemocytoblast

↓

Erythroblast

↓

Normoblast

↓

Reticulocyte

↓→Vit B12, Vit C,

Folic acid are needed for maturation

↓

RBC

- The total process will take 72 hours
- In one minute time 2 to 10 million were produced and destroyed
- Life span in male – 120 days, in female – 110 days
- For estimation of life span of RBC Cr_{51} radioactive element is used.

Destruction of RBC

- Gravegard of RBC is Spleen & Liver.

- ❖ While destruction it is converted into Bilirubin (Yellow), Biliverdin (Green)
- ❖ This will give colour to fecal matters and urine

- RBC, WBC count measuring instrument : Haemocytometer
- RBC diluting liquid : Hayem's,
- WBC diluting liquid : Turk's

Diseases :-

- ❖ Polycythemia - RBC count increase in blood
- ❖ Anaemia - RBC count decreases in blood
- ❖ Hypochromic anaemia - Deficiency of Iron in food
- ❖ Pernicious anaemia - Deficiency of Vitamin B12 in food
- ❖ Megaloblast anaemia - Deficiency of folic acid in food
- ❖ Sickle cell anaemia - It is genetic and RBC becomes sickle shaped
- ❖ Thalassemia - It is genetic and body does not make Hb or RBC
- ❖ Aplastic anaemia - Failure of RBC formation by over drug intake
- ❖ Haemolytic anaemia - Destruction of RBC by snake venum
- ❖ Septicemia - Its a sort of blood presence of microorganisms and their toxins in blood.

Functions :

1. RBC carry the oxygen
2. RBC transport CO_2
3. RBC maintains pH

Colour of Blood :

- ❖ Fe – Red colour
- ❖ Cu – Blue colour
- ❖ Mn – Brown colour
- ❖ Mg – No colour

White Blood Corpuscles

- ❖ Leucocytes / Police force of body
- ❖ Colourless because they lack haemoglobin
- ❖ Amoeboid & nucleated cells.
- ❖ Least count when compared with RBC
- ❖ RBC : WBC = 600 :1
- ❖ Count 6000-8000 / cubic millimeter
- ❖ Life span 3-4 days
- ❖ Having a prominent nucleus (amoeboid)

COMPARISON BETWEEN PLASMA AND LYMPH	
PLASMA	**LYMPH**
• It is cell free part of blood, contains, salts considerable amount of proteins as well as more or less all constituents of body.	• It is modified tissue fluid, contains cells like lymphocyte and monocytes, salts and small amount of proteins. It is colourless.
• It flows with in blood vessels.	• It flows within lymphatic vessels.
• It takes part in nutrition excretion respiration etc by transporting various materials and helps in the defence mechanism of the body by producing antibodies.	• It supplies nutrition to tissue devoid or blood supply, takes part in fat absorption and defence Mechanism of the body.
• It can Coagulate because it contains fibrinogen and prothrombin	• It can coagulate but very slowly because it contains these two in small quantities.

Granulocytes – Characterised by presence of granules in cytoplasm and differentiated in the bone marrow. (Neutrophils, Eosinophils & Basophils).

Agranulocytes – Characterised by absence of granules in cytoplasm and differentiated in the lymph glands & spleen, (Lymphocytes, Monocytes).

WBC

Monocucleated Agranulocytes Polymorpho nucleated granulocytes	
Lymphocytes 26%	Eosinophills (a) acidophils : 2.8%
Monocytes 6%	Neutrophils : 65%
	Basophils : 0.2 %

1. Lymphocytes

- Small WBC
- 7 μ in diameter
- Life span 28 days
- Produce T cells to destroy viruses

2. Monocytes (Macro Policeman)

- Largest WBC
- 22 μ in diameter
- Life span 28 days
- These are phagocytic in nature

3. Eosinophils

- Nuclear is bilobed
- More motility in nature

- Life span few hours only
- Non – Phacolytic in nature
- It increase during certain types of parasitic infections & allergic reactions
- If secretes heparin, serotonin and histamines
- They also involve in inflammatory reactions.

4. Neutrophils/Micro Policeman:

- Also called as heterophils Maximum number is total WBCG
- Nucleus is multilobulated, hence called as polymorphonuclear neutrophils (PMN)
- Life span 2-4 days
- 10 μ in size
- Phagocytic in nature

5. Basophils; :

- Minimum number in total WBC
- Life span 12-15 days
- Heparin is present which preventing blood clotting inside the capillaries.

Functions:

- ❖ WBC protects our body from microorganisms
- ❖ The introduced foreign bodies were destroyed and digested by cells.

Diseases:

- ❖ Increase of WBC count in blood - leukemia (Blood cancer)
- ❖ Decrease of WBC count in blood – leukopenia

BLOOD PLATELETS

- ❖ Name coined by Bizzozero
- ❖ Present only in mammals
- ❖ No nucleus
- ❖ Irregular in shape
- ❖ Produced from cells of bone marrow
- ❖ Count 2,00,000 – 4,00,000 / cubic millimeter
- ❖ Life span 5-9 days
- ❖ For estimation of life span -DPF^{32}
- ❖ Important role in blood clotting (hemostasis)
- ❖ Destructed in Spleen and Liver
- ❖ Count increased leads to – Thrombocythemia
- ❖ Count decreased leads to – Thrombocytopenia

BLOOD CLOTTING

- When blood come out from the capillaries it will lose its liquid state and it changes into jelly like structure is called clotting of blood.
- First discovered by Schimidst 1892 and further explained by Morawitz
- During clotting the fibrin protein threads are formed .
- It stops the blood particles to come out
- All the clotting factors are present in blood plasma in inert stage. Once injury happens it will turn in to active phase
- There are 13 factors present
  1. Thrombokinase enzyme production : The injured blood platelets releases a lipoprotein
  2. Thromboplastin. Its added with some factors in blood and produces the enzyme Thromokinase
  3. With this the plasma protein prothrombin is converted into thrombin with the help of $CaCl_2$ ions.
  4. Vitamin K is essential for synthesis of prothrombin
  5. Then the soluble protein fibrinogen is converted into insoluble protein fibrin
- Normal time of blood clotting 5-8 minutes.

Haemophilia

- It is genetic disorder
- Due to chromosomal aberration in sex linked genes deficiency in blood clotting is happened results in continous flow of blood leads to death
- Its first identified to British royal family
- Discovered by John Kotta (1803)

Donar	Recipient
A	A, AB
B	B, AB
AB	AB
O	O, A, B, AB

Blood Group

- Discovered by Karl Landsteiner, 1900
- Discovered A, B, O groups
- AB group discovered by De-Castello and Sturli
- Dominant is O group

- ❖ Recessive is AB group
- ❖ Total number of blood group is 103 but nearly 14 blood groups are used in practice

Blood Transfusion methods :

Before blood transfusion the major consideration is the Antigen of RBC and antibodies of WBC

A group blood is not acceptable for B group persons. If its mixed there will be agglutinations leads to death.

1) **Universal donars** are 'O' group. No antigens present
2) So it can be transfused in to any type of blood.
3) **Universal acceptors** are AB group. No antibodies present
4) The anti coagulants used in blood donation
   - Sodium citrate salts
   - Aluminium oxalate salts
   - Pottassium oxalate salts
   - EDATA – Ethylene Di Amine Tetra Acetic Acid
5) It should be kept at 4° to - 6° C for long preservation
6) It's Ca ions removed by centrifugation immediately down the donated blood as it will not clot.
7) In Leechs they having a anticoagulant Hirudin in their salaivary glands, it prevents the clotting of blood
8) In human Heparin an anticoagulant is used to prevent clotting of blood inside blood capillaries.

Recipient

Donar	O Antibody a, b	A Antibody b	B Antibody a	AB Antibody Nil
O - antigen; nil	---	---	---	---
A - antigen a	+	---	+	---
B - antigen b	+	+	---	---
AB- antigen a,b	+	+	+	---

Functions of blood

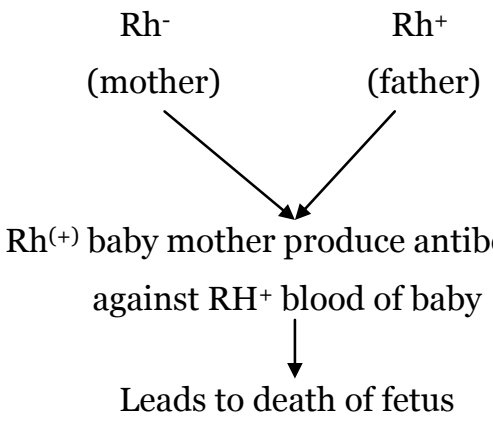
1. Maintains the body temperature
2. It transports O_2 throughout the body
3. Plasma transports glucose hormones, enzymes
4. WBC – protects from diseases.

Rhesus Factor

- Another types of blood variety Rh+, Rh -
- Discovered by Karl Landsteiner and Veiner 1940
- Rh+ → Rh antigen present
- Rh- → Rh antigen absent
- In world population 70 - 85 % are RH-
- Rh- type is acceptable for all
- First identified in Rhesus monkey
- So, before blood transfusion along with blood group determination the Rh factor test is also essential

Erythroblastosis Fetalis in Pregnant Mothers

- If blood of Rh+ person is transfused to Rh- person the first transfusion is safe and second is associated with baby.



- It anti – D – injection is given to mother after 1st birth already present anti bodies in mother blood are destroyed and IInd birth is safe.

BLOOD GROUP	ALLELES
O	I^o I^O
A	I^A I^A (or) I^A I^o
B	I^B I^B (or) I^B I^O
AB	I^A I^B

Blood group genetics

- ABO groups genetic sign is given as I
- I^A allele produces Antigen A
- I^B allele produces Antigen B;
- I^O doesn't produces any alleles
- So fair types of blood groups produces six types of all types.

Blood groups and Medicolegal cases

- According to parents blood group their childrens blood group is determined
- A particular type blood grouped parents can able to produces particular types only

Parents	possible	Not possible
O x O	O	A, B, AB
O x A	O, A	B, AB
O x B	O, B	A, AB
O x AB	A, B	O, AB
A x A	A, O	B, AB
A x B	A, B, AB, O	None
B x B	B, O	A, AB
A x AB	A, B, AB	O
B x AB	A, B, AB	O
AB x AB	A, B, AB	O

Glossary :

- ❖ Diapedesis - Squeezing out of WBC through the walls of capillaries
- ❖ Pus - It contains destroyed tissue + dead neutrophils + like micro organism
- ❖ Edema - Accumulation of interstitial fluid as water and some
- ❖ Proteins which leak from capillary in to tissues.
- ❖ Inflammation - serial changes in tissues (toxins, virus, bacteria)
- ❖ Oponius - Blood substance which stimulate WBC to attack on bacteria
- ❖ Vaccination - To develop acquired immunity against specific disease
- ❖ Hypoglycemia - Decrease Blood sugar level.
- ❖ Hyperglycemia - Increase Blood sugar level
- ❖ Hypovolemia - Increase blood area decrease volume of blood in body
- ❖ Hyper Volemia - Increase volume of blood in bodies
- ❖ Heamophilia - absence of blood clotting
- ❖ Uremia - increase blood urea level
- ❖ Haemostasis - process of checking bleeding
- ❖ Thrombus - Blood clot in blood vessel
- ❖ Clot - Semisolid jelly like appearance of blood
- ❖ Embolus - piece of intra vascular clot
- ❖ Haematuria - Blood in urine
- ❖ Haemoglobinaemia - Due to destruction of RBC haemoglobin is set free in blood plasma.

BLOOD CIRCULATION

Blood circulation means, blood is transported from one part of a body to another part of the body. The essentials are

1. Blood
2. Pumping organ - Heart
3. Vessels - Arteries, Veins, Capillaries

HEART

Willam Harvey

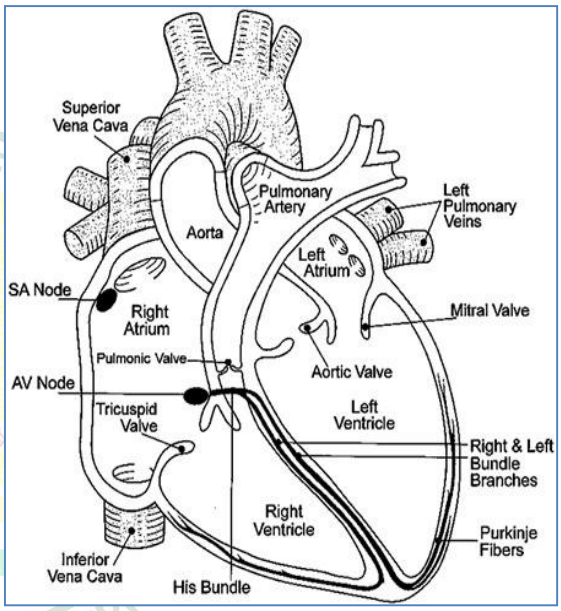
- Heart acts as pump
- Valves are present in veins (Valves were first reported by Fabricious)

- ❖ Heart is a hollow muscle – fibarous organ
- ❖ Conical (or) Pyrimidal in shape
- ❖ It has the size of a clenched fist
- ❖ Length 12 cm diameter 8-9 cm
- ❖ Weight is about 230 -280 gms
- ❖ It has four chambers
- ❖ It is situated in the mediastinum area
- ❖ It is protected by a double walled pericardial membrane

Pericerdium

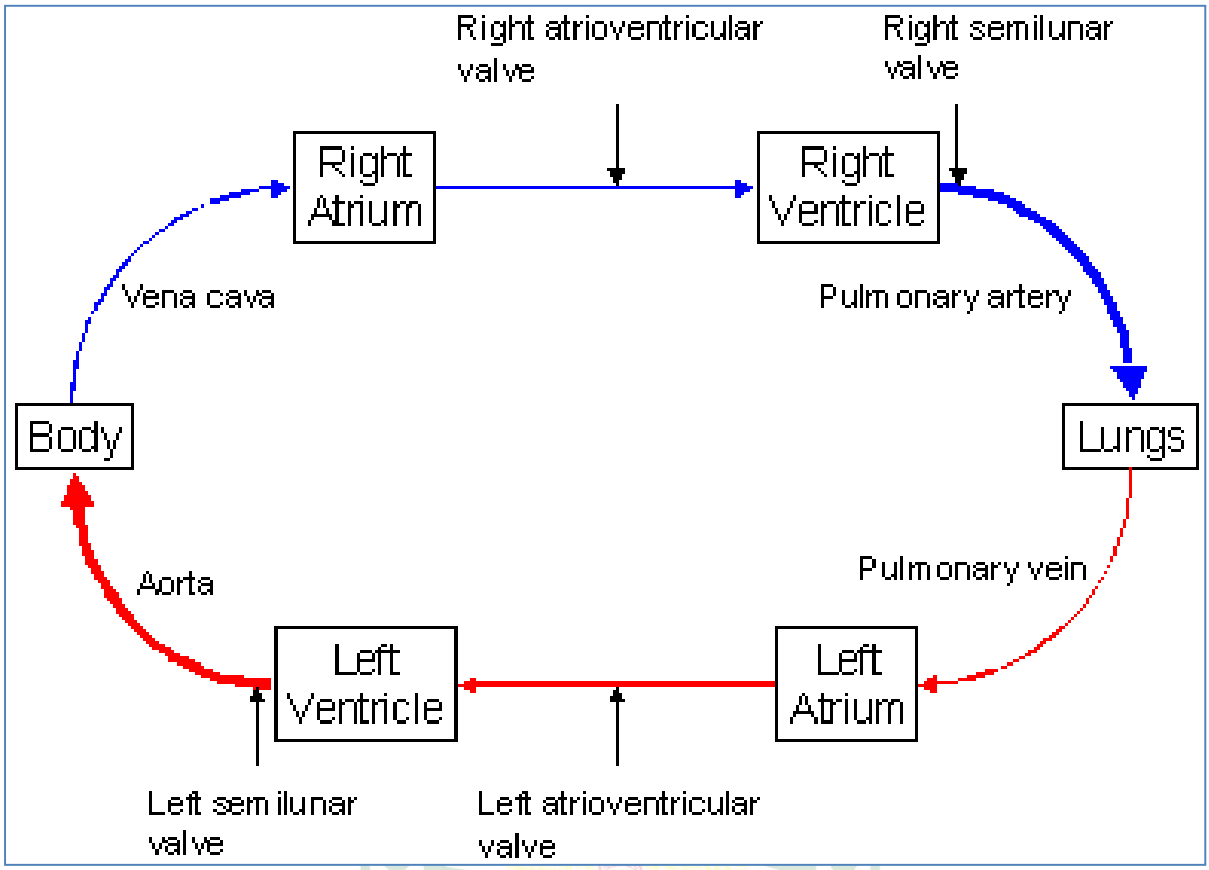
Outer layer	Middle	Inner layer
Fibrious P.C	Parietal	Cellular P.C

Pericardium



Heart wall is made up of 3 layers

- ❖ Epicardium – outer part
- ❖ Myocardium – middle part
  - – It is made up of muscle tissues
  - – It is important in heart functioning
- ❖ Endocardium – inner part



Double Circuit Circulation

In Mammals double circuit circulation is found. i.e. the blood flow in heart twice a time.

1) Pulmonary Circuit

- Right atrium → Right ventricle → pulmonary artery $\xrightarrow{O_2}$ lungs → Pulmonary vein → left atrium

2) Hepatic portal circuit

- Body part (spleen, pancrease, reproductive organs, intestine) veins → liver → inferior vena cara Right Atrium

Capillaries :

- Its made up of Elastin and collagen fibres
- Size 5-7 microns
- It connects arteries to veins
- It transports O_2, CO_2, food , water, ions, vitamins, hormones and Anti oxins

The blood circulation for the wall of blood vessels is conducted by vasa vasorum

ARTERY	VEIN
• Distributing vessel • Pink in colour • Deep in location • All arteries have pure (or) oxygenated blood except pulmonary artery • Blood flows with pressure • Wall is elastic 1.Ginduating vessels 2. Disperging vessels 3. Blocking vessels • 30-40 mircon in size • Non Collapsible • More muscular • Internal valves are absent • Smallest arteries divided and break into arteriole • Progressively divides and decrease in size • 3 distinct layers • Tunica externa • Tunica media (Thick) • Tunica interna	• Collecting Vessel • Red in colour • Superficial in location • All veins carry impure or deoxygenated blood except (pulmanory vein) • Blood flows with low pressure • Wall is no elastic • Due to this is store more blood. So the blood flows in low pressure also • 30 microns only • Collapsible • Less muscular • Internal valves are present (2mm above) • Smallest vein arises form venule • Progressively uniting and increasing in size • 3 distinct layers • Tunica externa • Tunica media (Thin) • Tunica interna

Valves	Situated at
1. Biauspid valve (or) mitral valve	– left auriculas ventricular opening
2. Tricuspid valve	– right auriculas ventricular opening
3. Semilunar valve	– at the opening of aorta from ventricle
4. Haversian valve	– end of opening of superior vena cava
5. Eustactian valve	– end of opening of inferior vena cava
6. Thebesian valve	– opening of coronary sinus

Circulation of blood

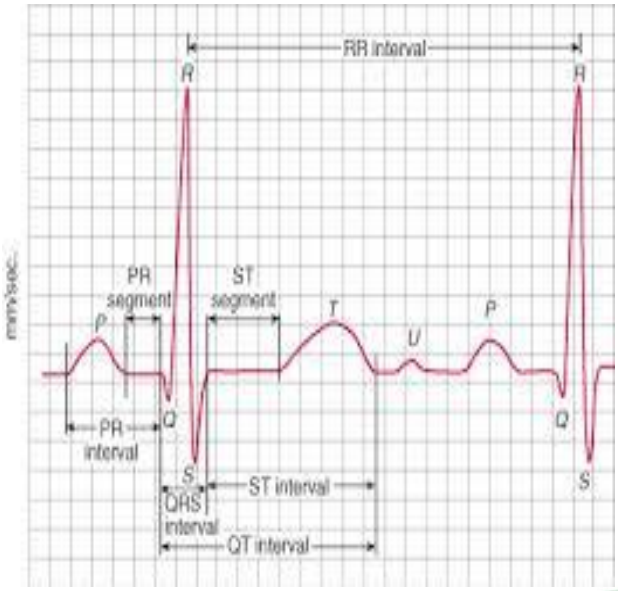
1) The impure blood of body is collected by inferior vena cava, superior vena cava and it is poured in to right atrium by coronary sinus (coronary sinus – collects impure blood from heart walls)
2) Its pours in to right ventricle by tricuspid valves
3) From here its departs through pulmonary artery to lungs after purification it starts by pulmonary veins and reach left atrium
4) By bicuspid valve it reaches left ventricle from here it starts from aorta in the supply to all over the body parts.

HEART INDUCTION AND SPREADING OF IMPULSE

- SA node/ Sino – auricular node / Pacemaker / Keith & Flock Node
- A patch of nodal tissue present in upper corner of right atrium 1.5 cm x 3 mm
- The another mass of tissue seen in the lower left corner of right atrium close to the atrio ventricular septum called atrio – ventricular node.
- The impulse passes from AV node to bundle of His and purkinje fibres
- The regular heart beat starts.

HEART BEAT

- Rhythmic contraction and relaxation of auricles & ventricles
- A single cardia cycle represented by a single heart beat
- It includes one systole and one diastole
- Heart beat in man = 72 per minute
- In children = 100 per minute



- In newborn baby = 120-140 per minute

Single cardiac cycle

Auricular systole - 0.1 min
Auricular diastole - 0.7 min } 0.8 min
Ventricular systole - 0.3 min
Ventricular diastole -0.5 min } 0.8 min

- Less number of heart beat than normal – Bradycardia
- More rate of heart beat than normal – Tachycardia

Rate of heart beat increases

1) Due to increased respiration
2) By hot drinks
3) Shock and tension
4) Fall in P^H value of blood
5) High blood pressure
6) Excess quantity of food intake

Rate of heart beat decreases:

1) Heart failure - When SA node does not initiate any impulse
2) Heart block - When Av node damage
3) Circulator arrest - blood flow completely stops
4) Arteriosclerosis - Excessive deposition of cholesterol with calcium salts.

