

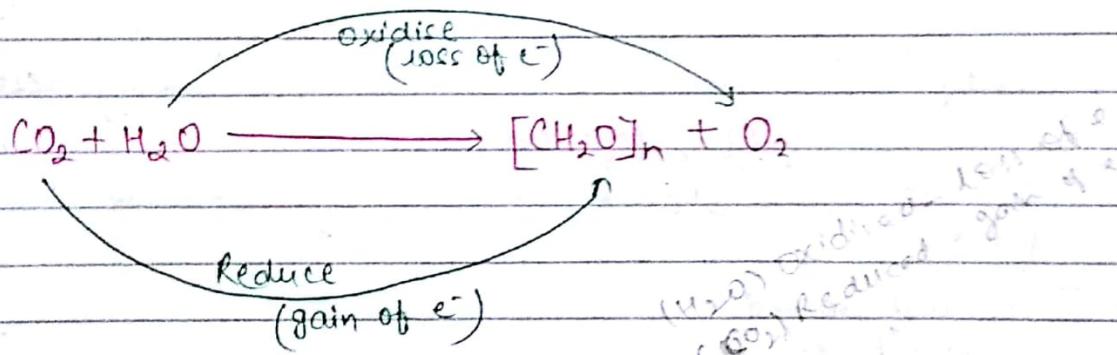
Plant Physiology + Plant Dev Bio.

①

PHOTOSYNTHESIS

(Synthesis using light)

- Photosynthesis is a energy absorbing process / endothermic process or endergonic process in which light energy is utilized.
- It is an anabolic process in which smaller inorganic mol. (CO_2 and H_2O) is converted into larger organic mol.
- Photosynthesis is a redox reacn in which H_2O is oxidised (loss of e^-) and CO_2 is reduced that means H_2O act as a e^- donor.



- PS is completed into two diff. steps
 1. Light Reaction
 2. Dark Reaction

"Photosynthesis is a physiological process in which smaller inorganic mol. is converted into larger mol. by using various enzymes and their activity is regulated by light directly (in light reacn) and indirectly (in dark reacn)."

* Significance of PS

- PS is the only physiological process that can harvest solar energy into chemical (bio) energy which is universal source of energy of earth surface.

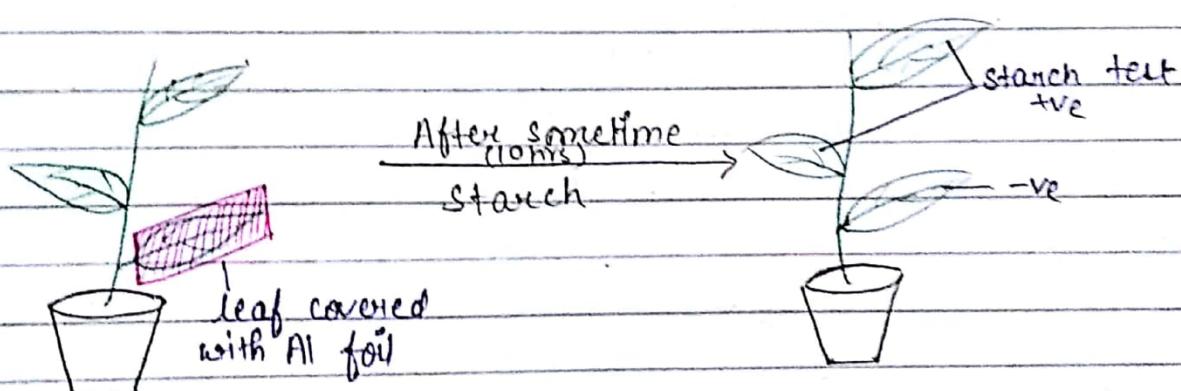
It is the ultimate source of O_2 .

Significance of O_2

- O_2 enhances metabolic efficiencies upto 15-16 times. That facilitates energy conservation.
- It is responsible for formation of ozone layer that protects the earth surface against harmful rays.