Heart Sounds

- Sounds were produced in a regular series
- Heared by stethoscope inventer - by Rene Laennec

I sound : Its known as L.U.B.B prolonged time 0.16 - 0.9 se dull sound

- Created by closer of atrio ventricular valve at the time of ventricular systole

II sound : Its known as D-U-B-B
Short time 0. 10 sec

- High pitch sound
- Created by closer of semilunar valves at the time of ventricular diastole

Blood Pressure

Developed by flow of blood on the wall of blood vessel factors :

1) Amount of blood
2) Viscosity of blood
3) Flow of blood
4) Elasticity of blood vessel

- Measuring instrument : Sphygmomanometer (Karot koff 1905)
- It is measured at the point of branchial artery of fore arm
- Higher limit – systolic blood pressure / atrical contraction
- Lower limit – diastolic blood pressure/ ventricular contraction
- Normal B.P. of man = 120 (systolic) / 80 (diastolic) mm Hg

Factors influence the B.P

1. Thickening of arteries
2. During exercise
3. During Tension
4. During fear
5. By adrenal secretion
6. Increase of age
7. during nephritidis
8. hereditary condition
9. due to obesity

- Electrocardiogram E.C.G
- Invented by Einthoven 1906
- It is first recorded by waller 1907
- Its recorded activities of heart on paper
- P wave - due to activation of SA node
- PQ wave - Its interval representation when article contracts
- RS wave - Speed of impulse from AV node to bundle of His purkinje
- ST wave - interval period of ventricular ejection.

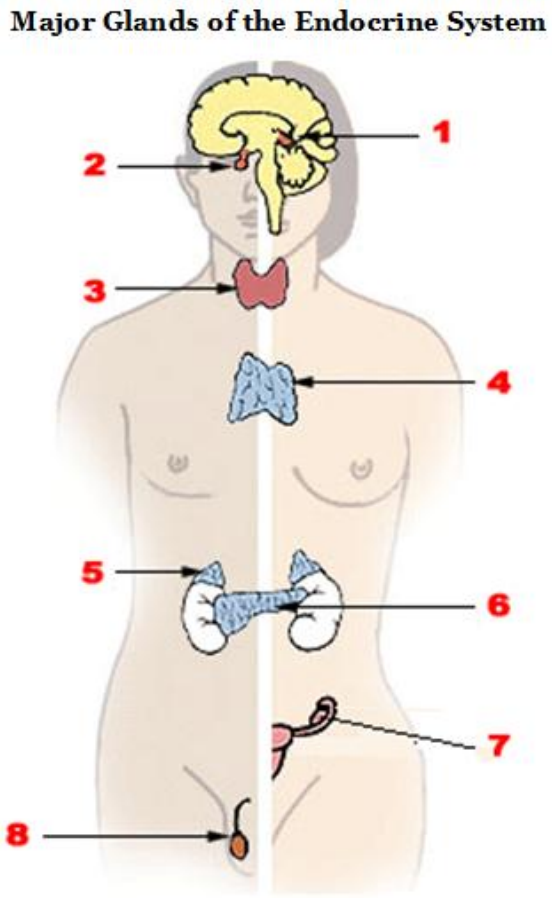
- P wave - 0.20 sec
- P-R interval - 0.25 sec
- QRS interval - 0.35 sec
- T wave - 0.20 sec

- First heart transplant operation : Dr. Christian Bernad
- First artificial heart operation : Dr. Alexis Koral

ENDOCRINE GLANDS

- Endocrinology – study of endocrine glands and their secretion
- Father of Endocrine Glands - T. Addision
- They secrets hormones / chemical messangers
- Name Hormones was given by E.H.Starling 1906
- Earliest known hormone is Insulin
- Insulin were extracted by Banting & Macbet in 1923
- Thyroxine identified by - E.C. Kondall 1914
- Molecular structure of Insulin given by Sanger in 1954 He was awarded Nobel prize
- Fernando Housie 1947 – described functions of pituitary

Endocrine glands are glands of the endocrine system that secrete their products, hormones directly into the blood rather than through a duct.



1. **Pineal gland**
2. **Pituitary gland**
3. **Thyroid gland**
4. **Thymes**
5. **Adrenal gland**
6. **Pancreas**
7. **Ovary (Female)**
8. **Testis (Male)**

Characters :

- Produced by many endocrine glands
- Pituitary, thyroid, kidney, pancreas, thymus, gonads. Pineal, placenta, intestine
- Hormones were secreted in to blood prior to use
- Hormones do not take in metabolic reaction
- Hormones are produced in low amount
- After finishing the particular work hormone secretion will stop by feedback mechanism
- Hormones are easily diffusible through cell membrane
- Soluble in water, have low molecular weight
- It balance the internal physiological functions.
- Hormones are destroyed after use
- Hormones are not stored in body
- Hormones are non antigenic so no antibody formation against them

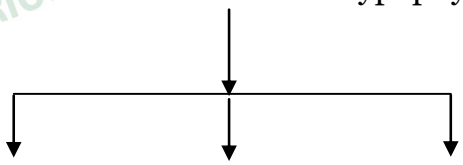
Chemical nature of Hormones

- Amino acid – Thyroxine, adrenaline, noradrenaline
- Amine (or) catecholamine – epinephrine, norepinephrine
- Steroid – adrenal cortex hormones
- Proteins, polypeptides – oxytoxin, vasopressin, relaxin, insulin
- Glycoprotein – FSH, CH & TSH
- Fats – Prostaglandin

PITIUITARY

- Hypophysis / master gland / Ring Master of the Orchestra
- Name was given by Vesalius
- It is found in hypophysis area of brain
- Made up of two lobes (Front & back)
- Both were joint by small funnel like infundibulum
- length 1 cm / breath - 1.5 cm/ weight 0.5 gm

1. Anterior lobe – Adenohypophysis



Pars distalis Pars tuberalis Pars intermedia

2. Posterior lobe - Neurohypophysis pars nervosa

- pars intermedia is also known as intermediate lobe
- Removal of pituitary : Hypo physectomy

ADENOHYPOPHYSIS:

1. STH / SOMATO TROPHIC HORMONE / GROWTH HORMONE

- STH
- Growth hormone
- It controls over all growth of body
- Its important for bone growth
- It retains the salts N, K, P, Na salts in body

Hyposecretion of STH (less secretion)

1. In childrens - dwarfism
2. In adults – Simmond's disease

Hypersecretion of STH (more secretion)

1. In children - Gigantism
2. In adults – Acromegaly

2. TSH / Thyroid stimulating hormone / Thyrotropin

- It act on thyroid glands
- Stimulate the functioning of Thyroid glands
- Also stimulate uptake of Iodine

3. ACTH / Adreno Cartico Tropic Hormone

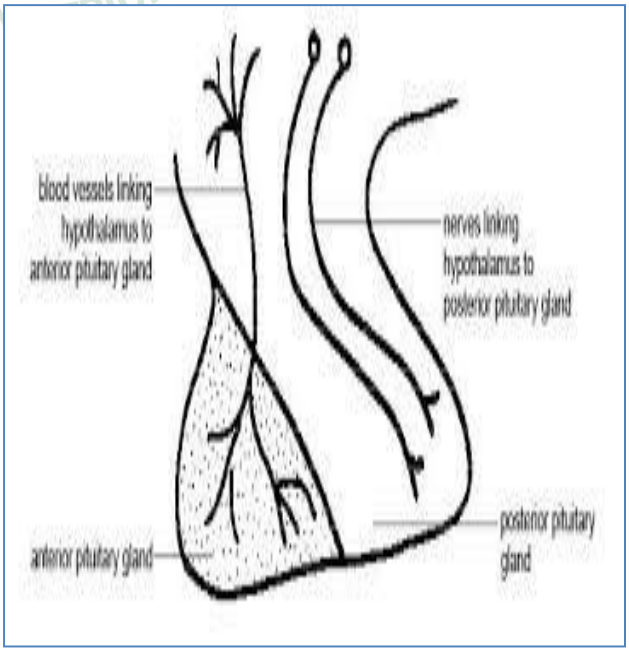
- Stimulate function of cortex of adrenal glands
- Stimulate melancocytes and change skin pigments
- It transports fats from adipose tissues

4. FSH / Follile Stimulating Hormone

- It is secreted both in male, female and stimulate the development of reproductive cells.

Males:

- It acts on testis and stimulates spermatogenesis
- For this it acts on epithelial cells of sperm tubules



Females

- ❖ It acts on ovaries
- ❖ Total weight of ovary increases
- ❖ It stimulates the grafian follicte cells for production of ovum cells.

5. LTH / Leuto trophic hormone / prolactin

- ❖ It influences growth of mammary glands and secretion of milk during pregnancy
- ❖ It acts on corpus lutum to secrete progesterone
- ❖ It joins with oestrogen for milk secretion

6. LT / Luteinizing hormone

- ❖ Its function is the relase of ovum from ovaries
- ❖ When the ovum is transferred to uterus. The empty gradtian follicle become corpus luteum

7. ICSH / Interstitial cells stimulating hormone

- ❖ In males it stimulates the interstitical cells in testis for the secretion of testosterone.

NEURO HYPOPHYOSIS

1. Oxytocin / pitocin

- ❖ It stimulactes the contraction of smooth muscle of uterus and makes the parturition (quick birth of young one)
- ❖ It stimulates the flow of milk by contraction of myoepithelial cells of mammary glands.

2. Vasopressin / ADH – Anti Diuretic hormone / Pitressin

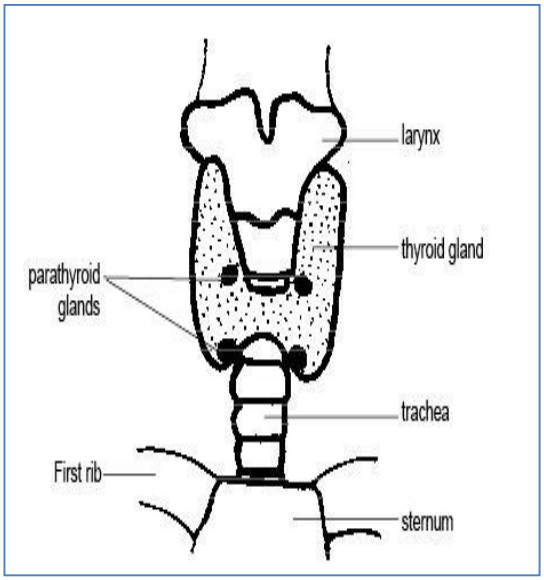
- ❖ It influence water balance by reducing output of urine by this the essential minerals are retained
- ❖ It controls blood pressure
- ❖ It store the Urea
- ❖ Less secretion leads to Diabetes insipidus

Symoptoms :

- ❖ polyurea - more urination
- ❖ polydipsia - more water drinking
- ❖ polyphagia - more food intake

THYROID:

- ❖ It is the largest endocrine gland and situated in neck region
- ❖ It has 2 lobes
- ❖ Present of ventral side of trachea
- ❖ Both the lobes of thyroid are connected by a sheath of connective tissue known as isthmus



- ❖ Thyroxine first isolated by : Kocher
- ❖ Crystal of thyroxine were 1st prepared by : Kendall
- ❖ Molecular structure given by : Harrington

Function of Thyroid

- ❖ It is important for development of nervous system in foetus and after birth upto one year in childrens.
- ❖ It control BMR (Basal Metabolic Rate)
- ❖ It reduces cholesterol level in blood.
- ❖ It stimulates metamorphosis
- ❖ It indirectly controls the body growth, so it is also known as manly hormone.

HYPOTHYROIDISM:

1) Simple Goitre / Endemic goitre

- Thyroid gland increases in size.

2) Cretinism

- Hyposecretion in children results Cretinism.
- Sex organ retard / low IQ / deformed bones.

3) Myxoedema / Gull's Disease

- Body weight increase , low pulse rate
- Skin becomes puffy, become dry, patient feel cold

Hyperthyroidism

- ❖ In childhood early sexual maturity takes place.
- ❖ In adult may result Graves disease
- ❖ Treatment is only surgey of gland

Parathyroid Gland

- ❖ Two pairs embedded in thyroid lobes.
- ❖ Colour : purple/ elongated in shape
- ❖ This hormone studied and discovered by - Collip

- ❖ Structure given by - Sandstrom
- ❖ Molecular strucutre by - Pot
- ❖ Crystals by - Craig
- ❖ It secretes two hormones.

1) Parathormone

- ❖ It works for small duration only.
- ❖ Its half life period is 20-30 minutes only
- ❖ It works on three parts.
- ❖ Bones → It gives new structure
- ❖ Kidneys → It regulartes P^H
- ❖ Intestine → It helps in Vitamin D synthesis

2) Calcitonin

- ❖ Lower the level of calcium in blood.
- ❖ It secretes HCL in stomach
- ❖ It is antagonistic to Parathormone.

ADRENAL GLAND

- ❖ It is also known as emergency gland
- ❖ Also know as suprarenal gland
- ❖ It is situated at the top of the kidney
- ❖ It was discovered by : Eustachian
- ❖ It divided 2 distinct region
- ❖ Cortex : 80% / Medulla - 20%
- ❖ Cortex is divided in to 3 parts

1. Zona glomerulosa - Outer - mineralo corticoid Hormone
2. Zona fasciculata - Middle - Gluco corticoid Hormone
3. Zona Reticulata - Inner - Sex Hormones

- ❖ Medulla has two hormones

1. Adrenaline (or) Epinephrine - 80%
2. Nor adrenaline (or) Nor Epinephrine - 20%

Adrenaline / Emergency Hormones:

3F Hormone	4S Hormone
F- Fear	S- Sugar Metabolism
F- Fight	S - Salt Retaining
F- Flight	S- Sex Hormone
	S- Source of Energy

- ❖ It increases flow of blood.
- ❖ It contracts arrector pili muscle.
- ❖ It increases respiration and increase the sharpness of brain.
- ❖ It increases heart beat rate.
- ❖ It increase blood glucose level

Noradrenaline:

- ❖ It raises blood pressure
- ❖ It is antagonistic to adrenaline

GONADS

Testis

- ❖ It has epithelial cells called leydig cells which produce reproductive cells.
- ❖ Leydig cells act as endocrine glands.
- ❖ It secretes Androgens and important is testosterone

TESTTOSTERONE

Functions :

- ❖ It is responsible for proper development of secondary sexual characters in male. e.g : deep voice
- ❖ Enlargement of genital organs.
- ❖ Appearance of beard
- ❖ Growth and function of epididymis and vas deferens, prostate gland, seminal vesicle and penis

Ovary :

- ❖ A pair of round structures present in lower abdomen
- ❖ It has three secretions

1) Estrogens / Oestrogens

- ❖ It is secreted by graffian follicle, induced by FSH
- ❖ Estrogen is responsible for development of secondary sexual characters in female.
- ❖ Thin voice, complete development of ovary, oviduct, mammary gland, uterus and vagina.

2) Progestrone

- ❖ It is a hormone produced by corpus luteum
- ❖ It also decrases level of FSH so maturation of new ovum and follicle is checked.
- ❖ It prepare the endometrium for implantation of the embryo or foetus.
- ❖ It helps in implantation with the wall of uterus.
- ❖ It maintain pregnancy so known as pregnancy hormone
- ❖ It stimulate the growth of breast and mammary gland during pregnancy
- ❖ It suppress the contraction of uterine muscle during pregnancy

- ❖ It is also called anti abortion hormone.

3) Relaxin

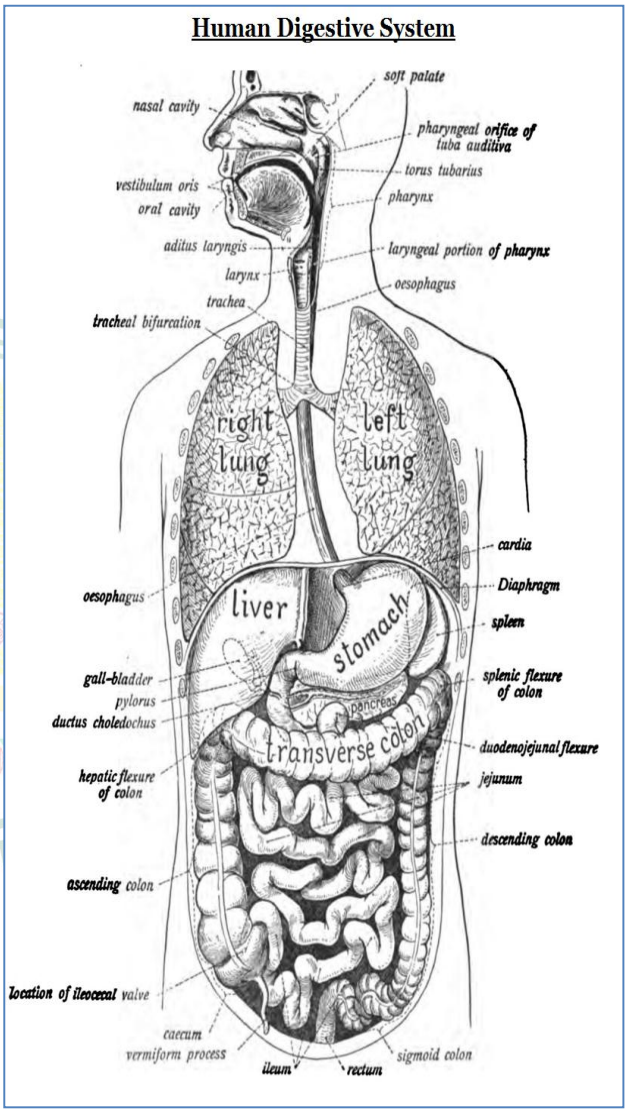
- ❖ It secreted by corpus luteum of pregnant woman
- ❖ Which relax the pubis symphyisis and pelvic girdle to make the child birth easy.

Digestive System

- The human digestive system consists of the gastrointestinal tract plus the accessory organs of digestion (the tongue, salivary glands, pancreas, liver and gall blader).
- In this system, the proless of digestion has many stages the first of which starts in the mouth (oral cavity)

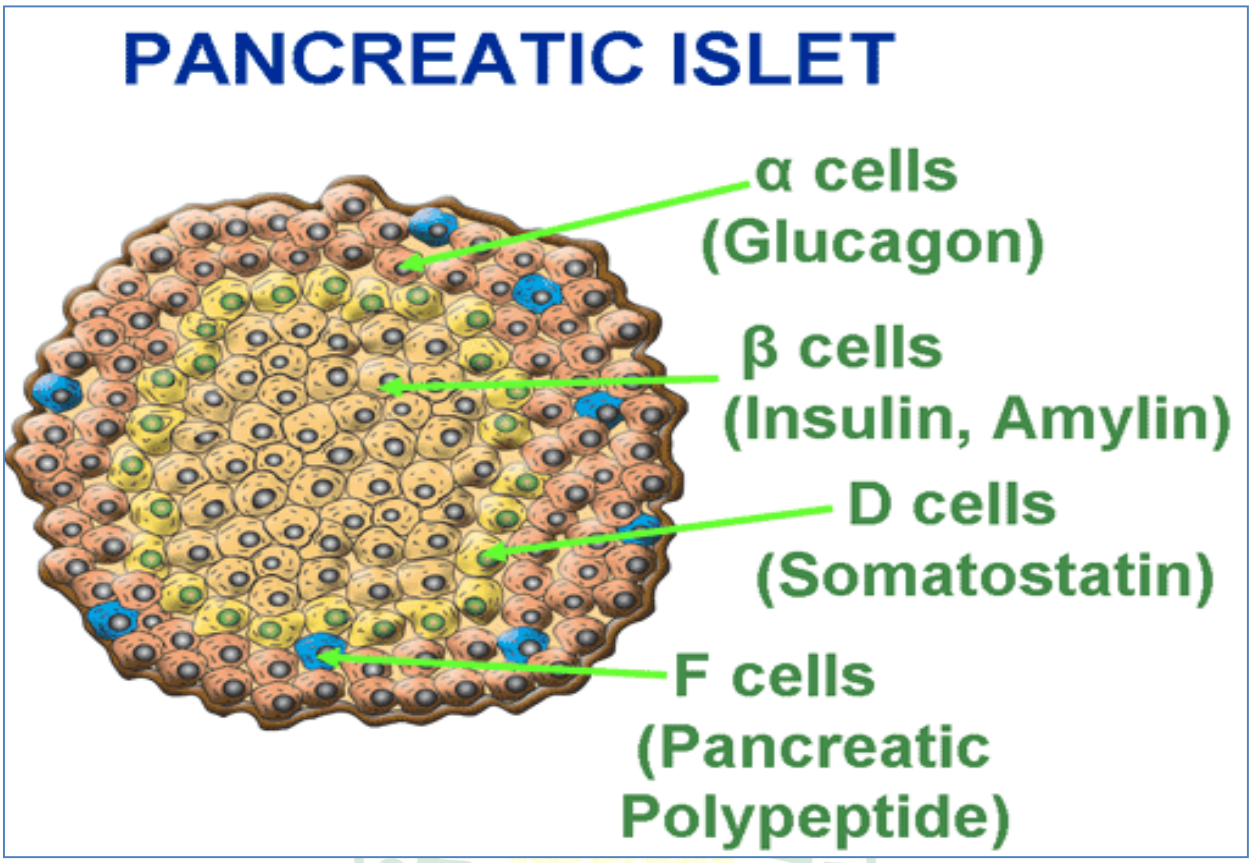
Thymus

- ❖ It is endocrine gland nearest to the heart
- ❖ It is partly endocrine and partly lymphoid
- ❖ It play important role in immunity
- ❖ It produces thymine
- ❖ Hassell's corpuscles are found in thymus and also know as Thymic cells.
- ❖ It play important role in formation of Antibodies in embryo and infants.
- ❖ T – cells or T- Lymphocyte cells are produced in Thymus.



Digestive Glands

- Salivary glands
- Gastric glands
- Liver
- Pancreas
- Intestinal glands



1. Starch into sugar.
2. Gastric acts on the gastric glands and stimulates the secretion of HCL and Pepsinogen.
3. It secrets bile juice that is stored in a sac called the gallbladder.
4. Pancreas: Exocrine portion secretes an alkaline Pancreatic juice containing enzymes. Endocrine portion secretes Hormones, Insulin, Glucogon.

Pineal body

- ❖ It atrophies in man at the age of 7 years.
- ❖ Pineal secretes a Hormone called Melatonin
- ❖ Pineal body found in brain
- ❖ Pineal body represent vestige of 3rd eye in man.
- ❖ It regulates sleep and wakefulness.
- ❖ Melatonin also influences Metabolism, Pigmentation, the menstrual cycle as well as our defence capability.

Pancreas

- ❖ Pancreas is a mixed type of gland in which pancreatic acini are

exocrine and islets of Langerhans is endocrine

- Pancera are three endocrine
- α cells - larger - peripheral cell produce glucagon
- β cells - central and smaller cell - produce insulin
- γ or δ cells - Middle - produce somatostatin

Insulin

- Glucose - Glycogen
- It stimulates glycogenolysis
- It oxidises glucose more in tissues
- It converts glucose in to fatty acids and stores in tissues

Glucagon

- It is antagonistic to insulin increase blood sugar level in blood stream.
- It stimulates glycogenolysis
- Glycogen - glucose
- It makes glucose from the non carbohydrate materials of the body.
- In kidneys it increases the filtration of glucose

Insulin Deficiency

- The glucose level in blood increased and it is excreted through urine.
- This conditions is known as Diabetes mellitus

Glucose level

- Fasting - 70- 110 mg / decilitre
- Normal - 80 - 120 mg / decilitre
- Excess - 140 - 150 mg / decilitre
- Abnormal - 300 - 400 mg / decilitre

Diabetes

Type I		Type II
Genetic cause	-	body produces
Unable to produce insulin	-	insulin but unable to use it effectively
Less found	-	more common

REPRODUCTIVE SYSTEM

❖ Reproduction is means one organism produces its phylogeny that is its off springs. It takes place in two modes.

Reproduction

A sexual Reproduction	sexual Reproduction
Takes place in body cells	Takes place in Reproductive cells
It is done by a mitosis or mitosis methods	meiosis tooks places first and after fertilization mitosis will occur.
1. Binary fission – Bacteria	1.Conjugation - hereditary exchange
2. Multiple fission –amoeba	2.Cytogamy - cytoplasimic fussion of two cells
3.Budding - coelenterates	3.Karyogamy - Nucleus fusion of two cells.
4.Gemmules – sea sponges	4. Automixis - Fusion of germ cells
5.regeneration – echinodermates	5. Syngamy - Fusion of maleacne female cells.

Mode of Asexual reproduction	Organism
Fission	Amoeba, bacteria, flatworm
Budding	Hydra, Yeast and Sponge
Syngamy	Cockroach, Frog and human being

* Autogamy
* Excogamy
* Hologamy
* Pedogamy
* Mesogamy
* Isogamy
* Anisogamy
* Macrogamy
* Microgamy

Sexual Reproduction:

- It is a important process of nature.
- Due to this healthier new generations will be produced.
- For this process the organisms maintain several provisions
- By this structural, physiological and anatomical changes have been evolved
- In humans internal and external genital organs were neatly coordinated. And also simple in functioning
- The functions are depending upon mental stress and hormonal factors
- The study of the fundamentals of sex education is very essential to eliminate misbehaviours in society
- Gynaecology - study of reproductive organs
- A.V. Leeuwen hoek - Discovered male sperm cells
- Carl Von Bohar - Discovered female ovary cells
- Bouveri - coined the term oocyte
- Bateson - coined the term zygote
- Danielli - developed cell in test tube
- Ronald Edward - first test tube baby
- Robert Burrchutti - invented viagra / awarded nobel prize

Viviparous - Most mammals:

- The embryo is developed inside female body and it is comes out as a new one.

Gestation Periods of Some Animals	
Animal	**Gestation Period**
Buffalo	310 days
Elephant	610 days
Lion	120 days
Whale	365 days
Horse	340 days
Leopard	105 days
Tiger	103 days
Squirrel	40 days

Oviparous – Reptiles, Birds

- The fertilized egg is covered with calcium layer and it is kept in a secure place outside of the body.
- It is hatched till the new one come out from the egg.

Types of Eggs :

1. **Depending on egg yolk**:
   - A lecithal - yolk less egg - human
   - Micro lecithal - less amount of yolk - acidian
   - Meso lecithal - exact amount of yolk - frog
   - Mega lecithal - more amount of yolk- reptiles, birds.

Distribution of Egg Yolk :

- Homo lecithal - equally distributed - ascaris
- Telo lecithal - present in one sided - frog
- Meso lecithal - present in corner (denser) - reptiles, birds
- Centro lecithal - present at centre - insects

MALE REPRODUCTIVE ORGANS

Vas deferens or ductus deferens

- It emerges from the tail end of the epididymis and ascends along the posterior side of the testis.
- It becomes associated with the blood vessels and nerves that supply the testis.
- Collectively these structures constitute the **spermatic cord**. Thus the spermatic cord consists of
- Vas deferens
- testicular artery and venus plexus
- lymph vessels
- nerves
- fibrous processes and muscles.
- This cord enters into the pelvic region. The end of the vas deferns enlarges to form the **ampulla**.
- At this region the vas deferens is surrounded by smooth muscles capable of peristaltic contraction. They help to propel the sperm cells through the ductus deferens.

Ejaculatory Duct :

- Nearer to the ampulla of each vas deferens there is a sac like **seminal vesicles**. It joins the ductus deferens to form the ejaculatory duct.
- These ducts are about 2.5 cm long. They project into the prostate gland and end by opening into the urethra.

Urethra :

- The male urethra extends from the urinary bladder to the distal end of the penis.

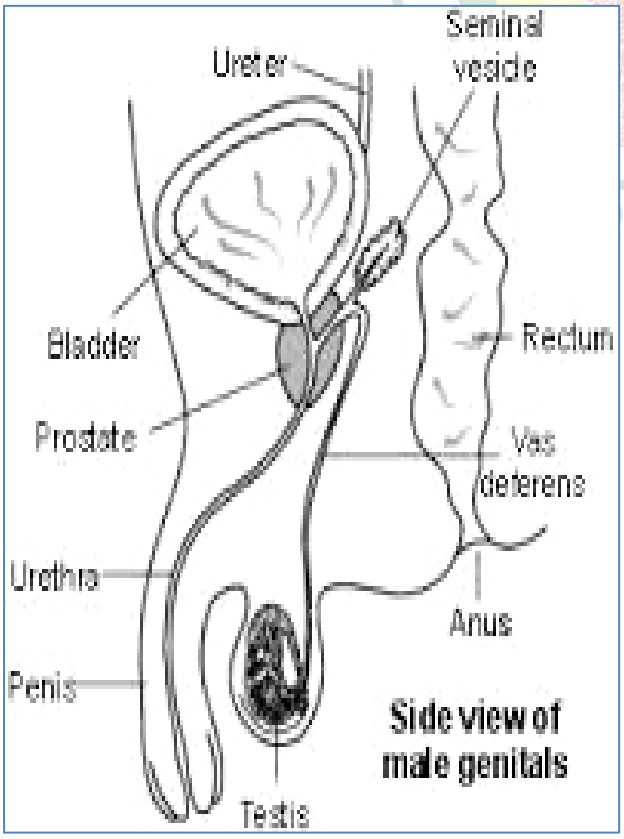
- It is about 20 cm long. It is a passage way for both urine and reproductive fluids.
- The urethra is divided into three parts.
- They are

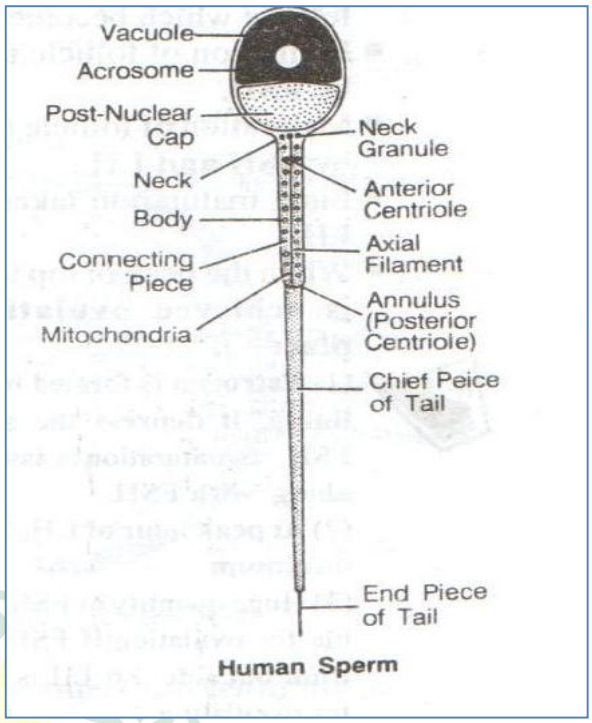
1. The Prostatic Urethra :

- It is closest to the bladder and passes through the prostate gland

2. The membranous urethra

- It is the shortest part of the urethra and it extends from the prostatic urethra.



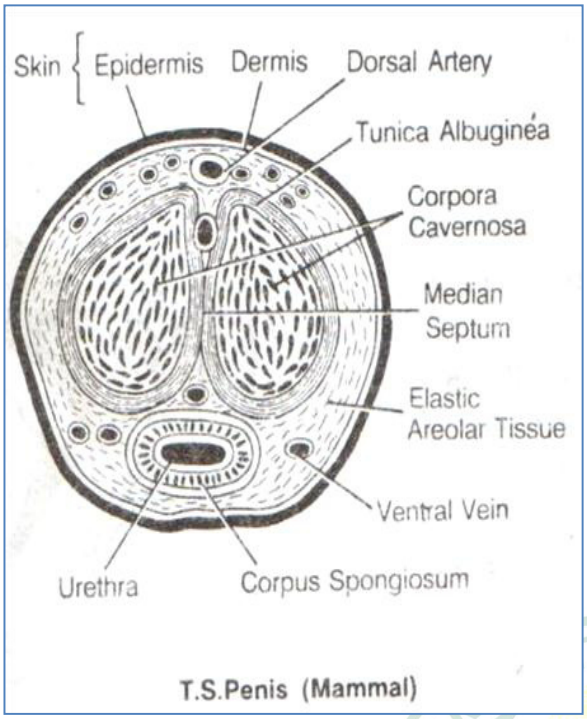


3. The spongy urethra or penile urethra –

- It is the longest part of the urethra. It extends from the membranous urethra, through the length of the penis. There are several minute mucus secreting urethral glands opening into the urethral passage.

Penis :

- It is the male copulatory organ.
- It consists of two parts namely **the radix** or **root** and **the corpus** or **body**.
- The radix attaches the penis to the lower abdomen.



T.S.Penis (Mammal)

- The corpus is normally pendulous. It is covered by a loose skin.
- The corpus of the penis consists of three masses of erectile tissue.
- Flooding these tissues with blood causes the penis to enlarge and become firm.
- These tissues are the right and left **corpora cavernosa** and the median **corpus spongiosum penis**.
- Most of the corpus is formed of the corpora cavernosa.
- The corpus spongiosum penis surrounds the urethra and near the end of the penis it expands into a conical, **glans penis**.
- Its swollen base is the **corona glandis**.
- The skin over the penis is thin. It is loosely connected to the **tunica albuginea**.
- At the tip of the penis it is folded to form the **prepuce** or the **foreskin**.
- It overlaps the glans penis. The corona glandis and penile neck have numerous **preputial glands**.

Seminal vesicles :

- These are two sac-like structures located between the bladder and rectum.
- Each vesicle is about 5 cm long. Their secretions contribute about 70% of the seminal fluid.

Prostate :

- It is a firm structure. It is partly glandular and partly fibromuscular.
- It is found around the beginning of the male urethra. It is about 3 cm in diameter. It weighs about 8g.
- The muscular part of the prostate may help in dilating the urethra to hold the seminal fluid (3-5ml)

during the period of sexual excitement prior to ejaculation.

- After the middle age the prostate often enlarges. It may project into the bladder and interrupt urination.

Bulbo-urethral gland :

- These are two glands. They are small round masses about 1 cm in diameter.
- They lie lateral to the membranous urethra.
- Its secretion may control genito-urinary diseases.

Scrotum :

- It is a fibromuscular sac. It contains the testes and their associated ducts.
- It is divided into right and left by cutaneous raphe. Its left side is usually lower.
- The external appearence varies according to age and body temperature.
- The scrotal skin is thin and pigmented. It has numerous sweat glands and nerve endings.

FEMALE REPRODUCTIVE ORGANS

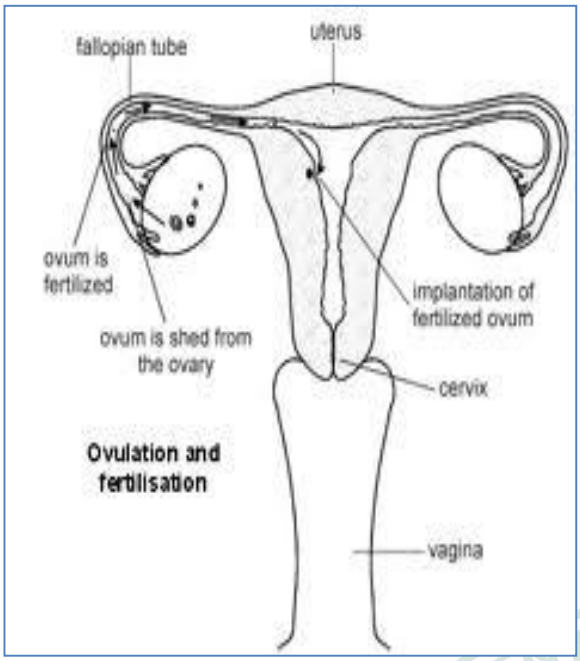
- In human female the internal reproductive organs are the **ovaries**, **uterus**, **uterine tubes** and **vagina**. Externally the organs are the **mons pubis**, **labia majora** and **labia minora**, **clitoris** and **vestibular glands**.

Ovaries :

- These are paired structures.
- The two ovaries are placed on each side of the uterus in the pelvic region.
- They are greyish pink in colour.
- Each ovary is almond shaped. They are about 3cm long,1.5cm wide and 1cm thick.
- The ovary is attached to the posterior surface of the inner body wall by a membranous fold called the mesovarium.
- The ovary is further supported by suspensory and ovarian ligaments.

Ovarian structure :

- In young female the surface of the ovary is covered by a layer of **ovarian surface epithelium**.



- It consists of a single layer of cuboidal cells. Beneath the epithelium the ovary is surrounded by a tough coat named **tunica albuginea**.
- It is made of collagenous tissue.
- The ovary proper is divisible into two regions, namely the **cortex** and the **medulla**.
- The cortex region contains the ovarian follicles.
- The medulla is interior. It receives blood vessels and nerves at the hilum.
- After puberty **the cortex** forms the major part of the ovary.
- It contains **ovarian follicles** and **corpora lutea** of various sizes.
- Their size depends on the stage of menstrual cycle or age. The cortex is filled with stroma composed of collagen.
- The follicles are embedded in the stroma.

Ovarian follicles

- The formation of the female gamete has many different phases and it is complex.
- At birth, the primordial follicles are found in the superficial zone of the cortex. They contain primary oocytes (about 25mm in diameter).
- Each one of them is surrounded by a single layer of flat follicular cells.
- The follicles undergo changes as the female attains puberty.
- The various follicular stages are:

1. **Primary follicle** :

- The follicle cells are converted from squamous to cuboidal cells.
- The follicular membrane or **membrana granulosa** becomes multilayered.

- The oocyte increases in size. It has an outer thick layer called the **zona pellucida**.
- The follicular cells divide and form **granulosa cells**.

2. Secondary follicle :

- It is about 20µm thick. The granulosa cells surround the oocyte and form a mound of cells called the **cumulus ovaricus**.
- The inner and outer theca become prominent. The **theca interna** is well established.

3. Tertiary follicle :

- Only one follicle reaches the tertiary stage.
- It increases in size (2mm diameter).
- Now it is called the **graffian follicle**.
- The oocyte and ring of cells surrounding the oocyte (corona radiata) break away and float freely in the follicular fluid.
- Finally the wall of the follicle ruptures and the contents are released into the peritoneum.

- The ovary of the foetus at 5 months gestation has 7 million oocytes.
- At birth the ovary of the child contains about 1 million oocytes.
- Due to further degeneration at the time of puberty only about 40,000 oocytes remain.
- Of the 40,000 oocytes only about 400 undergo ovulation during the reproductive years.

Corpus luteum :

- It is formed after ovulation.
- The walls of the empty follicle collapses and fold extensively.
- The granulosa cells of the theca externa get enlarged.
- They are now termed as **luteal cells**. They secrete hormones.
- I pregnancy the corpus luteum persists.
- Otherwise, it degenerates after 10-12 days.
- The connective tissue cells get enlarged.
- It becomes white in colour and is now called as the **corpus albicans**.
- In course of time it shrinks and disappears.

Uterine tubes (Fallopian tubes) :

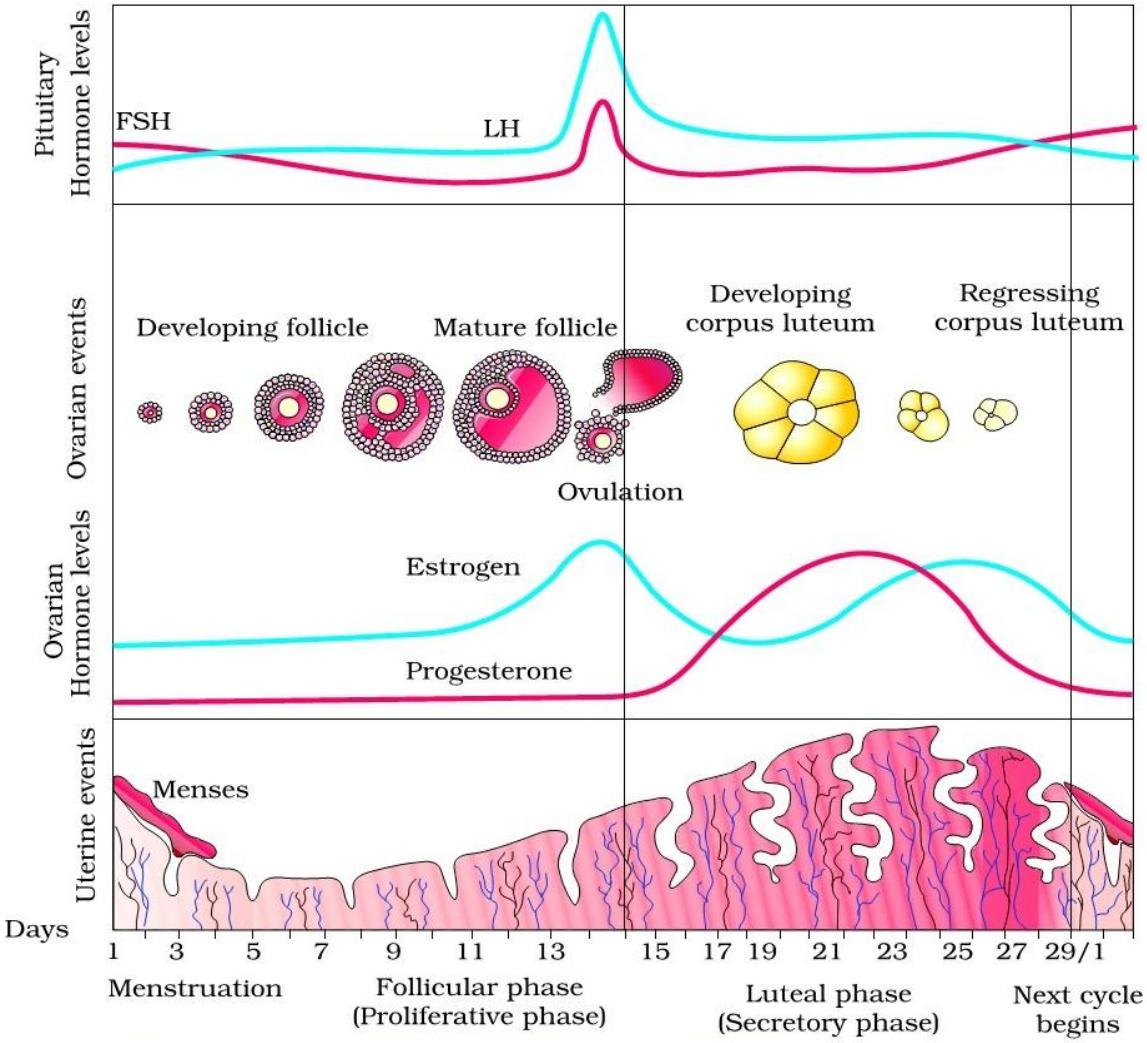
- There are two uterine tubes or **oviducts,** one on each side of the uterus.
- Each one is associated with a ovary.
- Each tube is about 10 cm length.
- The terminal part of the tube is enlarged to form the infundibulum.
- It opens into the peritoneal cavity.
- The opening is called the **ostium**.
- The uterine tube consists of three parts. The part nearer to the infundibulum is called the **ampulla**.
- It is the longest part. That part of the tube nearer to the uterus is called the **isthmus**.
- It is narrow. The tubular part entering into the uterus is called the **uterine** or intramural part.

Uterus

- It is a hollow thick walled muscular organ.
- It is pear shaped. It is about 7.5cm long and 5 cm wide. It weighs about 50g.
- During pregnancy its weight may go upto 1kg.
- Its larger rounded part is called as the **fundus**.
- The narrower part is called as the **cervix**. The cervix is directed inferiorly.
- The middle part is the **body**.
- The uterus continues as the **cervical canal** and opens into the vagina through a opening called the **ostium**.
- The wall of the uterus is three layered.
- The outermost layer is the **perimetrium** or **serous layer**.
- The major part of the wall is made up of the next layer called the **myometrium** or **muscular coat**.
- The innermost layer is the **endometrium** or **mucus membrane**.
- The endometrium is a functional layer.
- It undergoes menstrual changes and sloughing during female sex cycle.

Vagina :

- It is the female copulatory organ.
- It is a fibromuscular tube. It is about 10 cm long.
- It extends from the uterus to the outside.
- The vaginal passage is used during intercourse and it allows menstrual flow and child birth.



Diagrammatic presentation of various events during a menstrual cycle

External Genitalia

Vestibule :

- The external female genitalia is known as the **vulva** or **pudendum**.
- It consists of the vestibule and its surrounding structures.
- The vestibular region remains in between the two **labia majora**.
- It contains the vaginal opening and the **urethral opening**.
- The vestibular region is surrounded by the **mons pubis** anteriorly and **labia majora** and **labia minora** on the lateral sides.

Mons pubis :

- It is a rounded eminence situated anteriorly.
- It is made up of subcutaneous adipose connective tissue.
- It is covered by coarse hair at the time of puberty.

- It corresponds to similar structure in the male.

Labia majora :

- These are two longitudinal folds of skin.
- They form the outer boundary for the vestibule.

Labia minora :

- These two small skinfolds lie between the labia majora.
- They remain nearer to the vaginal opening.

Clitoris :

- It is homologus with male penis. It is an erectile structure.
- It is found in the anterior margin of the vestibule.
- It is a sensitive region having sensory receptors.

Hymen vaginae :

- It is a thin mucus membrane.
- It is found within the vaginal orifice or opening.
- If the membrane completely closes the vaginal opening, it should be removed to allow menstrual flow.
- In young women the hymen may normally get torn during physical exercise.
- In some women it may be absent. It has no established function.

External urethral opening :

- This opening is about 2.5 cm below the clitoris.
- It is anterior to the vaginal opening. It remains as a small cleft.

GENETICS

- Branch of science deals with heredity
- Heredity means transmission of characters from parents to offsprings
- Father of genetics G.J. Mendel
- Birth 1822 Chekoslovakia – Heidendendraft – sisilian
- Work as a Teacher in Imperial royal school
- He did his research in brunne for 9 years (1856 -1865
- Book experiments on plant hybridization
- He used Pisum Sativum plant for his research
- Pisum Sativum is called as garden peas

Mendel work was rediscovered by three biologists

1. Huge de vries
2. Carl correns
3. Erich Von Tschermak

Reason for using Pisum Sativum :

- Self pollinating flowers of peculiar structure
- Short growth and short life style
- Easy for artificial cross pollination
- Had contrasting heritable characters
- Various available varieties
- In 34 characters he made research in 7 characters

Character	Dominant	Recessive
Length	Long	Short
Flower position	Axial	Terminal
Pod Shape	Inflated	Constricted
Pod colour	Green	Yellow
Seed shape	Round	Wrinkled
Seed coat colour	Grey	White
Colour of cotyledon	Yellow	Green

F1 First filial Generation :

- ❖ The Resultant hybrids of parent generation by cross fertilization

F2 Second filial Generation :

- F1 progeny is allowed to self fertilize among themselves, they produce F2

Result

Monohybrid cross	phenotyphic ratio	-	3 : 1
	Geno typhic ratio	-	1 : 2 : 1
	Test cross ratio	-	1 : 1
Dihybrid cross	phenotyphic ratio;	-	9 : 3 : 3 : 1
	Test cross ratio	-	1 : 1 : 1 : 1

Monohybrid cross phenotyphic ratio

180 cm height long — 45 cm height short

Cross fertilization

F1 progeny - expressed (all are long) - dominant T

Suppressed - recessive t

Self pollination

F1 + F1

F2 1064

787 off springs long — 277 off springs short

3 : 1

Male

Female	Gamete	T	t
	T	TT	Tt
	t	Tt	tt

- ❖ Punnet has made square for proving Mendel ‘s results.
- ❖ It is called Chequered square

Mendel's laws:

1. Mono Hybrid cross

- ❖ Law of dominance
- ❖ Law of segregation (or) Law of purity of gametes

2. Di Hybrid cross

- ❖ Law of independant assortment (or) law of random assortment
- ❖ Mendel's laws were introduce to the world by the followers 1900
- ❖ Holland – Hugo de vries - oenothera lamarckiana
- ❖ Germany – Carl correns - Xenia, peas, majze
- ❖ Austria – Von Tschermark - flowering plants
- ❖ From this genetics is accepted as a new branch.
- ❖ It is a younger branch in science.
- ❖ 21st century is called as gene century

Jumping Genes

- Found by Barbara McClintock
- Working on Maize, presence of movable genetic elements which could detach from one site and move to new positions in either the same or different chromosomes.
- These elements called as transposable elements, transposons insertion, elements or jumping genes.

Glossary :

1. Genes - Factors controlling a single character.
2. Phenotype - expression of a character
3. Gene type - the genes are controlling a character.
4. Allele - each of two or more alternative forms of a gene (T, t)
5. Allelomorph - character having different phonotype
6. Homozygous - having identical alleles at corresponding chromosomal loci (TT, tt)
7. Heterozygous - having dissimilar alleles at corresponding chromosomal loci (T t)
8. Dominant - expressed character in F1
9. Recessive - suppressed character in F1
10. Hybrid - a composite of mixed origin

11. Emasculation - neutering a male animal by removing the testicles
12. Back Cross - mate a hybrid of the first generation with one of its parents
13. Test Cross - a cross between an organism whose genotype for a certain trait is unknown and an organism that is homozygous recessive for that trait so the unknown genotype can be determined from that of the offspring.

Gene Therapy

- Gene therapy involves the replacement of corrective genes in place of defective genes in human.
- Types
  - Somatic cell gene therapy
  - Germ line cell gene theraphy
- Both may be employed for treating the inherited diseases

Human Chromosomes

- Male xy
- Female xx

23 pairs pedigree analysis

Genetic Engineering

- The technology of preparing recombinant DNA in vitro by cutting up DNA molecules and splicing together fragments from more than one organism.

Applications of Genetic Engineering in Biotechnology :

- The basic principle of genetic engineering is gene transfer, achieved by various methods to produce recombinant proteins, genetically modified microorganisms, transgenic plants and transgenic animals for commercial application.
- Genetic engineering, thus ultimately influences the growth of biotech industry.
- The two significant feature of genetic engineering is production of beneficial proteins and enzymes in surplus quantities and creation of transgenic plants, transgenic animals and genetically modified microorganisms with new characters beneficial for themselves using recombinant DNA technology.

- The discovery of a new protein either with a therapeutic property or application in food industry by a researcher or scientist would not have reached humans, for the use by humans without the application of genetic engineering in mass producing such proteins.

Restriction Enzymes

- Restriction enzymes or to use their correct name, restriction endonucleases, are a type of enzyme which have the ability to cut molecules of DNA.
- They are often referred to as genetic scissors.
- The restriction enzyme recognises a unique sequence of nucleotides in the DNA strand, which is usually between four to six base – pairs in length.
- The complimentary DNA strand has the same sequence but in the reverse direction, thus ensuring both strands of DNA are cut at the same location.

Uses of Bio technology :

1. Manufacture of liquors
2. Manufacture of enzymes
3. Manufacture of antibiotics
4. Manufacture of acetic acid
5. Manufacture of vitamins
6. Manufacture of vaccines
7. Manufacture of steroids
8. Manufacture of monoclonal antibodies

Genetic Diseases

1. Sickle cell Anaemia
2. Thalassemia
3. Agammaglobulinemia
4. Albinism
5. Huntington's Chorea
6. Severe combined immunodeficiency (SCID)

Genetic Disorders	
Mendelian Nature	Chromosomal Nature
Haemophilia	Downs
Sickle cell Anaemia	Klinefelter's
Phenylketonuria	Turners syndrome

Types of cloning :

1.Molecular cloning :

- Actually points to the procedure of the isolation of a defined DNA sequence (gene) and through which the obtaining of multiple copies of it within a living organism.

- Molecular Cloning is used in a broad spectrum of biological experiments and technological applications which are the inclusive of large scale protein production.

2.Embryo cloning :

- It is basically a medical technique which duplicates the process that nature uses to produce twins or triplets.
- One or more cells are removed from a fertilised embryo and
- Encouraged to develop into one or more duplicate embryos. Twins or triplets are thus formed, with identical DNA.
- This has been done for many years on various species of animals, but only very limited experimentation has been done on humans.

3.Reproductive cloning :

- It involves producing a duplicate of an existing animal.
- It has been used to clone various mammals now, but the most famous cloned mammal is still "Dolly the Sheep".
- The DNA from an embryo is removed and replaced with the DNA from an adult animal. Then, the embryo is implanted in a womb and allowed to develop into a new animal.
- It has not been tried on humans.

4.Therapeutic cloning:

- It is a procedure that starts off like adult DNA cloning. However, the stem cells; cells that can replicate indefinitely and which can differentiate into other cells, are removed from the embryo with the intent of producing tissue or a whole organ for transplant back into the person who supplied the DNA.
- The embryo dies in the process. The goal of therapeutic cloning is to produce a healthy copy of a sick person's tissue or organ for transplant in order to avoid organ transplants from other people.
- The tissue or organ would have the sick person's original DNA so there would be no fear of an

immune reaction to the donor organ

Bio – Sensors:

- A device which uses a living organism or biological molecules, especially enzymes or antibodies, to detect the presence of chemicals.

Uses of Bio – Sensors :

- A biosensor is an analytical device, used for the detection of an analyte, that combines a biological component with a physicochemical detector.
- The sensitive biological element (e.g. tissue, microorganisms, organelles, cell receptors, enzymes, antibodies, nucleic acids, etc.), a biologically derived material or biomimetic component that interacts (binds or recognizes) the analyte under study.
- The biologically sensitive elements can also be created by biological engineering.
- The transducer or the detector element (works in a physicochemical way; optical, piezoelectric, electrochemical, etc.) that transforms the signal resulting from the interaction of the analyte with the biological element into another signal (i.e., transduces) that can be more easily measured and quantified;
- Biosensor reader device with the associated electronics or signal processors that are primarily responsible for the display of the results in a user-friendly way.
- This sometimes accounts for the most expensive part of the sensor device, however it is possible to generate a user friendly display that includes transducer and sensitive element.

Bio – Chips :

- a microchip designed or intended to function in a biological environment, especially inside a living organism.

Uses of Bio – Chips :

- Multi-purpose Tracking Device
- Medical / Scientific Device
- Identification System
- Military / Defense Mechanism
- Business

Stem cells

- ❖ Stem cells are undifferentiated biological cells that can differentiate into specialized cells and can divide (through mitosis) to produce more stem cells. They are found in multicellular organisms.
- ❖ In mammals, there are two broad types of stem cells: embryonic stem cells, which are isolated from the inner cell mass of blastocysts, and adult stem cells, which are found in various tissues.
- ❖ In adult organisms, stem cells and progenitor cells act as a repair system for the body, replenishing adult tissues.
- ❖ In a developing embryo, stem cells can differentiate into all the specialized cells-ectoderm, endoderm and mesoderm but also maintain the normal turnover of regenerative organs, such as blood, skin, or intestinal tissues.
- ❖ There are three accessible sources of autologous adult stem cells in humans:
  - Bone marrow, which requires extraction by harvesting, that is, drilling into bone (typically the femur or iliac crest),
  - Adipose tissue (lipid cells), which requires extraction by liposuction, and
  - Blood, which requires extraction through apheresis, wherein blood is drawn from the donor (similar to a blood donation), and passed through a machine that extracts the stem cells and returns other portions of the blood to the donor.
- ❖ Stem cells can also be taken from umbilical cord blood just after birth.
- ❖ Of all stem cell types, autologous harvesting involves the least risk. By definition, autologous cells are obtained from one's own body, just as one may bank his or her own blood for elective surgical procedures.
- ❖ Adult stem cells are frequently used in medical therapies, for example in bone marrow transplantation.
- ❖ Stem cells can now be artificially grown and transformed (differentiated) into specialized

cell types with characteristics consistent with cells of various tissues such as muscles or nerves.

- ❖ Embryonic cell lines and autologous embryonic stem cells generated through therapeutic cloning have also been proposed as promising candidates for future therapies

Totipotent Stem Cells

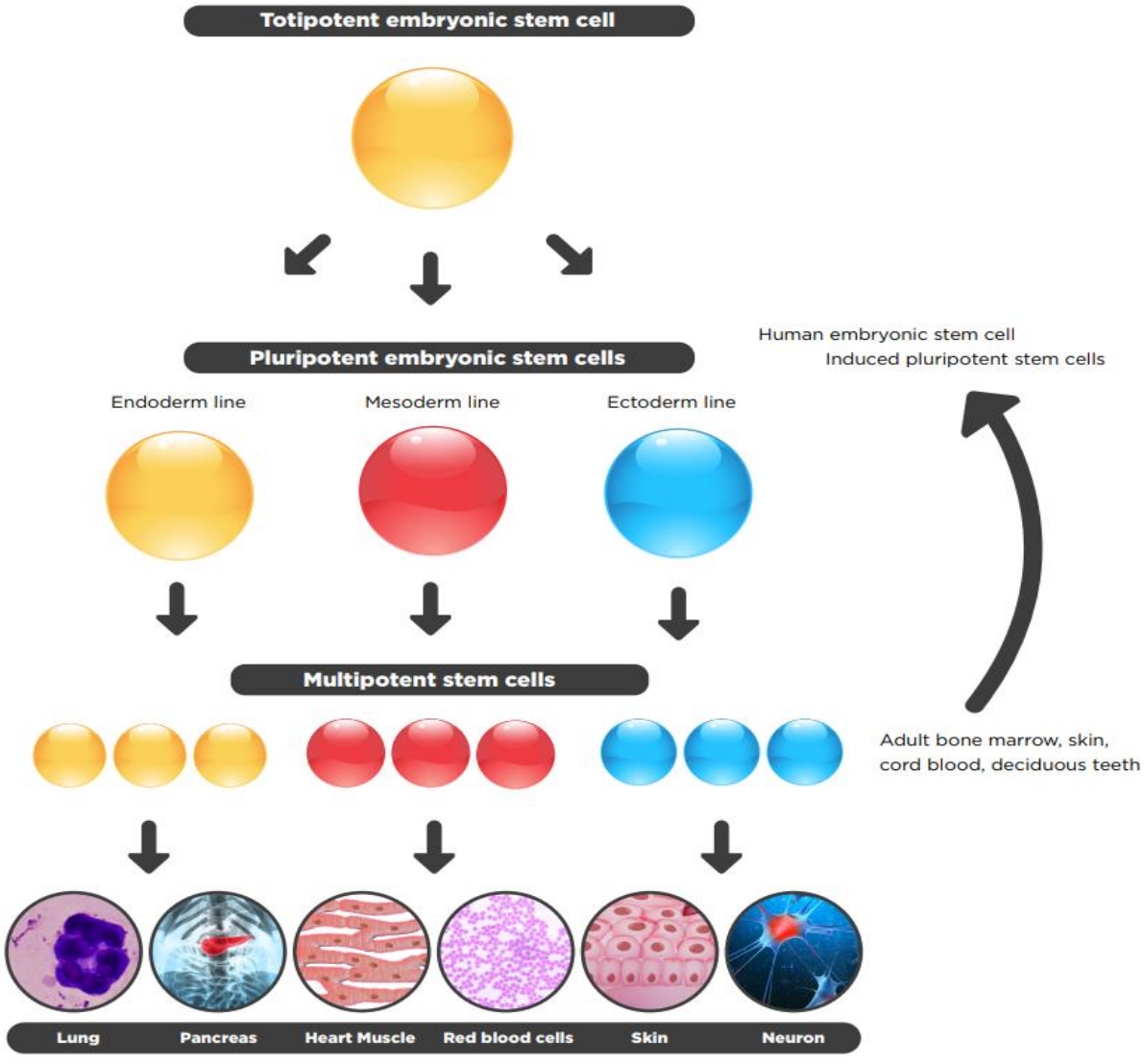
- ❖ Totipotent (omnipotent) stem cells can give rise to any of the 220 cell types found in an embryo as well as extra-embryonic cells (placenta).

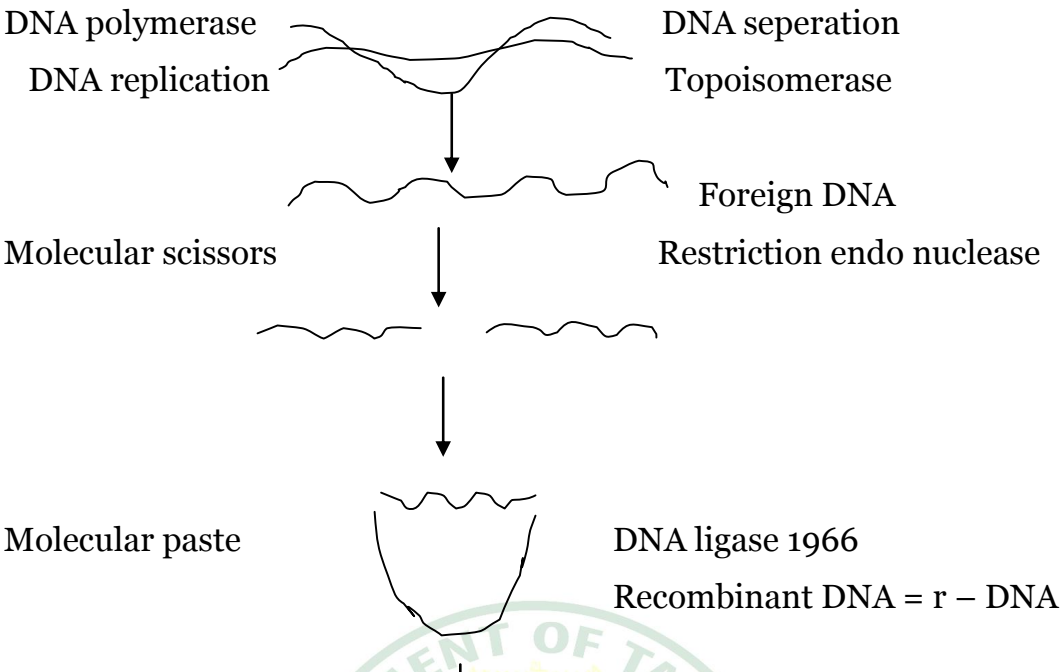
Pluripotent Stem Cells

- ❖ Pluripotent stem cells can give rise to all cell types of the body (but not the placenta).

Multipotent Stem Cells

- ❖ Multipotent stem cells can develop into a limited number of cell types in a particular lineage.





Cloning Vehicle	Host cells
Bacterio phage	E coli
Plasmid	Bacillus
cosmid	Streptomyces
Ti Plasmid	yeast

Heredity Diseases :

I. Body cell deficiency - dominant

- Huntington Chorea
- Cat Cry Syndrome
- Brachy dactyly

II. Sex cells deficiency - recessive

- Albinism
- Galactoseamia
- Phenylketonuria

III. Linked – dominant

- Haemophilia
- Christimas Disease
- Color blindness

IV. Linked – dominant

- Hypertrichosis

V. Linked – dominant

- Total color blindness

ECOLOGY & ENVIRONMENT

- Ecology is a Greek word / meaning **:** House or living area.
- Ecology word was introduced by : Reiter
- Father of Ecology : Ernst Hackal (1869)
- Father of Indian Ecology **:** R.Misra

Ecology: A Branch of science concerned with the interrelationship of organisms and their environments

Enviornmental Biology :

- ❖ Environmental biology is the study of how regional groups of animals and plants interact and live within their environment. They also explore the relationship of animals and plants within their species and other species as well.

Eco - system :

- ❖ The complex of a community of organisms and its environment functioning as an ecological unit
- ❖ Introduced By : A.G. Tansley 1935

Branches :

1. **Autecology:** The branch of ecology that deals with the biological relationship between an individual organism or an individual special its environment.
2. **Synecology:** The ecological study of the relation between natural communities and their environment.
3. **Gynecology:** The study of the gene frequency of a species in relation to its population distribution within a particular environment
4. **Paleoecology:** The branch of ecology that deals with the interaction between ancient organisms and their environment.
5. **Applied ecology:** Ecology is defined as the branch of science that studies how people or organisms relate to each other and their environment.

6. **Systems ecology:** Ecology a system involving the interactions between a community of living organisms in a particular area and its non living environment
7. **Bio ecology:** The study of the interrelations among living organisms in their natural environment; ecology.

ECOSYSTEM

- The system of interaction between living organisms and their environment is termed as ecosystem. It is the unit of the environment.

TYPES OF ECOSYSTEM

Ecosystem is classified on the basis of the type of organisms and the nature of habitat. The ecosystem are of following types

1. Forest ecosystem
2. Grassland ecosystem
3. Desert ecosystem
4. Aquatic ecosystem
5. Coastal ecosystem

Forest Ecosystem

It is a land with thick growth of trees. Development of forest is determined by number of climatic factors such as temperature, rainfall, humidity, altitude and availability of sufficient space. About 23% of India's land is under forest cover. Several types of forests are recognized. The two important types of forest seen in India are tropical rainforest and tropical deciduous forest.

Grassland Ecosystem

- Typical grasslands are characteristics of temperate climates and occur in the Himalayan region in India. The tropical grasslands found in India and elsewhere are the Steppes (shorter species of grass) and Savannas (taller grass species).

Desert Ecosystem

- Desert is a waterless, treeless large land covered with sand. Deserts have extremes of temperature and characteristic fauna and flora. They occur in areas having less than 25 cm rainfall per year. The hot type desert is the Thar Desert in Sindh - Rajasthan, and Cold type is seen in Ladakh and Tibet.

Aquatic Ecosystem.

- Aquatic ecosystem is associated with water bodies. Two types of aquatic ecosystems are identified

based on the differences in salt content of the waters. They are the marine ecosystem, fresh water ecosystem.

Marine ecosystem.

- The marine ecosystem is the largest of all ecosystem and is the most stable one. It is not subjected to severe climatic changes, problems of water supply, food and fire, and human activities like industrialization. However earthquakes under the sea, movement of land masses, eruption of volcanoes in the sea may disturb the marine ecosystem. Recent Tsunami had caused severe damage to the marine ecosystem.

Fresh water ecosystem.

- These are much smaller and are divisible into two types. They are lentic ecosystem or standing water ecosystem. e.g., ponds, pools, lakes, and swamps and lotic ecosystem or running water ecosystem. e.g., streams, rivers and springs.

Coastal ecosystem

- It includes saline, brackish (mixed saline and fresh) as well as coast lines and adjacent lands."

ECOSYSTEM

- **Biotic**
  - Plant
  - Animal
- **Abiotic**
  - Physical
    - light
    - temperature
    - moisture
    - atmosphere
    - pressure
  - Organic
    - protein
    - carbohydrate
    - fat
  - In organic
    - water
    - oxygen
    - nitrogen
    - Co_2

- Natural eco system : pond, meadow, forest, lake, desert
- Artificial eco system : aquarium, park, paddy field

1. Biotic factors :

- ❖ Classified into three divisions
- ❖ All the living things are included
- ❖ Plants and animals depend on each other for their life, growth and reproduction
  - **Ex :** Honey Bees → depend on flowers for their food.
  - Flowers → depend on Honey bees for pollination

a. PRODUCERS :

- ❖ They can prepare their food by photosynthesis. ex : plants
  - **$6\ Co_2 + 12\ H_2o \rightarrow C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O$**

b. CONSUMERS :

- ❖ These can eat both plants & animals

c. DECOMPOSERS :

- ❖ These can get their food by disintegrated dead plant and animal matter. By this the minerals were reinter into soil.
- ❖ Ex. Bacteria, fungi (natural scavengers)

2. Abiotic factors :

- ❖ Air, water, soil, light, temperature included in this .
- ❖ Plants need light, water and CO_2 for their life
- ❖ Animals need food, water and O_2 for their life

Food Chain

- ❖ A food chain is the sequence of who eats whom in a biological community (an ecosystem) to obtain nutrition.

Trophic Levels

- ❖ The trophic level of an organism is the position it holds in a food chain.
  - **Primary producers**: Organisms that make their own food from sunlight and/or chemical energy from deep sea vents are the base of every food chain - these organisms are called autotrophs.
  - **Primary consumers:** Are animals that eat primary producers; they are also called Herbivores (plant-eaters).
  - **Secondary consumers :** eat primary consumers. They are Carnivores (meat-eaters) and Omnivores (animals that eat both animals and plants).

- **Tertiary consumers:** eat secondary consumers.
- **Quaternary consumers :** eat tertiary consumers.
- Food chains "end" with top predators, animals that have little or no natural enemies.
  - ❖ When any organism dies, it is eventually eaten by detritivores (like vultures, worms and crabs) and broken down by decomposers (mostly bacteria and fungi), and the exchange of energy continues.
  - ❖ Some organisms' position in the food chain can vary as their diet differs. For example, when a bear eats berries, the bear is functioning as a primary consumer.
  - ❖ When a bear eats a plant-eating rodent, the bear is functioning as a secondary consumer.
  - ❖ When the bear eats salmon, the bear is functioning as a tertiary consumer (this is because salmon is a secondary consumer).
  - ❖ since salmon eat herring that eat zooplankton that eat phytoplankton, that make their own energy from sunlight).
  - ❖ Think about how people's place in the food chain varies - often within a single meal.

1. Food Chain in Meadows:

Paddy → **Rat** → **Snake** → **Kite**

(producer) (herbivore) (Primary carnivore) (Secondary carnivore)

2. Food Chain in Forest :

Grass → **Rabbit** → **Wolf** → **Tiger**

(producer) (primary consumer) (primary carnivore) (Secondary carnivore)

3. Food Chain in Pond :

phytoplankton → insect → small fish → Big fish → Humans

Ecological Pyramids

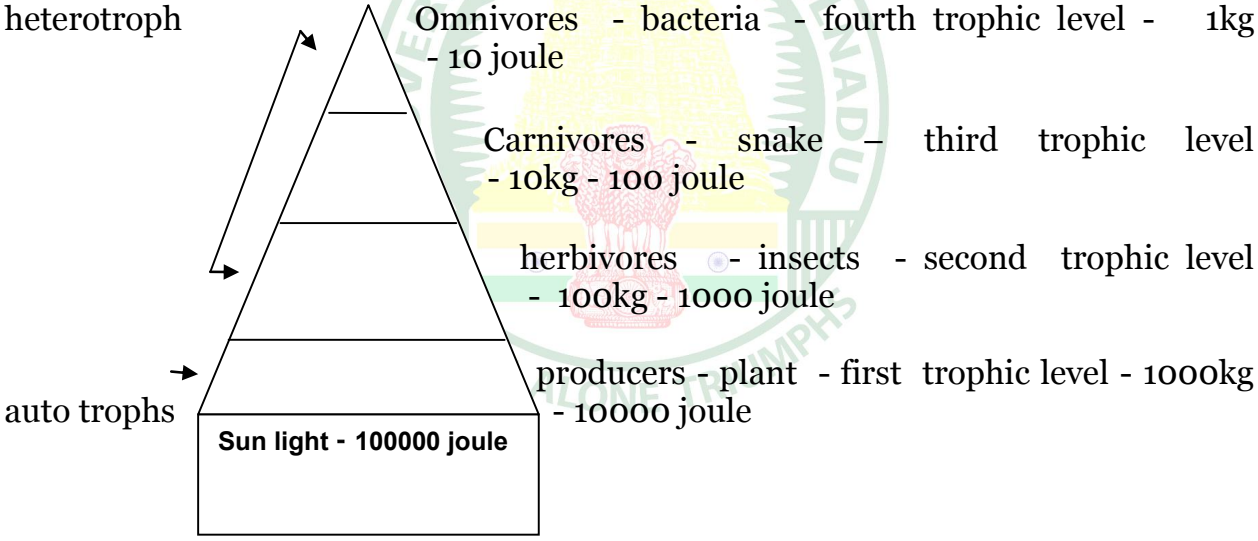
- Pyramid of Numbers
  - Upright
  - Inverted
- Pyramid of Biomass
  - Upright
  - Inverted
- Pyramid of Energy
  - Upright only (10% law)

Only 10% energy transferred from one trophic level to another trophic level.

FOOD PYRAMID

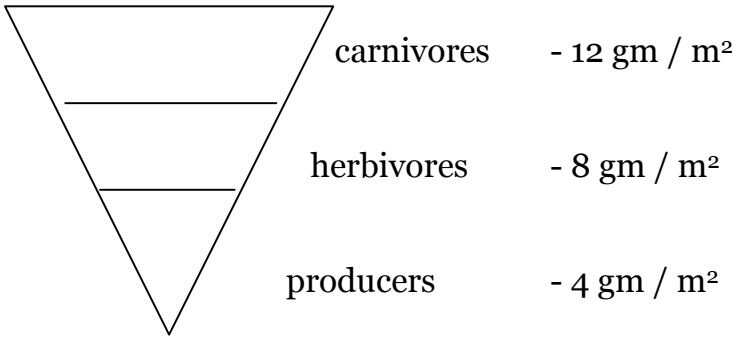
- The graphic representation of food chain
- It is of two types

1. Up Pyramid – Terrestrial



10 % Law is given by : Lindemamn 1942

2. Down Pyramid – Ponds :



Food Web

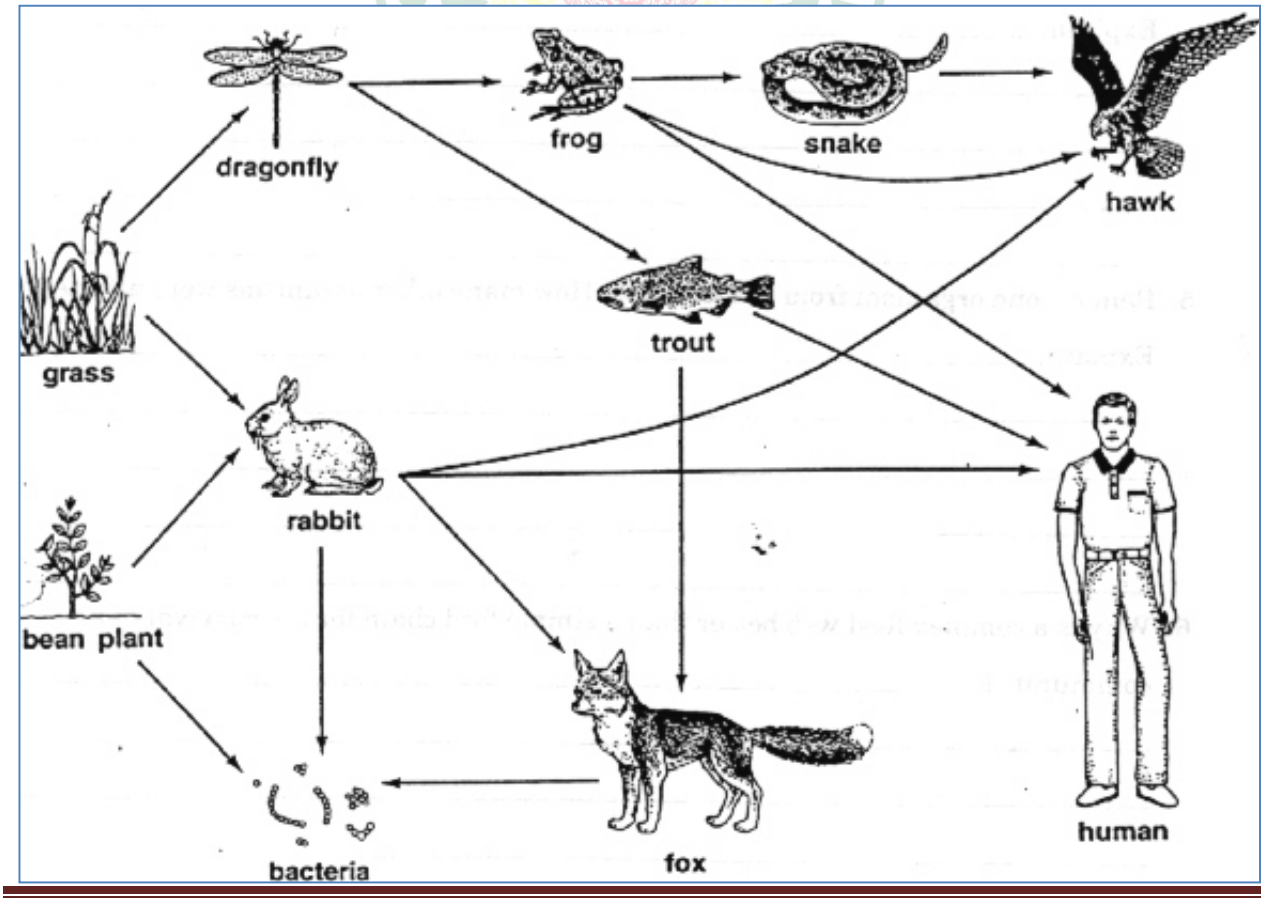
- A food web is a system of interconnected and interdependent food chains.
- It can also be defined as a network of food relationships through which nutrients and energy are passed from one living organism to another. Food web is a series of organisms related by predator, prey and consumer, resource interactions; the entirety of interrelated food chains in an ecological community.

Biogeochemical Cycles

- In geography and Earth science, a biogeochemical cycle or substance turnover or cycling of substances is a pathway by which a chemical element or molecule moves through both biotic and abiotic compartments of Earth

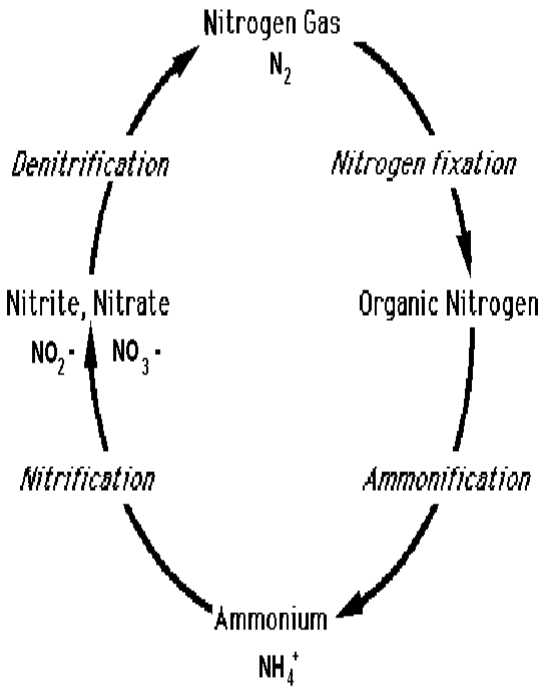
Nitrogen Cycle

- Nitrogen is required for the manufacturing of all amino acids and nucleic acids;
- however, the average organism can not use atmospheric



nitrogen for these tasks and as a result is dependent on the nitrogen cycle as a source for its usable nitrogen.

- The nitrogen cycle begins with nitrogen stored in the atmosphere as N_2 or nitrogen stored in the soil as ammonium (NH4+), ammonia (NH3), nitrite (NO2−), or nitrate (NO3−).
- Nitrogen is assimilated into living organisms through three stages: nitrogen fixation, nitrification, and plant metabolism..
- Nitrogen fixation is a process which occurs in prokaryotes in which N2 is converted to (NH4+).
- Atmospheric nitrogen can also undergo nitrogen fixation by lighting and UV radiation and become NO3-. Following nitrogen fixation, nitrification occurs.
- During nitrification, ammonia is converted into nitrite, and nitrite is converted into nitrate.
- Nitrification occurs in various bacteria. In the final stage, plants absorb ammonia and nitrate and incorporate it into their metabolic pathways.
- Once the nitrogen has entered the plant metabolic pathway, it may be transferred to animals when the plant is eaten.
- Nitrogen is released back into the cycle when denitrifying bacteria convert NO3- into N2 in the process of denitrification,
- When detrivorous bacteria convert organic compounds back into ammonia in the process of ammonification, or when animals excrete ammonia, urea, or uric acid.
- A lot of environmental problems are caused by the disruption of

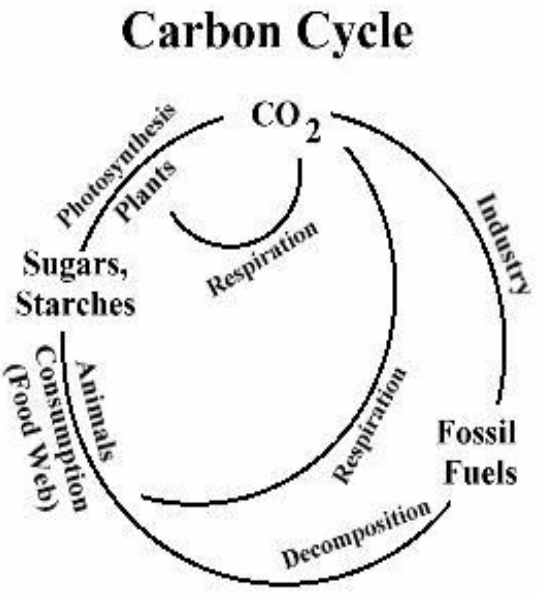


the nitrogen cycle by human activity some of the problems caused range from the production of tropospheric (lower atmospheric) smog to the perturbation of stratospheric ozone and contamination of ground water.

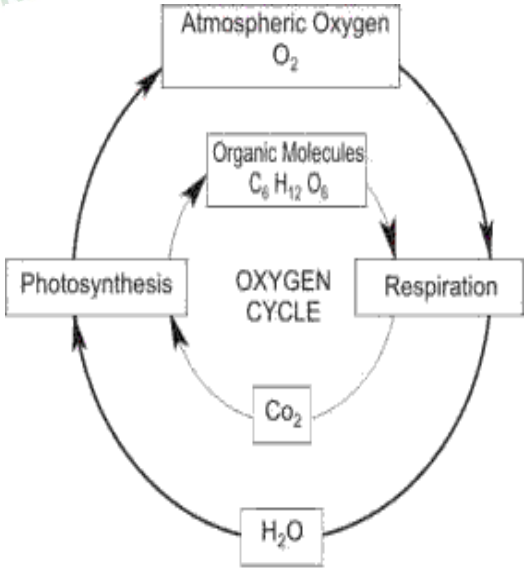
- An example of one of the problems caused is the formation of greenhouse gas.
- Like carbon dioxide and water vapor greenhouse gas traps heat near the earth's surface and destroys the stratospheric ozone.
- Once that occurs nitrous oxide in the earth's atmosphere is broken down by UV light into nitrogen dioxide and nitric oxide.
- These two products can reduce the ozone.
- Nitrogen oxides can be changed back into nitrates and nitrite compounds and recycled back into the earth's surface.
- The non disturbance of eco system
- It is naturally done by bio geo chemical cycles.
- But the activities of humans the land, water, air is polluted leads to harmful effects to eco systems
- They are classified as follows
  1. land pollution
  2. water pollution
  3. air pollution
  4. sound pollution
  5. radioactive pollution

Carbon Cycle

- Carbon is required for the building of all organic compounds.
- Carbon in the form of carbon dioxide (CO_2) is obtained from the atmosphere and transformed into a usable organic form by organisms.



- The reservoirs for the carbon cycle are the atmosphere, where carbon dioxide exists as a free gas, fossil organic deposits (such as oil and coal), and durable organic materials like cellulose.
- Mineral carbonates, such as limestone, are a significant geological sink for carbon.
- During the process of carbon fixation, carbon dioxide is taken up from the atmospheric reservoir (or from biocarbonates dissolved in water) by plants, photosynthetic bacteria, and algae and is "fixed" into organic substances.
- Animals obtain their requirements for carbon (as carbon-based molecules) by eating plants or other animals.
- For the biological links, the carbon cycle comes full cycle when carbon is released by either plants and animals as they respire or after life as they decompose.
- Organisms respire carbon dioxide as a waste product from the breakdown of organic molecules as their cells derive energy from oxidizing the molecules containing "fixed" carbon.
- The burning of organic material such as wood or fuels also results in the release of carbon dioxide from organic carbon.
- CO_2 is a trace gas and has huge effects on Earth's heat balance by absorbing infrared radiation.
- During the growing season or summer, there is a decrease in atmospheric CO2 because increased sunlight and temperature helps plants increase their carbon dioxide uptake and growth.
- In the winter time, more CO2 enters the atmosphere than can be removed by plants.
- This happens because plant



respirations and the death of plants happens faster than photosynthesis. Life and Biogeochemical Cycles

Oxygen Cycle

- The oxygen cycle is the biogeochemical cycle that describes the movement of oxygen within its three main reservoirs: the atmosphere (air), the total content of biological matter within the biosphere (the global sum of all ecosystems), and the lithosphere (Earth's crust).
- Failures in the oxygen cycle within the hydrosphere (the combined mass of water found on, under, and over the surface of planet Earth) can result in the development of hypoxic zones.
- The main driving factor of the oxygen cycle is photosynthesis, which is responsible for the modern Earth's atmosphere and life on earth (see the Great Oxygenation Event).
- By far the largest reservoir of Earth's oxygen is within the silicate and oxide minerals of the crust and mantle (99.5%).
- Only a small portion has been released as free oxygen to the biosphere (0.01%) and atmosphere (0.36%).
- The main source of atmospheric free oxygen is photosynthesis, which produces sugars and free oxygen from carbon dioxide and water:
- Photosynthesizing organisms include the plant life of the land areas as well as the phytoplankton of the oceans.
- The tiny marine cyan bacterium Prochlorococcus was discovered in 1986 and accounts for more than half of the photosynthesis of the open ocean.
- An additional source of atmospheric free oxygen comes from photolysis, whereby high energy ultraviolet radiation breaks down atmospheric water and nitrous oxide into component atoms.
- The free H and N atoms escape into space leaving O2 in the atmosphere:

- The main way free oxygen is lost from the atmosphere is via respiration and decay, mechanisms in which animal life and bacteria consume oxygen and release carbon dioxide.
- The lithosphere also consumes free oxygen via chemical weathering and surface reactions. An example of surface weathering chemistry is formation of iron-oxides (rust):
- Oxygen is also cycled between the biosphere and lithosphere. Marine organisms in the biosphere create calcium carbonate shell material ($CaCO_3$) that is rich in oxygen.
- When the organism dies its shell is deposited on the shallow sea floor and buried over time to create the limestone sedimentary rock of the lithosphere.
- Weathering processes initiated by organisms can also free oxygen from the lithosphere. Plants and animals extract nutrient minerals from rocks and release oxygen in the process.

Pollution

- Pollution is the introduction into the air, water or ground of toxic substances that are damaging to human health and ecosystems.
- It is mainly linked with human activity: discharge of domestic, industrial and agricultural waste; application of pesticides by farmers; leaks of radioactive materials; gas emissions into the atmosphere etc

Pollutants: Something that pollutes, especially a waste material that contaminates air, soil, or water

Land pollution

- Land is the degradation of Earth's land surfaces often caused by human activities and their misuse of land resources. It occurs when waste is not disposed properly.
- Haphazard disposal of urban and industrial wastes, exploitation of minerals, and improper use of soil by inadequate agricultural practices are a few factors.
- Urbanization and industrialization are major causes of land pollution.

- The Industrial Revolution set a series of events into motion which destroyed natural habitats and polluted the environment, causing diseases in both humans and other species of animals

Pollutants :

- Land pollution is the destruction of Earth's land surfaces through misuse of land resources by human activities.
- Polluted land has deposits of liquid and solid waste such as rubbish, garbage, paper, glass and plastic objects.

Effects :

- When land pollution is bad enough, it damages the soil.
- This means that plants may fail to grow there, robbing the eco-system of a food source for animals.
- Eco-systems may also be upset by pollution when the soil fails to sustain native plants, but can still support other vegetation.
- Invasive weeds that choke off the remaining sources of native vegetation can spring up in areas that have been weakened by pollution.

Recycling

- One of the easiest things we can all do to improve our environment is to recycle wastes whenever possible. Recycling saves natural resources and energy and reduces the need for landfills or incinerators.
- It can also increase local jobs by collecting processing and manufacturing new products out of discarded materials.
- Efforts to reduce the use of plastics and to promote plastic recycling have occurred.
- E.g: Some supermarkets charge their customers for plastic bags, and in some places more efficient reusable or biodegradable materials are being used in place of plastics.

Bio plastic / natural plastic / biopal

- It is made up micro organisms known as alcaligenes by the process of disintegration
- It's a homopolimer type

- It's also called as polyhydroxybutrate.

Uses :

- Packaging such as milk bottles and water and soft drinks bottles is easily identified and hence setting up a recycling infrastructure has been quite successful in many parts of the world
- There are also concerns that bioplastics will damage existing recycling projects.
- Packaging made of PLA-blend bio-flex
- Medicine : artificial heart valves , serate dentition , bone fracture plates , artificial skin

WASTE GENERATION AND MANAGEMENT

SOURCES OF WASTE :

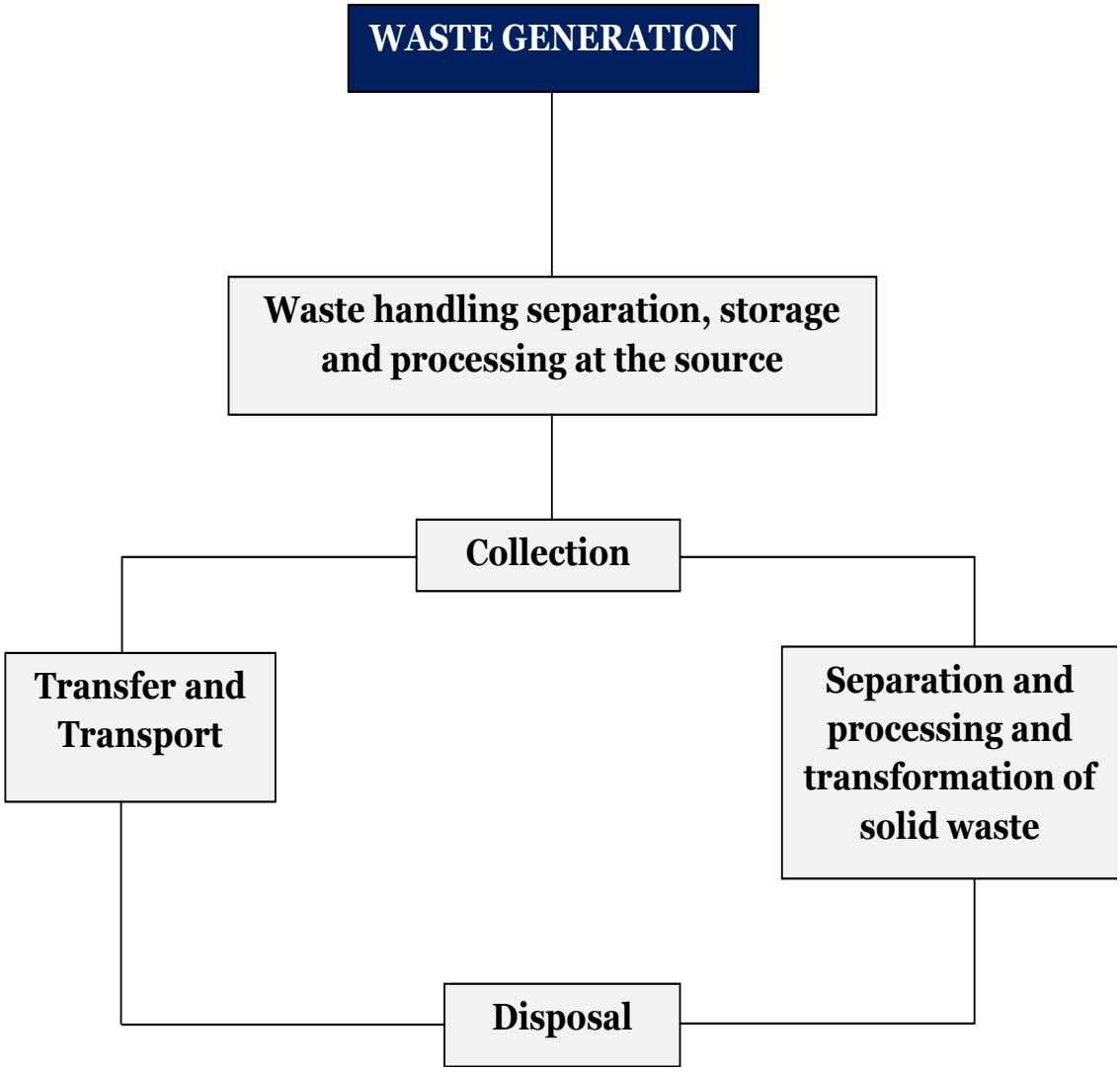
Pollution of land mainly affects the soil and water due to accumulation of undesirable materials disposed off as a result of human activity (Fig. 19). The waste consists of garbage, paper, wood, cloth, plastic, iron scrap, food residue, farm waste etc., The municipal solid waste generated in Indian cities has increased from 480 lakh tonnes in1997 to 10 crore tonnes currently. The sources of waste generated in our day-to-day life are classified broadly into

a. Domestic
b. Industrial
c. Agricultural and
d. Commercial

SOLID WASTE MANAGEMENT

Sources	Activity	Types of Waste
Residential	Single family, multi family, medium and high rise apartments	Garbage, Rubbish, ashes
Industrial	Fabrication, light and heavy manufacturing refineries, power plants.	Garbage, rubbish, Chemical and special wastes.

Open areas	Street, parks, vacant plots, play grounds, highways, beaches, etc.	Rubbish and special waste
Treatment plant	Water, sewage and industrial waste treatment plant	Treatment plant waste



Sources and Types of Solid waste

Domestic Waste

- ❖ Waste generated from residential premises is called domestic waste.

Municipal waste

- ❖ The combined solid and liquid waste from residential, commercial and industrial sources are called municipal waste.

Industrial waste

All the unwanted materials generated from industries are called industrial wastes. The industrial wastes may be liquid, sludge, solid, gases, etc. The absence of adequate disposal facilities for the industries is a main factor for indiscriminate disposal of solid waste. It is mainly of three types

1. **Solid waste** - Toxic - mining waste, Non-toxic - building materials.
2. **Liquid wastes** - organic liquid waste and inorganic liquid waste.
   - Organic liquid waste - effluents from tanneries / distilleries / sugar factories
   - Inorganic liquid waste - from chemical and fertilizing industries

3. Gaseous waste

- Toxic: toxic fumes like ammonia, Hydrogen sulphide etc.,
- Non - toxic: steam / water vapour

Agricultural and Animal husbandry waste

- ❖ Agricultural and animal husbandry wastes are those generated by the rearing of animals and the production and harvest of crops or trees. It includes feed waste, non-edible oil seeds, straw, husk, coconut waste and cotton waste, rubber waste and its by products.

Commercial waste

- ❖ Most of the shops, restaurants, markets, offices are sources of commercial wastes like bottles, plastic bags, polythene, paper wrappers, non-biodegradable cups and wastes that are produced during construction of buildings etc.,

CLASSIFICATION OF WASTE

- ❖ Rapid industrialization and urbanization without due regard to environmental considerations are

leading to extensive environmental pollution. The materials consumed during these activities reduces non-renewable resources, and generate wastes. The wastes are classified into bio-degradable, non-biodegradable, toxic, non-toxic and bio-medical wastes.

Biodegradable

- Any waste that is capable of undergoing decomposition by microbes are called biodegradable wastes. The food, garden wastes, paper and paper board are certain examples of bio-degradable wastes.

Non-biodegradable

- Non-biodegradable wastes are those that cannot be decomposed by bacteria. Waste like ceramics, aluminium cans, PVC articles, plastics, bottles etc are best example for non-biodegradable waste.

Toxic waste

- Any waste that are harmful to life and environment is known as toxic waste. The toxic waste may be poisonous, radioactive, corrosive, carcinogenic (causing cancer), mutagenic (damaging chromosomes), teratogenic (in nature).
- Toxic waste are produced during industrial, chemical and biological process. Even household office and commercial wastes contain small quantities of toxic wastes (e.g., Batteries, old pesticides). Paints, pesticides, toxic chemicals broken tube lights, expired medicines, etc., are some of the toxic wastes. The waste generated by the nuclear power plant such as heavy water or the spent nuclear fuel are highly hazardous to the environment and all life forms.

Non-toxic waste

- The wastes of non-hazardous category are called non-toxic wastes. They do not harm to life.
- Kitchen waste, garbage, street sweepings, roadside litter, etc. are some examples of non-toxic wastes.

Biomedical waste

- The wastes that are generated in hospitals are biomedical wastes. e.g., syringes, blades, needles, cotton, human body parts, soiled plasters etc.,

IMPACT OF WASTE ACCUMULATION

Spoilage of Landscape

- Sanitary landfill is commonly used for final disposal of solid wastes. The main disadvantage over open dumps is in the aspects of public health. The availability of land for the dumping of wastes is also a problem.

Pollution

- Land and soil pollution is responsible for loss of fertility and productivity of soil.
- The decomposition of the various types of waste material releases harmful gases and bad smell, which pollute the environment.
- The municipal and domestic waste is often discharged in water bodies, is responsible for water pollution
- The excreta of humans, animals and birds is a source of soil pollution by biological agents. Digested sewage sludge, used as a fertilizer also causes soil pollution.

Health hazard

- The radioactive wastes produced by nuclear testing laboratories and industries reach the soil and accumulate in the soil. Waste from nuclear reactors emit radiations are harmful to soil, plants and affects the health of human by causing cancer.

Effect on Terrestrial and aquatic life

- Most of the thermal and electric power plants discharge large quantities of hot water into streams or rivers. Hot water has lower dissolved oxygen level. So, thermal pollution is considered for the whole aquatic ecosystem. Due to a minimum concentration of oxygen, fishes and other marine organisms migrate from the polluted area or die in large numbers. Waste from industries such as insecticides, acids, alkalies etc. also destroy the growth of aquatic plants.

NEED FOR MANAGEMENT OF WASTE

- Waste can be converted into new products using technology. Used or unused wastes cause a great hazard to the human environment. Utilization and

reducing of waste is a complex field. In waste management, there is a need for techno-economic studies. To live in a better way, the quantity of wastes should be minimized by controlling wastes from industry, agriculture, urban areas etc., we can protect the health of future generation and also the environment.

- Due to expansion of industrial activities and growth of population, we are using more resources and producing more wastes. The waste disposal is expensive and also cause pollution to environment. Much of our waste could be minimized by our waste management plans by means of the following three methods (Three 'R's). They are as follows.
  1. First Reduce the waste
  2. Then Re-use items or articles
- Then Recycle them for further use and finally dispose of what is left.

Waste	Recycling Possibilities
Paper	• Use of scrap paper or personal stationery, exchange magazines and newspapers with friends , Repulp to reclaim fibre , Compost, Incinerate heat
Glass	• Purchase drinks in deposit bottles and return them, use other bottles as storage bins in the home , Crush and remelt for glass manufacture Crush and use as aggregate for building , material or antiskid additive for road surface.
Tyre	• Recap usable casings • Use of swings, crush guards, boat bumpers, etc., • Shred and use of manufacture of new tyres Grind and use as additive in road construction
Manure	• Compost or spread directly on fields • Pertinent to yield methane, use residue as compost • Convert to oil by chemical treatment

	• Treat chemically and re-use as animal feed
Food scraps	• Save for meals of leftovers • Sterilize and use as hog food • Compost • Use as culture for yeast for food production • Sterilize and use as animal feed

METHODS OF SAFE DISPOSAL OF WASTES

❖ The methods of disposal of wastes can be carried out by segregation, dumping, composting, drainage, treatment of effluents before discharge, incineration and sue of scrubbers and electrostatic precipitators.

Segregation

❖ The waste materials of non-biodegradable type like glass, plastics etc and bio-degradable like paper and organic materials are separated before being disposed off.

Dumping

❖ Attempt of depositing solid wastes upon land is known as dumping. The segregated wastes are dumped separately for further process of management.

Composting

❖ It is a biological process of decomposing organic materials such as fallen leaves, grass clippings, kitchen wastes, garden wastes, food wastes etc., by microbes.

Drainage

❖ Wastewater and sewage must be taken away from all buildings through gully. In urban areas the rain water cannot drain into the grounds. Therefore, the excess rain water are nowadays drained by soak ways or by down pipes in to the well to harvest the rain water.

Treatment of effluents before discharge

❖ In urban areas two drainage systems are found. One is designed to collect clean rainwater and the other is to

collect foul sewer from toilet and sink wastes. The dirty water including industrial wastes and domestic wastes are let into a treatment tank. In the treatment tank, the drained effluents are biodegraded before returning to river. The sewage sludge formed during treatment process are recycled as fertilizers.

Incineration

- It is destruction of waste by controlled burning at high temperature. It is the best way to dispose of pharmaceuticals wastes. It is an environmentally and technically superior method of waste disposal.

Scrubbers

- The Scrubbers are another device, which saturate the gas stream in order to remove the dry fly ash. Particulate vapours and gases are controlled by this device. Scrubbers are used on coal mining power plants, asphalt, concrete plants which are emitting sulphur dioxide and hydrogen sulphide.

Electrostatic precipitator

- Electrostatic precipitator is a device developed to reduce the serious smoke nuisances. Today it is found mainly on large power plants, cement plants, incinerators and various boiler applications. Electrostatic precipitators are 99 effective instrument for the attraction of particle emitted power plants, paper mill etc.,

NEED FOR REDUCING, RE-USING AND RECYCLING WASTES

Reduce of Waste

We can reduce the waste by way of consuming and throwing away less. It includes:

- Purchasing of durable and long lasting goods
- Buying products with packaging that are as free of toxic as possible.
- Avoid disposable products.
- Get drinks in returnable products
- Repair rather than buy a new one
- Compost kitchen and garden waste.

Re-use of Wastes

After reducing the waste, we need to think about reusing of goods. Reusing involves neither additional energy consumption nor for raw materials. The following are certain methods for re-use of products which are likely to be thrown away as wastes.

- Donate unwanted goods to charity club
- Purchasing refillable pens
- Refill the water bottles

Recycle of Wastes

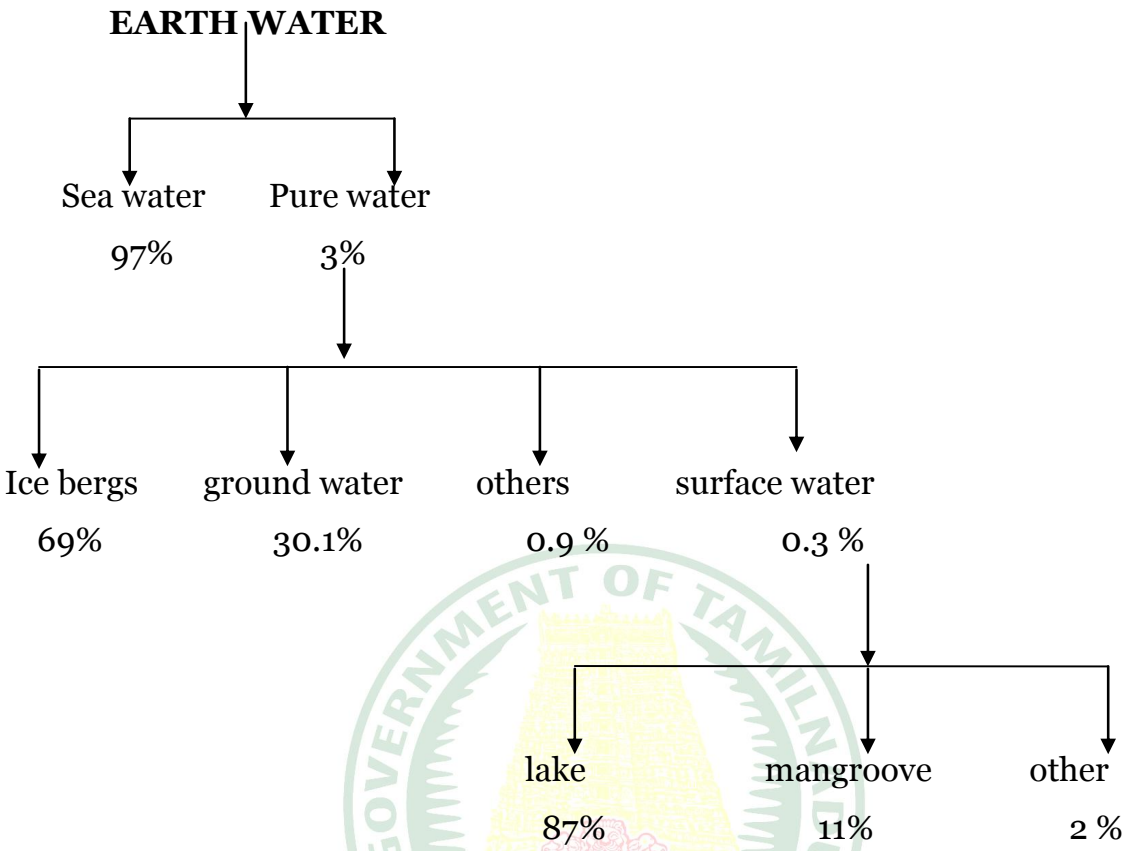
- Converting of waste materials into valuable new materials or products is termed as recycling of wastes. This method of waste management generates environmental, financial and social benefits. Materials like glass, metals, plastics and paper can be processed into new products.

LEGAL PROVISIONS FOR HANDLING AND MANAGEMENT OF WASTES

- The Government has framed several rules and guidelines on the management and handling of hazardous waste. These rules are implemented through State pollution control boards (SPCBs) and pollution control committees in states.
- India is one of the first countries, which has provided a protection for the improvement of environment in its constitution. The article 51.A(g) of the constitution states the responsibility of every citizen to protect the environment. Among the existing environmental Protection Act, the act such as "Hazardous Waste (Management and Handling) Rules, 1989" and "Biomedical Wastes (Management and Handling) Rules, 1996 are providing some legal provisions for handling and management of solid wastes.

WATER

- Water pollution refers to the contamination of water bodies such as rivers, oceans, lakes, and groundwater caused by human activities.
- This can be harmful to plants and organisms which live in these water bodies.

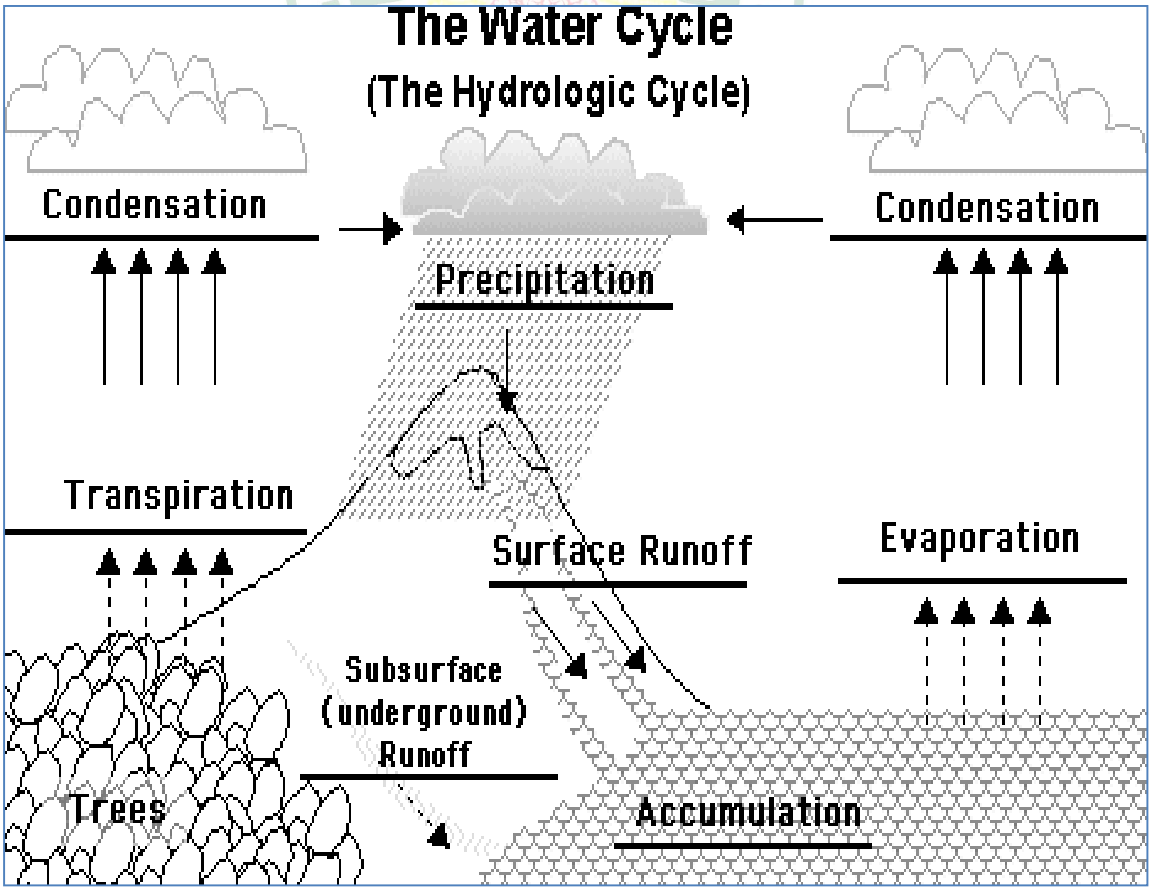


- The pollutants undergo many reactions and can become hazardous.
- 70 % of India's fresh water is polluted, including several high altitude lakes.
- While water pollution is easier to study and manage, its control is highly complex and very costly.
- Water pollution is defined as presence of any foreign substance (organic, inorganic, biological or radiological) in water which tends to degrade the quality so as to constitute a hazard, or impair the usefulness of water.
- It contains various types of impurities such as dissolved gases, dissolved minerals, suspended matters and even microbes.
- Per day a man consumes around 50 lts of water for drinking , washing , cooking and for maintenance of body

- ❖ On the basis of availability of water for a year to a man , India stands on 133th place
- ❖ In human body two third of water is present.
- ❖ In India , the renewable water capacity is 1897 sq kilo meters / per year
- ❖ WHO states that wouldbe heavy water scarcity by 2025

Water Cycle

- ❖ A very significant molecule (on planet Earth) that cycles through ecosystems is the water molecule (H_2O), for the reason that life is so dependent on water as the medium of chemical reactions within cells.
- ❖ While it generally is the case that we discuss the water cycle in terms of the various states of water, at least some water molecules are taken up by plants and split apart (photolysed) into atoms of hydrogen and oxygen; the latter is released into the atmosphere as molecular oxygen (O_2).
- ❖ Thus, by virtue of photosynthesizing organisms (*photoautotrophs*), the water cycle



is an important part of both the oxygen and the hydrogen cycles.

- Note that hydrogen ends up as part of an organic molecule, and therefore a participant in the carbon cycle.
- The majority of water in the water cycle is found within the oceans and the polar ice caps, although water is present in the bodies of organisms, in freshwater lakes and rivers, frozen in glaciers, and in the ground as groundwater.
- Water moves more or less freely between these storage reservoirs: by evaporation, by precipitation, and by runoff from the land.
- The sedimentation cycle is an extension of the hydrological cycle. The water carries material from the land to the ocean, where they are added as sediments.
- The sediment cycle includes the physical and chemical erosion, nutrient transport, and sediment formation from water flows.
- The sedimentation cycle is an extension of the hydrological cycle. The water carries material from the land to the ocean, where they are added as sediments.
- The sediment cycle includes the physical and chemical erosion, nutrient transport, and sediment formation from water flows.
- The sediment formed from water flows is mostly responsible for the buildup of sediments at the bottom of the ocean. The sediment cycle is tied in with the flow of six important elements, which are hydrogen, carbon, oxygen, nitrogen, phosphorus and sulfur. These elements also known as macroelements make up 95 % of all living things.
- The balancing of these molecules is required to sustain life. These elements have to be recycled for life to continuously regenerate.

Decrease of Water

1. Natural reasons:

- Low amount of rainfall and hot air will decrease the ground water level

2. Human activities:

- Deforestration, population explasion, fast urbanization, and

more usage of ground water will reduce the water level.

3. Sea water intrusion:

- Due to the flow of sea water into pure water resources will leads into spoilage of drinking water.
- The ground water is also spoiled

4. Commercial water :

- Some private organization make use of more water from rivers will leads to lower level of ground water.
- eg : Tiruppur dyeing factories – Noyyal river

5. Agricultural reasons:

- Basically India is an agricultural based nation.
- So the usage of water is always high.

WATER MANAGEMENT

- Water resource management is the activity of planning, developing, distributing and managing the optimum use of water resources. It is a sub-set of water cycle management.

1. Cloud Seeding :

- A form of intentional weather modification, is the attempt to change the amount or type of precipitation that falls from clouds, by dispersing substances into the air that serve as cloud condensation or ice nuclei, which alter the microphysical processes within the cloud.
- The usual intent is to increase precipitation (rain or snow), but hail and fog suppression are also widely practiced in airports.

2. Rainwater harvesting:

- Rainwater harvesting is the accumulation and deposition of rainwater for reuse before it reaches the aquifer.
- Uses include water for garden, water for livestock, water for irrigation, etc. In many places the water collected is just redirected to a deep pit with percolation.

Uses :

- Makes use of a natural resource and reduces flooding, storm water, erosion, and contamination of surface water with pesticides, sediment, metals and fertilizers.

- Excellent source of water for landscape irrigation, with no chemicals such as fluoride and chlorine, and any dissolved salts and minerals from the soil.
- Home systems can be relatively simple to install and operate and it may reduce your water bill.
- Promotes both water and energy conservation.

3. Dams, Reservoirs, Canals

- By constructing these we can able be to store excess amount of water from the river.

4. Watershed management

- Watershed management is the study of the relevant characteristics of a watershed aimed at the sustainable distribution of its resources and the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that affect the plant, animal, and human .

5. Icebergs drinking water:

- The concept of using icebergs as a water source has been around for a long time. It has always been seen as something that is vaguely possible one day in the not too far distant future.

6. Storage in wet land :

- Main purpose is for drinking Transportation purpose and also for taking one place to another place.

7. Saving in Houses:

- Due to some changes in our daily activities we can able to save some amount of water daily

8. Purification of Sea Water :

- Reverse osmosis is most commonly known for its use in drinking water purification from seawater, removing the salt and other effluent materials from the water molecules.
- It is very expensive method

9. Saving in factories:

- The coolant used in machineries is to be recycled again and again.

Water Pollution

- Water pollution is the contamination of water bodies

(e.g. lakes, rivers, oceans, aquifers and groundwater).

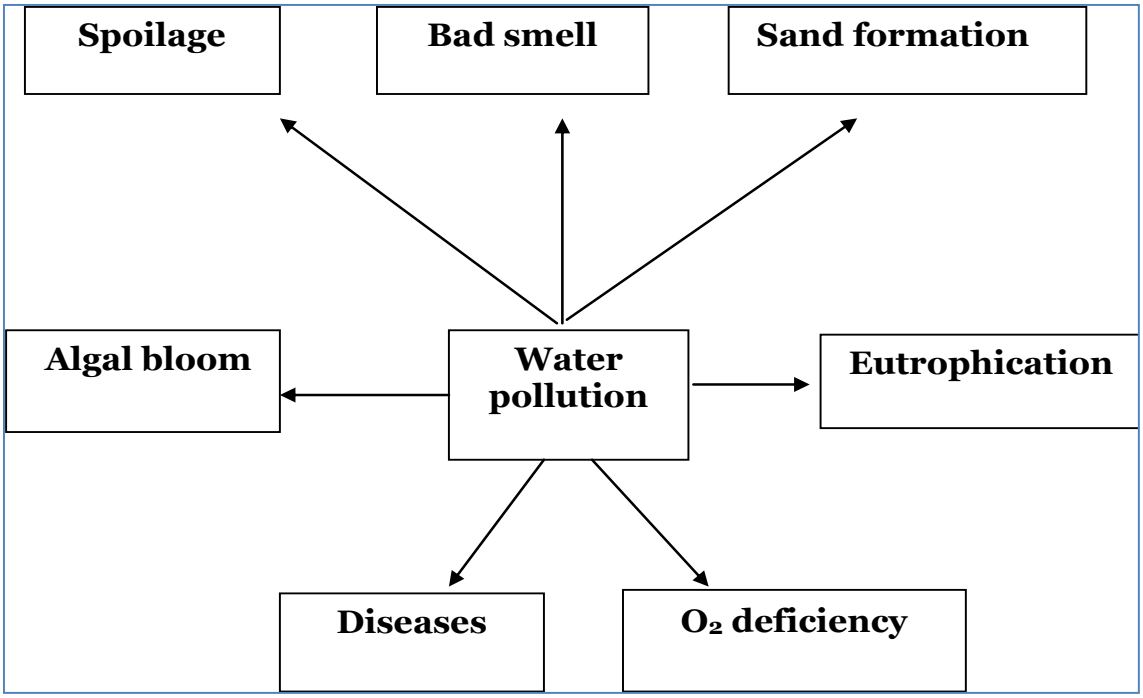
- Water pollution occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds.
- Water pollution affects plants and organisms living in these bodies of water.
- In almost all cases the effect is damaging not only to individual species and populations, but also to the natural biological communities.

Reasons for water pollution :

1. **Factory waste**
2. **Soil Erosion**.
3. **Oil waste**
4. **Domestic waste**

Control measures:

1. Cleaning of waste water before liberated in water sources.
2. Avoid of fertilizers, insecticides and weedicides.
3. Avoid more usage of water
4. Domestic used water used in gardens.
5. Nitrosomonas Europhea – bacteria is used to demolish the micro organisms in domestic waste water.



6. Eucalyptus trees can absorb minerals from waste water.
7. Implementing law full act.
8. Awareness in peoples.

Air pollution

- **Air pollution** is the introduction of chemicals, particulates, biological materials, or other harmful materials into the Earth's atmosphere, possibly causing disease, death to humans, damage to other living organisms such as food crops, or the natural or built environment.
- The atmosphere is a complex natural gaseous system that is essential to support life on planet Earth.
- Stratospheric ozone depletion due to air pollution has long been recognized as a threat to human health as well as to the Earth's ecosystems

Composition of air :

nitrogen	: 78%
O_2	: 20.9%
Argan	: 0.9%
Co_2	: 0.03%
Water vapour	: less amount

Causes of Air pollution :

1. Natural soruces :

- Volcanoes, forest fire, sea water salinity, photo chemical oxidation, pollens, sperms, radioactive elements in earth crust, radiation in atmosphere.

Pollutants	Sources	Effect
Carbon monooxide	Fuels	Death of humans
Carbondioxide	Coal, petrol	Global warming
Nitrogen oxide	Vehicles	Acid rain
Sulphur di oxide	Factories	Cancer, asthma
Carbon	Coal mines	Black lung disease
CFC	Fridge, Air cooler , solvents	Ozone depletion, cancer
Methyl Iso Cyanide	Bhopal – union carbide factory	Many death, disease

2. Human activity sources / anthropogenics :

- ❖ Mainly of factory song

Acid Rain

- ❖ Rainfall made so acidic by atmospheric pollution that it causes environmental harm, chiefly to forests and lakes.
- ❖ The main cause is the industrial burning of coal and other fossil fuels, the waste gases from which contain sulphur and nitrogen oxides which combine with atmospheric water to form acids.

– $Co_2 + H_20 \rightarrow H_2Co_3$ carbonic acid

– $So_2 + H_20 \rightarrow H_2So_4$ sulphuric acid

– $No_2 + H_20 \rightarrow HNo_3$ nitric acid

Causes

1. Burning of fossil fuels like coal.
2. Vehicle emission
3. Burning of forests and grasslands
4. Release of gases from chemical industries.

Effects :

1) Soil acidity: eco system is affected.
2) Water acidity: pond, river are affected,
3) Human impact: ground water spoilage, eye and skin irritation
4) Building impact: Tajmahal is affected.

Ozone Depletion

- ❖ Ozone depletion describes two distinct but related phenomena observed since the late 1970s: a steady decline of about 4% per decade in the total volume of ozone in Earth's stratosphere, and a much larger springtime decrease in stratospheric ozone over Earth's Polar Regions.
- ❖ The latter phenomenon is referred to as the ozone hole.
- ❖ In addition to these well-known stratospheric phenomena, there are also spring time polar tropospheric ozone depletion events.
- ❖ The details of polar ozone hole formation differ from that of mid-latitude thinning, but the most important process in both is catalytic destruction of ozone by atomic halogens.
- ❖ The main source of these halogen atoms in the stratosphere is photo dissociation of man-made halocarbon refrigerants, solvents, propellants, and foam-

blowing agents (CFCs, HCFCs, freons, halons).

- ❖ These compounds are transported into the stratosphere after being emitted at the surface.
- ❖ Both types of ozone depletion have been observed to increase as emissions of halo-carbons increased.
- ❖ CFCs and other contributory substances are referred to as ozone-depleting substances (ODS).
- ❖ Since the ozone layer prevents most harmful UVB wavelengths (280–315 nm) of ultraviolet light (UV light) from passing through the Earth's atmosphere, observed and projected decreases in ozone have generated worldwide concern leading to adoption of the Montreal Protocol that bans the production of CFCs, halons, and other ozone-depleting chemicals such as carbon tetrachloride and trichloroethane
- ❖ It is suspected that a variety of biological consequences such as increases in skin cancer, cataracts, damage to plants, and reduction of plankton populations in the ocean's photic zone may result from the increased UV exposure due to ozone depletion.

Ozone O_2 cycle:

- ❖ Three forms (or allotropes) of oxygen are involved in the ozone-oxygen cycle: oxygen atoms (O or atomic oxygen), oxygen gas (O_2 or diatomic oxygen), and ozone gas (O_3 or triatomic oxygen).
- ❖ Ozone is formed in the stratosphere when oxygen molecules photodissociate after absorbing an ultraviolet photon whose wavelength is shorter than 240 nm.
- ❖ This converts a single O_2 into two atomic oxygen radicals.
- ❖ The atomic oxygen radicals then combine with separate O_2 molecules to create two O_3 molecules.
- ❖ These ozone molecules absorb UV light between 310 and 200 nm, following which ozone splits into a molecule of $O_2$and an oxygen atom.

- The oxygen atom then joins up with an oxygen molecule to regenerate ozone.
- This is a continuing process that terminates when an oxygen atom "recombines" with an ozone molecule to make two O2 molecules.
  - $2\ O_3 \rightarrow 3\ O_2$ chemical equation
- The overall amount of ozone in the stratosphere is determined by a balance between photochemical production and recombination.
- Ozone can be destroyed by a number of free radical catalysts, the most important of which are the hydroxyl radical (OH•), the nitric oxide radical (NO•), atomic chlorine ion (Cl•) and atomic bromine ion (Br•).
- The dot is a common notation to indicate that all of these species have an unpaired electron and are thus extremely reactive.
- All of these have both natural and man-made sources; at the present time, most of the OH• and NO• in the stratosphere is of natural origin, but human activity has dramatically increased the levels of chlorine and bromine.
- These elements are found in certain stable organic compounds, especially chlorofluorocarbons (CFCs), which may find their way to the stratosphere without being destroyed in the troposphere due to their low reactivity.
- Once in the stratosphere, the Cl and Br atoms are liberated from the parent compounds by the action of ultraviolet light, e.g.
  - $CFCl_3$ + electromagnetic radiation $\rightarrow CFCl_2 + Cl$
  - The Cl and Br atoms can then destroy ozone molecules through a variety of catalytic cycles.
- In the simplest example of such a cycle, a chlorine atom reacts with an ozone molecule, taking an oxygen atom with it (forming ClO) and leaving a normal oxygen molecule.
- The chlorine monoxide (i.e., the ClO) can react with a second molecule of ozone (i.e., O3) to yield another chlorine atom and two molecules of oxygen. The chemical shorthand for these gas-phase reactions is:
  - $Cl + O_3 \rightarrow ClO + O_2$:

❖ Ozone = Greek = smell		area	: 20 m.sq.km
❖ Discovered by	: van marron	first by	: 1984 / NASA
❖ Name coined by	: Shaan Bean	place	: antartica
❖ Density unit : Dobson unit (Du)			

❖ The chlorine atom changes an ozone molecule to ordinary oxygen

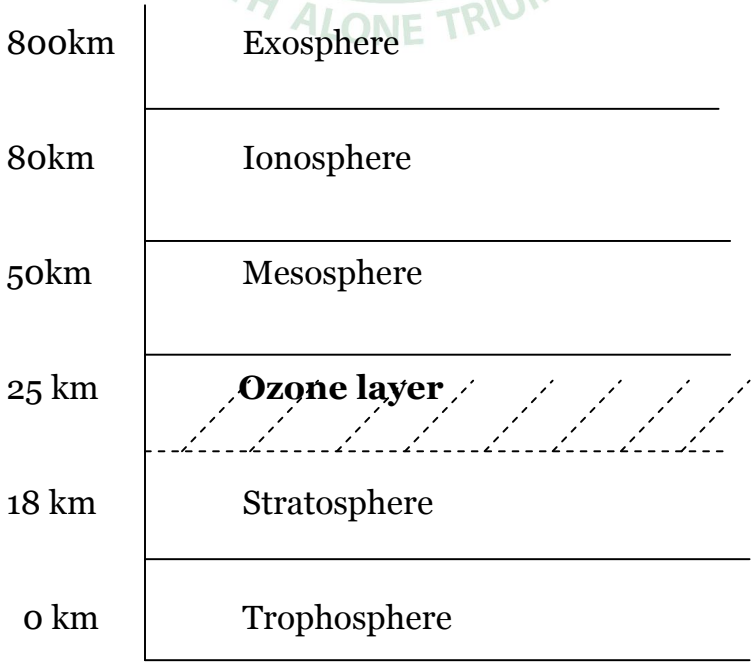
- $ClO + O_3 \rightarrow Cl + 2\ O_2$

❖ The ClO from the previous reaction destroys a second ozone molecule and recreates the original chlorine atom, which can repeat the first reaction and continue to destroy ozone.

❖ CFCs and related compounds in the atmosphere

❖ Chlorofluorocarbons (CFCs) and other halogenated ozone depleting substances (ODS) are mainly responsible for man-made chemical ozone depletion.

❖ The total amount of effective halogens (chlorine and bromine) in the stratosphere can be calculated and are known as the equivalent effective stratospheric chlorine



Effects :

- Skin cancer
- Cataract
- Melanin pigment change
- Global warming

Green House Effect

❖ The trapping of the sun's warmth in a planet's lower atmosphere, due to the greater transparency of the atmosphere to visible radiation from the sun than to infrared radiation emitted from the planet's surface.

❖ The greenhouse effect is a process by which thermal radiation from a planetary surface is absorbed by atmospheric greenhouse gases, and is re-radiated in all directions.

❖ Since part of this re-radiation is back towards the surface and the lower atmosphere, it results in an elevation of the average surface temperature above what it would be in the absence of the gases

❖ CO_2 is produced by fossil fuel burning and other activities such as cement production and tropical deforestation

❖ Greenhouse gases are those that can absorb and emit infrared radiation, but not radiation in or near the visible spectrum.

❖ In order, the most abundant greenhouse gases in Earth's atmosphere are:

- Carbon dioxide (CO_2) - 60%
- Methane (CH_4) - 20%
- Nitrousoxide (N_2O) - 16%
- CFCs - 6%
- Ozone (O3)
- Watervapor (H_2O)

❖ The Earth receives energy from the Sun in the form UV, visible, and near IR radiation, most of which passes through the atmosphere without being absorbed.

❖ Of the total amount of energy available at the top of the atmosphere (TOA), about 50% is absorbed at the Earth's surface.

❖ Because it is warm, the surface radiates far IR thermal radiation that consists of wavelengths that are predominantly much longer than the wavelengths that were absorbed (the overlap between

the incident solar spectrum and the terrestrial thermal spectrum is small enough to be neglected for most purposes).

- Most of this thermal radiation is absorbed by the atmosphere and re-radiated both upwards and downwards; that radiated downwards is absorbed by the Earth's surface.
- This trapping of long-wavelength thermal radiation leads to a higher equilibrium temperature than if the atmosphere were absent

Control devices

- The following items are commonly used as pollution control devices by industry or transportation devices.
- They can either destroy contaminants or remove them from an exhaust stream before it is emitted into the atmosphere.

Particulate control

- Mechanical collectors (dust cyclones, multicyclones)
- Electrostatic precipitators (ESP), or electrostatic air cleaner is a particulate collection device that removes particles from a flowing gas (such as air) using the force of an induced electrostatic charge.
- Electrostatic precipitators are highly efficient filtration devices that minimally impede the flow of gases through the device, and can easily remove fine particulates such as dust and smoke from the air stream.
- Baghouses Designed to handle heavy dust loads, a dust collector consists of a blower, dust filter, a filter-cleaning system, and a dust receptacle or dust removal system (distinguished from air cleaners which utilize disposable filters to remove the dust).
- Particulate scrubbers Wet scrubber is a form of pollution control technology.
- The term describes a variety of devices that use pollutants from a furnace flue gas or from other gas streams.
- In a wet scrubber, the polluted gas stream is brought into contact with the scrubbing

liquid, by spraying it with the liquid, by forcing it through a pool of liquid, or by some other contact method, so as to remove the pollutants.

Sound Pollution

- Noise pollution is the disturbing or excessive noise that may harm the activity or balance of human or animal life.
- The source of most outdoor noise worldwide is mainly caused by machines and transportation systems, Noise pollution is a major problem in countries such as India during the festivals of Diwali, Navaratri, and Ganpati.
- The government of India has regulations against firecrackers and loudspeakers, but enforcement is extremely lax. Vehicle, aircraft, and trains.Outdoor noise is summarized by the word environmental noise.
- Poor urban planning may give rise to noise pollution, since side-by-side industrial and residential buildings can result in noise pollution in the residential areas
- Noise pollution is measured by decibel units.
  - Jet plans - 145 db
  - Traffic - 90 db
  - Vaccum cleaner - 85 db
  - Speech - 60 db

Effects :

- Hearing loss
- Cardiovascular effects
- Stress
- Annoyance
- Child physical development
- The skin, the largest organ of the body, protects the internal system from knocks, scrapes and cuts; senses changes in the environment;
- The main route for air pollutants is through the nose, mouth and throat.
- The nose is very efficient at trapping and holding some inhaled pollutants.
- Concentrations of chemicals build up in the nose as the air is cleaned.
- The pollutants that accumulate in the nose can cause problems in the nose and sinuses or be absorbed in mucus membranes,

resulting in a number of harmful effects on the body.

Radio Active Pollution

- Radioactive wastes are wastes that contain radioactive material. Radioactive wastes are usually by-products of nuclear power generation and other applications of nuclear fission or nuclear technology, such as research and medicine.
- Radioactive contamination, also called radiological contamination, is the deposition of, or presence of radioactive substances on surfaces or within solids, liquids or gases (including the human body), where their presence is unintended or undesirable .
- Such contamination presents a hazard because of the radioactive decay of the contaminants, which emit harmful ionising radiation such as alpha or beta particles, gamma rays or neutrons.

Effects:

- The impact Long-term exposure or exposure to high amounts of radiation can have far more serious health effects.
- Radioactive rays can cause irreparable damage to DNA molecules and can lead to a life-threatening condition. Prolonged exposure leads to a large number of molecules in the body being ionized into free radicals.
- Free radicals promote the growth of cancerous cells, i.e. tumors, in the body. People with heavy radiation exposure are at a very high risk for cancers
- The impact of radioactive pollution on human beings can vary from mild to fatal; the magnitude of the adverse effects largely depends on the level and duration of exposure to radioactivity.
- Low levels of localized exposure may only have a superficial effect and cause mild skin irritation.

Preventive Measures :

- Out coming of Ratioactive waste is to be avoided
- Ratioactive waste is to be eliminated in safe manner.

- ❖ Precautionary measures is to be taken before the construction of nuclear breeders.
- ❖ Controlled atom bomb test is essential.

ENVIRONMENTAL POLLUTION - CAUSE AND EFFECT

Emerging life styles in modern societies

- ❖ Earth is the only planet known so far to have life in the solar system. Conditions on earth when life just originated were very different from what they are today. As condition changed, there evolved more and more varied forms of life.
- ❖ Primitive man's needs were modest gradually he discovered fire and invented tools and techniques. The invention and widespread use of different kinds of machineries brought about the Industrial revolution. This may be considered as a boon as well as bane to humanity.
- ❖ Some of our 'technological progresses' have seriously affected our air, water, land, forests, plants and animals. Because of the increase in population, we use up the resources excessively. We do not have control over the use of natural resources. We convert the forests into living places. Thus. we stop the rain which is a major natural source of water. Since forests disappear fast, we are causing soil erosion yet another damage to natural resource.
- ❖ The rapidly increasing population has led to an increase in the consumption of energy. The increasing consumption of fuels such as coal and petroleum is an alarming issue because already the world is running short of these fuels. Major amount of our precious foreign exchange goes out only for importing crude oil & petroleum products.
- ❖ The modern life style of man has ushered in the production and the usage of synthetic materials such as plastics, detergents, paints, refrigents etc. There are both advantages and disadvantages of using these synthetic materials.

Plastic: Advantages

1. Plastics are attractive and they are available in various forms.
2. They are easy to handle
3. Plastic bags are convenient for packing.

Disadvantages

1. Plastics are not easily degradable
2. They affect the soil fertility when dumped in the soil. They block the sewers.
3. The plastic bags cause serious problems if they are swallowed by animals.
4. Health will be affected if low quality plastics are used.
5. When burnt, plastic produces toxic gases.
6. Wastes generated from plastic manufacturing industries are toxic.

Advantages of Detergents

1. Good fragrance, better lather formation and quick result in removing dirt.

Disadvantages

- Waste water mixed with detergents when discharged affects soil fertility. Quantity of water used for rinsing is comparatively more because of excessive lather. Sometimes they are the cause of skin allergies.

Factors affecting environment

- There are many factors which affect our environment adversely, ego over and unplanned exploitation of resources, exploding population growth, industrialisation, use of synthetic materials etc. Man has started over using and over exploiting the natural resources such as, water, land, fuels etc which in turn cause the depletion or shortage of the resources. Over exploitation of the natural resources like forest, may result in shortage of fuel wood, changed climate, soil erosion, drought, etc.

The impact of the human activities on environment due to over population are as follows:

1. Air pollution (automobile and industrial exhausts)

2. Water pollution (Sewage from houses, effluents from industries)
3. Land pollution (excessive use of fertilizers, non-degradable materials, pesticides, fungicides etc)
4. Urbanisation (encroachment, deforestation)

Green chemistry

- Production of non hazardous chemicals and avoiding its usage leads to green world.

Kyoto Protocol :

- The Kyoto Protocol to the United Nations Framework Convention on Climate Change is an international treaty that sets binding obligations on industrialised countries to reduce emissions of greenhouse gases.
- 1997 In December the countries conclude the Kyoto Protocol in Kyoto, Japan, in which they agree to the broad outlines of emissions targets.

Global Village :

- Global Village is a term closely associated with Marshall McLuhan,
- McLuhan described how the globe has been contracted into a village by electric technology and the instantaneous movement of information from every quarter to every point at the same time.In bringing all social and political functions together in a sudden implosion, electric speed heightened human awareness of responsibility to an intense degree.

Global Village Tech Park:

- Global Village Tech Park is a Software Technology park in Bangalore, India.
- The park is situated on Mysore Road, about 12 km away from the city railway station.
- Global Village Tech Park was constructed, and is owned, by the Coffee Day group under the brand name Tanglin. It is equipped with all modern facilities and boasts posh greenery inside the park.

INDIA ENVIRONMENT MOVEMENTS

M.S. Swaminathan Research Centre:

- M S Swaminathan Research Foundation (MSSRF) is a non-profit research organization and was established in 1988.
- MSSRF has all along been developing and following a pro-nature, pro-poor, pro-women and pro-sustainable on-farm and non-farm livelihoods through appropriate ecotechnology and knowledge empowerment.

Bishnois Movement :

- Khejarli which is a village in Jodhpur district of Rajasthan, India 26 km south-east of the city of Jodhpur.
- The Bishnois sacrificed their lives while protecting trees by hugging to them.

Chipko movement :

- Act of hugging trees to protect them from being felled.
- By the 1980s the movement had spread throughout India and led to the formulation of people-sensitive forest policies, which put a stop to the open felling of trees in regions as far reaching as Vindhyas and the Western Ghats. Today, it is seen as an inspiration and a precursor for Chipko movement of Garhwal.
- Its leader was Sunderlal Bahuguna.

Silent Valley movement :

- Silent Valley was a social movement aimed at the protection of Silent valley, an evergreen tropical forest in the Palakkad district of Kerala, India.
- It was started in 1973 to save the Silent Valley Reserve Forest from being flooded by a hydroelectric project. The valley was declared as Silent Valley National Park in 1985.
- The Kuntipuzha is a major river that flows 15 km southwest from Silent Valley. It takes its origin in the lush green forests of Silent valley.
- In 1928 the location at Sairandhri on the Kunthipuzha River was identified as an ideal site for electricity generation.
- A study and survey was conducted in 1958 of the area about the possibility of a hydroelectric project of 120 MV and one costing Rs. 17

Crore was later proposed by the Kerala State Electricity Board.

Narmada Bachao Andolan Movement :

- Narmada Bachao Andolan (NBA) is a social movement consisting of adivasis, farmers, environmentalists, and human rights activists against a number of large dams being built across the Narmada river.
- The river flows through the states of Gujarat, and Madhya Pradesh in India.
- Sardar Sarovar Dam in Gujarat is one of the biggest dams on the river and was one of the first focal points of the movement.
- Narmada Bachao Andolan, with its leading spokespersons Medha Patkar and Baba Amte.

Blue cross movement :

- Animal welfare is main motive.

Global Warming

- Earth has warmed at an unprecedented rate over last hundred years and particularly over the last two decades.
- There is also an upsurge in the amount of extreme weather events, such as wildfires, heat waves and tropical storms. This is particularly because of the **Global Warming**.
- Global Warming is the **increase of Earth's average surface temperature due to effect of greenhouse gases**, such as carbon dioxide emissions from burning fossil fuels or from deforestation, which trap heat that would otherwise escape from Earth. This is a type of **greenhouse effect**.

Ocean acidification

- **Ocean acidification** is the on-going **decrease** in the **pH** of the **oceans,** caused by the uptake of **Carbon Dioxide (CO_2)** from the atmosphere.
- An estimated 30–40% of the carbon dioxide from human activity released into the atmosphere dissolves into **oceans, rivers** and **lakes.**

Climate change

- The term mitigation refers to efforts to **cut** or **prevent** the **emission of greenhouse gases** - limiting the magnitude of future warming.
- It may also encompass attempts to **remove greenhouse gases from the atmosphere**.
- It differs from climate change adaptation, which refers to the actions taken to manage the unavoidable impacts of climate change.

HEALTH & HYGINE

- Average 70 kg man will content the followings in body (in grams)

Water	-	41, 400	Mg	-	21
Fat	-	12,600	Cl	-	85
Protein	-	12,600	P	-	670
Carbohydrate	-	300	S	-	112
Na	-	63	Fe	-	3
K	-	150	I	-	0.014
Ca	-	1160			

- For body growth, protection and various physiological activities energy should be derived from food.

Nutrition types :

- Carbohydrate
- Fat
- Protein
- Vitamins
- Iodidne
- water

Types of foods :

a) bodybuilders	-	Protein	-	4.3/ gm
b) energy producers	-	Carbohydrate	-	4.1 / gm
c) stored energy	-	Fat	-	9.3 / gm

Food materials :

S.No	Food Materials	Ingradients	Uses
1.	Rice, wheat, sugar, potata	Carbohydrate	energy producers
2.	Oil, butter, ghee	Fat	stored energy
3.	Egg, milk, soya, grams, fish, meat	Protein	bodybuilders
4.	Vegetable, meat, fish, egg	Iodidne	regulators
5.	Fruits, vegetable.	Vitamins	Protection
6.	Water	Water	Transport medium;

Ingredients in 100 grams of nutritive food :

Food materials	Carbohydrate (gm)	Protein (gm)	Fat (gm)
Millets	70	10	0
Grams	60	20	0
soya	20	40	20
Fruits, vegetable	10	1	0
milk	3	4	4
egg	0	13	13
meat, fish	0	20	0
ghee	0	0	100
sugar	100	0	0

nuts	20	20	50

Composite food :

- The food which is essential for body growth should be having . Carbohydrate, Fat > Protein, water & Vitamins.

Works	Indian % man			Indian % woman		
	sedentary work	Moderate work	heavy work	sedentary work	Moderate work	heavy work
Basal activities	460	460	460	354	354	354
Non working activities	1220	1220	1220	826	526	526
working activies	750	1100	2200	610	900	1800
Total	2430	2780	3880	1790	2080	2980

BMI - Body Mass Index

$$BMI = \frac{\text{body weight (kg)}}{\text{height (meter}^2\text{)}}$$

1) 18.5 - 24 - 9 - correct weight
2) Below 18 - low weight
3) 25 - 30 - excess weight
4) Above 30 - obesity

- Sidha medicine : Agasthiar - Father of sidha medicine
- Ayurvedic medicine : Charaka - Father of Ayurvedic medicine
- Homoeopathy medicine : Samueval hennman - Father of Homoeopathy medicine

- Unani medicine : Hippocratus -Father of Unani medicine
- Yoga : Pathanchali - Father of yoga medicine

National Institutes

Siddha	-	Tamilnadu
Ayurveda	-	Jaipur
Homeopathy	-	West Bengal
Unani	-	Bengaluru, Karnataka
Yoga	-	Delhi

IMMUNE SYSTEM

- **Innate / Natural immunity (Non Specific)**
  - **Physical**: Skin, Nucleus
  - **Physiological**: Acid in stomach, Saliva in mouth
  - **Cellular**: WBC's
  - **Cytokine**: Viral infected cells produce interferon's
- **Adaptive/acquired immunity (Specific)**
  - **Active**
    - **Natural**: Injection recovery an actual disease
    - **Artificial**: Immunisation vaccination
  - **Passive**
    - **Natural**: Mother to
      1. Child via placenta or milk
      2. Mother's milk has Yellowish fluid colostrums That has abundant Antibodies (lgA)
    - **Artificial**: Injection of immune serum (Gama globulin)

VACCINES

AGE	VACCINE
New born boby	BCG
15 days	Polio
6 th week	Tripleantigen
10 th week	Tripleantigen+ Polio
14 th week	DPT + Polio
9 -12 month	Measles
18 - 20 month	DPT + Polio
1 - 2 years	MMR
2 - 3 years	Typhoid
4 - 6 years	DT + Polio
10 - years	TT + typhoid
16 - years	TT + typhoid

BIO-DIVERSITY & ITS CONSERVATION

WORLD WIDE ENVIORNMENT ORGANIZATIONS

- CSD - Commission on Sustainable Development
- WWF - World Wide Fund for nature
- IUCN - International Union for Conservation of nature.

INDIAN ENVIORNMENT ORGANIZATIONS

- MoEF - Ministry of Enviornment of Forests
- CPCB - Central Pollution Control Board
- NGT - National Green Tribunal
- TERI - Tata Energy Research Institute
- BRAI - Biotechnology Regulatory Authority of India

Total number of plants in India		**Total Number of Animals in India :**	
		Totally 81,251 species are in India	
Phanarogams plants	- 15000	Insects	- 60000
Algae	- 1676	Mollusca	- 5000
Creep plant	- 1940	Mammals	- 372
Fungi	- 12480	Birds	- 1228
Bryophytes	- 2813	Reptiles	- 446
Pteridophytes	- 1012	Amphibines	- 204
		Fishes	- 2546

India

- National Animal - Bengal Tiger - Panthera tigris
- National Bird - Peacock - Pavo Crytatus

- National Fruit - Mango - Mangifera indica
- National Tree - Banyan Tree - Ficus Bengalensis
- National Flower - Lotus - Nelumbo neucifera
- Special Animal - Elephant - Elephentiasis Maximus
- National Aquatic animal - gangetic dolphins - Planista gangestica

Tamil Nadu

- Animal - Nilgiris Tahr
- Tree - Palmyra Palm
- Flower - Gloriosa lily / glory lily
- Bird - Emerald Dove
- Special flower - Kurinchi

National Park	Wild life sanctuary
❖ National Park is an area dedicated to protect the environment, the natural objects and the wild life there in no human habitation is permitted in main area.	❖ Sanctuaries are the places where the animals are well protected from any disturbance.
❖ Harvesting timbers, cultivation, collection of forest products are restricted	❖ Harvesting timbers, cultivation, collection of forest products are allowed with permission.
❖ The national park is cannot be changed into wildlife sanctuary	❖ The wildlife sanctuary can be changed into national park
❖ Total number of national park in India is 166	❖ Total number of wild life sanctuary in India is 442

MAB – Man And Biosphere

- In India there are 18 biosphere 's are there among which in these 11 were recognized by UNESCO

Sl. No.	World Biosphere Reserve	State	Year
1.	Nilgiri	TamilNadu, Karnataka, Kerala	2000
2.	Gulf of Mannar	Tamilnadu	2001
3.	Sundarbungs	West Bengal	2001
4.	Nandadevi	Uttarkhand	2004
5.	Simlipal	Odisha	2008
6.	Pachmarhi	Madhya Pradesh	2009
7.	Nokreh	Mehlaya	2009
8.	Achanakmar-Amarkantak	Chhattisgarh-Madhyapradesh	2012
9.	Nicobar Island	Andhaman- Nicobar	2013
10.	Agasthyamalai B.R.	Kerala – TN	2016
11.	Khangchentzonga	Sikkim	2018

The other biosphere's in India

Biosphere	State	year
Manas	Assam	1989
Dipru	Assam	1997
Dihang- Dibang	Arunachal pradesh	1998
Kangchenjunga	Sikkim	2000
Agashthyamalai	Kerala, Tamilnadu	2001
Great Rann of Kutch	Gujarat	2008
Cold Desert	Himachalpradesh	2009

Seshachalam	Andhrapradesh	2010
Panna	Madhya Pradesh	2011

Part	Name	Area	Year	Special
Biosphere Reserves	Nilgiri	Western ghats (Karnataka> Tamilnadu> Kerala	1986	First Bio-spehere reserve in India
	Gulf of Mannar	In between India & Sri lanka	1989	Marine biosphere reserve in India
	Agashthyamalai	Tamilnadu, Kerala, Western Ghats	2001	
National parks	Guindy	Chennai	1976	Eighth Smallest national park in India
	Gulf of Mannar marine national Park	Ramnad	1980	
	Mukurthi	Nilgiri	1982	The park was created to protect its Keystone species, the Nilgiri Tahr
	Mudumalai	Nilgiri	1940	First Modern National park in south India
	Indhra Gandhi national Park	Coimbatore	1989	First it was called Annaimalai National park. Largest national park in TamilNadu
	Mudumalai (Tiger)	Nilgiri	1940	
	Kalakkadu	Tirunelveli	1962	Lion tailed macaque

Wildlife Sanctuary				
	Mudumalai wildlife Sanctuary	Tirunelveli	1962	The Kalakkad Mundanthurai Tiger Reserve was created in 1988 by combining Kalakad Wildlife Sanctuary.
	Point calimere	Nagapattinam	1967	Deers
	Annamali/ Indhira Gandhi Wild life sanctuary	Coimbatore	1974	Inspite of Indhira Gandhi remarkable visit the old name of Annamalai was changed to Indhira Gandhi wildlife sanctuary
Squirrel Wildlife Sanctuary	Srivilliputhur sanctuary	Virudhunagar	1988	Grizzled squirrels
	Sathyamangalam Tiger & Wildlife Sanctuary	Erode	2008	Largest wildlife sanctuary in Tamilnadu
	Kanyakumari	Kanyakumari	2006	
	Meghamalai	Theni	2012	Last wildlife sanctuary in Tamilnadu
	Vallanadu	Tutucorin		
Tiger Reserve	Mudumalai	Nilgiri	2007	
	Kalakkadu	Tirunelveli	1988	
	Annamalai parambikkulam	Coimbatore	2006	

	Sathyamangalam	Erode	2012	Maximum tiger resident area

1992 PROJECT ELEPHANT – 4 SANCTUARY				
Elephant Sanctuary	Srivilliputhur	Virudhunagar	2002	
	Nilgiri	Nilgiri	2003	
	coimbatore	Coimbatore	2003	
	Annamali	Coimbatore	2003	
Conservation Reserves	Thiruvidaimarudhur	Tanjore	2005	
Bird Sanctuary	Vedanthangal	Kanchipuram	1936	
	Kodiyakkarai	Nagappatinam	1967	
	Vetangudi	Sivagangai	1977	
	Moondradaippu	Tirunelveli	1977	
	Pulicat lake	Thiruvallur	1980	
	Moondradaippu	Ramnad	1989	
	Kanchirakulam	Ramnad	1989	
	karikili	Kanchipuram	1989	
	Udhayamarthandapuram	Thiruvarur	1991	
	Vaduvoore	Thiruvarur	1991	
	Kundhankulam	Tirunelveli	1994	
	Vellode	Erode	1997	
	Melselvanoore	Ramnad	1998	
	Vaduvore	Tanjore	1999	
	Viralimalai	Trichi		
	Kalaperampur	Tanjore		
	Suchindram Teroor	Kanyakumari		

HUMAN DISEASES

Disease

Disease is a condition of the body or a part of it in which functions are disturbed

Human Diseases

- Congential Diseases
- Acquired Diseases
  - a) Infectious
  - b) Deficiency
  - c) Allergies
  - d) Degenerative

Communicable Diseases

1. Bacteria
2. Virus
3. Protozoa
4. Fungi
5. Helminth

Non Communicable Diseases

Deficiency
1. Vitamin
2. Proteins

Degenerative
1. Heart
2 Brain
3.Digestive
4.Lungs
5. Kidney
6.Eye

1. Bacteria :

Diseases	Causative agent
Thyphoid	Salmonella typhosa
Tetanus	Clostridium tetani
Cholera	Vibrio cholera
Syphilis	Troponema pallidum
Pneumonia	Diplococcus pneumonia
Gonorrhoea	Nesseria gonorrhoeae

Leprosy	Mycobacterium leprae
Plague	Bacillus yersinia pestis
Tuberculosis	Mucobacterium
Whooping cough	tuberculosis
Meningitis	Berdetall pertussis
Diptheira	Neisseria meningitides
	Cornebacterium
	diptheria

2. Virus:

Virus	Family
HIV virus	Retrovirus
Chicken pox	Orthomyzovirus
Influenze	Paramyxovirus
Measles	Paramyxovirus
Mumps	Togavirus
German Measles	Enterovirus
Poliomyelitis	Rabdovirus
Rabies	Rabdovirus

3. Fungi :

Name of Disease	Causative Agent
Dermatitis	Epidermophyton
Candiasis	Candido albigans
Liverrosis	Asper flavus
Allergy	Asper gillus
Drug	Claviceps purpuria

4. Protozoa :

Name of Disease	Causative agent	Vector	Parts affected/ symptoms
African sleeping sickness	Trypanosome gambiense	Tse – tse	Blood and nervous tissue.
	Entamoeba histolytica	---	Pain in abdomen.
Amoebic Dysentery	Leishmania donovani	Sand fly	Spleen and liver enlarge and high fever develops.
Kala Azar	Plasmodium sp.	Female anopheles mosquito	Periodical attack of high fever, pain joints
Malaria	i) p. vivax	”	accompanied by chill heavy perspiration and fast pulse.
	ii) p. falciparum	”	
	iii) p. malariae	”	
	iv) p. ovale	”	

5. Helminth :

Name of Disease	Causitive agent	vector	Parts affected/ symptoms
Ascariasis	Ascaris lumbricoides	----	loose motions.
Elephantiasis or filariasis	Wuchereria bancrofti	Female culex mosquito snail	Anaemia, abnormal enlargement and swelling of legs.
Schistosomiasis	Schistosoma haematobium	pig	Itching rachesaches fever and eosinophilia General weakness
Taenuasis	Tenia solium		

6. Vitamin : VIT – A :

Name	Discovered	Deficiency
Retinol Antixerophthalmic vitamin anti infection vitamin	Maccallum 1913	Xerophthalmia Nyctalopia Dermatosis Keratomalacia

VIT – D :

Name	Discovered	Deficiency
Calciferol, antirachitic, Sunshine Vit	Maccullum 1922	Osteomalacia, Rickets, tetany

VIT – E :

Name	Discovered	Deficiency
Tocopherol, Antisterility	Mattil & Conklin; 1920	Muscular atrophy Sterility

VIT – K :

Name	Discovered	Deficiency
Antihamorrbagic	Dam 1935	Haemorrhage due to defective blood coagulation

VIT – B Complex

Vitamins	Name	Discovered	Deficiency
B1	Thiamine	Janson & donath 1926	Beri-beri
B2	Riboflavin	War burgh & Christian 1932	Chilosis, keratosis
B3	Pantothenic acid	Williams; 1933	Nervous disorders

B5	Nicotinic acid, niacin	Kesal 1935	pellagra
B7	Biotin	Bateman 1916	Dermatits, thickening of skin
B9	Folic acid	Day	Nutritional disorder, Retarded growth
B12	Cyanocobalamin or cobalamin	Smith & parker 1948	Megaloblastic or pernicious anaemia, hyperglycaemia
Vit C	Ascorbic acid	Szent gyorgi 1928	Scurvy, malformation of teeth, bones and gums

7. Proteins :

Diseases	Causes
Marasmus kwashiorkor	Weight loss in children, dysentery, skin is coated over body. Muscles become thin face and stomach becomes bulgy

8. Heart :

Diseases	Causes
Myocardial infraction	Death
Heart pain	Due to oxygen Deficiency
Arteriosclerosis	Blood arteries swallon in size
Heart block	Waves do not pass to ventricles.
Blood pressure	Averge 120 / 80 mm hg / by : Sphygmomanometer.

9. Brain

Diseases	Causes
Amnesia	Memory loss
Parkinson	Paralysis
Huntington chorea	Body movement paralysed (Third generation)
Block	Blood vessel collapse
Head ache	Brain membrane swelling
Herpes zoster	Skin disease
Alzheimer	Continuous memory loss
Epilepsy	Excessive function of CNS
Edema	Blood leak in blood vessels

10. Digestive :

Diseases	Causes
Peptic ulcer	More secretion of Hcl
Herenea (hernia)	Busrtruptuned (pain)
Appendix	Small intestinal bulge
Gall bladder stone	Stone formation above 40 years
Hepatitis	Malfunction of liver

11.; Lungs :

Diseases	Causes
Pneumonia	Blood stroge in alveoli 1. virus 2. bacteria
T.B	1. bacteria
Bronchitis	Shrunken alveoli
Chronic Bronchitis	Swallon alveoli
Asthma	Shrunken bronchi

12. Kidney :

Diseases	Causes
Kidney malfunction	Pressure increased
Kidney stones	Pain
Diabetes mellitus (insulin dependent)	Polyurea, polydypsia, polyphagia

13. Eye :

Name of Diseases	Effects / symptoms
Myopia	Short sightedness (Bioconcave lens)
Hypermetropia	Far sightness (Biconvex lens)
Cataract	Lens becomes opaque - Normal vision in hampered, blindness may be caused

Agencies involved in Control of Diseases

The following are involved in control of diseases:

- National Leprosy Eradication Programme (NLEP) – to eradicate leprosy
- Massive Polio immunisation campaign to arrest polio completely
- National Tuberculosis Programme – NTP to eradicate Tuberculosis
- National Filaria Control Programme (NFCP) – to eradicate Filaria
- National Malaria Eradication Programme (NMEP) – to stamp out Malaria
- The National Immunisation programme in India – recommends Measles vaccination MMR between 9 and 15 Months of age
- Global immunisation programme for children to protect them against six preventable diseases DPT, Polio, Tuber Culosis and Measles.
- The state AIDS cell started functioning in Tamilnadu from 1990 to create awareness about AIDS.

14. Latest Disease:

Disease	Causes	Origin and Affected Areas	Year	Pathogen
Severe Acute Respiratory Syndrome (SARS)	Fever of 38°C (100°F) or higher and shortness of breath	Southern China	2002	SARS Corona virus (SARS – COV)
Zika Virus	1. Increase neurologic complications 2. Infection during pregnancy cause microcephaly in infants	Zika forest of Uganda	1947	Aedes Mosquitoes such as A.aegypti A.albopictus
Ebola Virus (EBOV)	• Decrease the function of Liver and Kidneys • Highrisk of death	West Africa	2013-2015	Zaire Ebola Virus
Dengue Fever (Dengue Virus)	• Muscle and joint • Higher Fever	Across world	Since second world war	Aedes Mosquitoes principally A.aegypti
Swine influenza	• Fever • Muscle pains • Respiratory problems		1918, In India – 2015	Swine in Fluenza Virus (SIV)