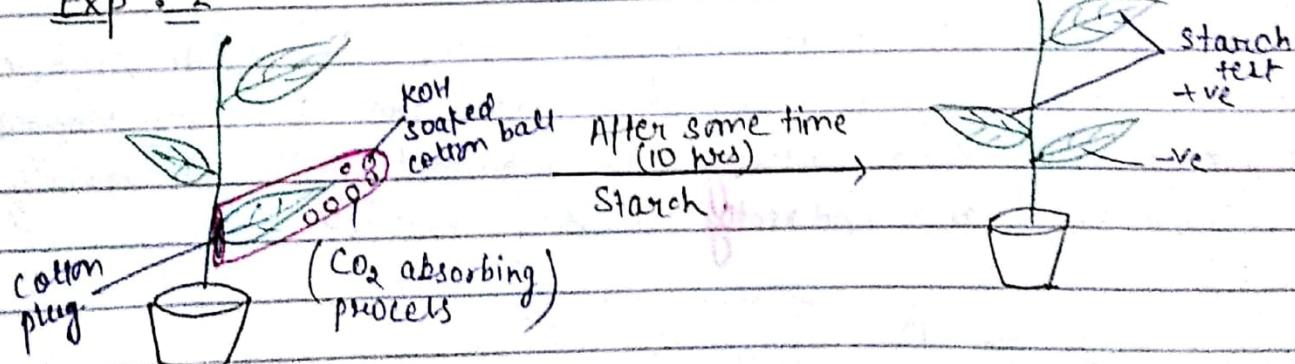
Some exp. regarding Photosynthesis -

Exp : 1



According to this exp. sunlight and Chlorophyll is essential for photosynthesis.

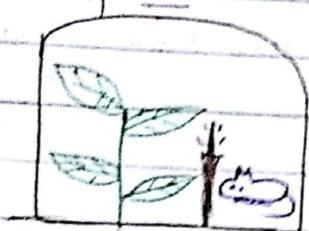
Exp : 2



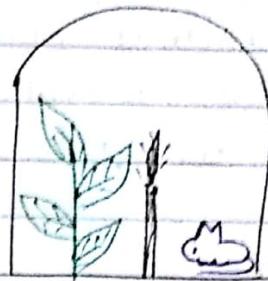
CO_2 is essential for photosynthesis.

Exp : 3

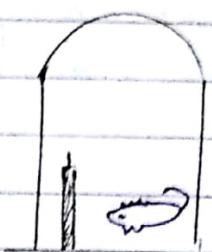
(2)



After sometime

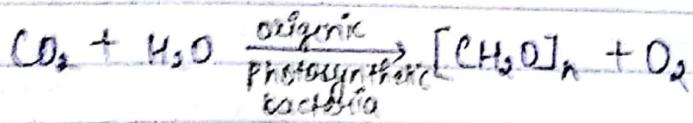
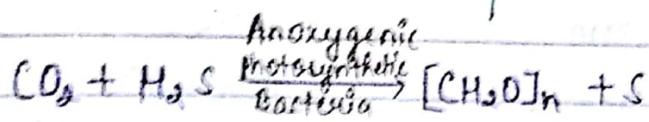


After sometime



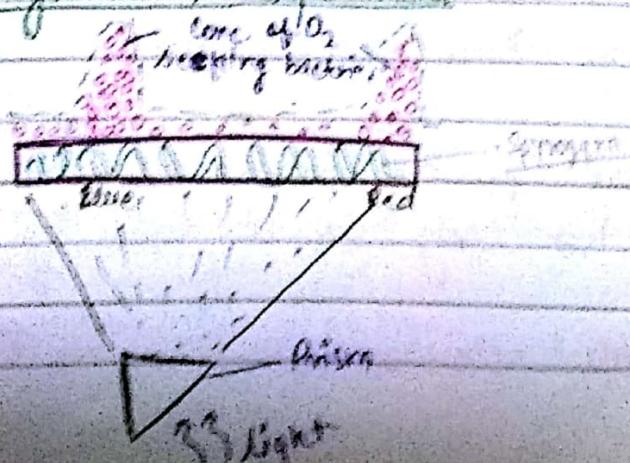
A/C to this exp plant convert phlogiston (impure) air into dephlogiston air (pure).

Exp : 4 C.V. Van Niel experiment



This exp prove that O₂ is derived from H₂O not from the CO₂.

Exp : 5 Englemann's experiment



Animal Physiology + Animal Dev Bio.

17/09/18

①

→ BLOOD ←

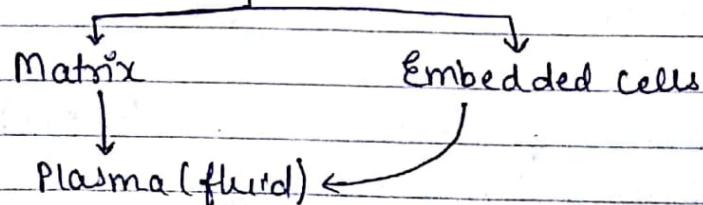
- Q If 'A' blood gp. blood is transferred to a person with 'B' blood gp., then minor and major agglutination reaction will occur b/w respectively -
 - a) Agglutinins of the Recipient and agglutinogen of the donor for minor reaction and agglutinogen of recipient to agglutinin of donor for major reaction.
 - b) Agglutinins of donor and agglutinogens of recipient for minor and agglutinins of recipient to agglutinogens of donor for major reaction.

- Q. Which one is the best suitable statement for defining the serum -

- (a) Plasma - prothrombin and fibrinogen (II)
- (b) Plasma - all clotting factors
- (c) Plasma - some clotting factors
- (d) Plasma - Clotting factor I, II, V, VIII ✓

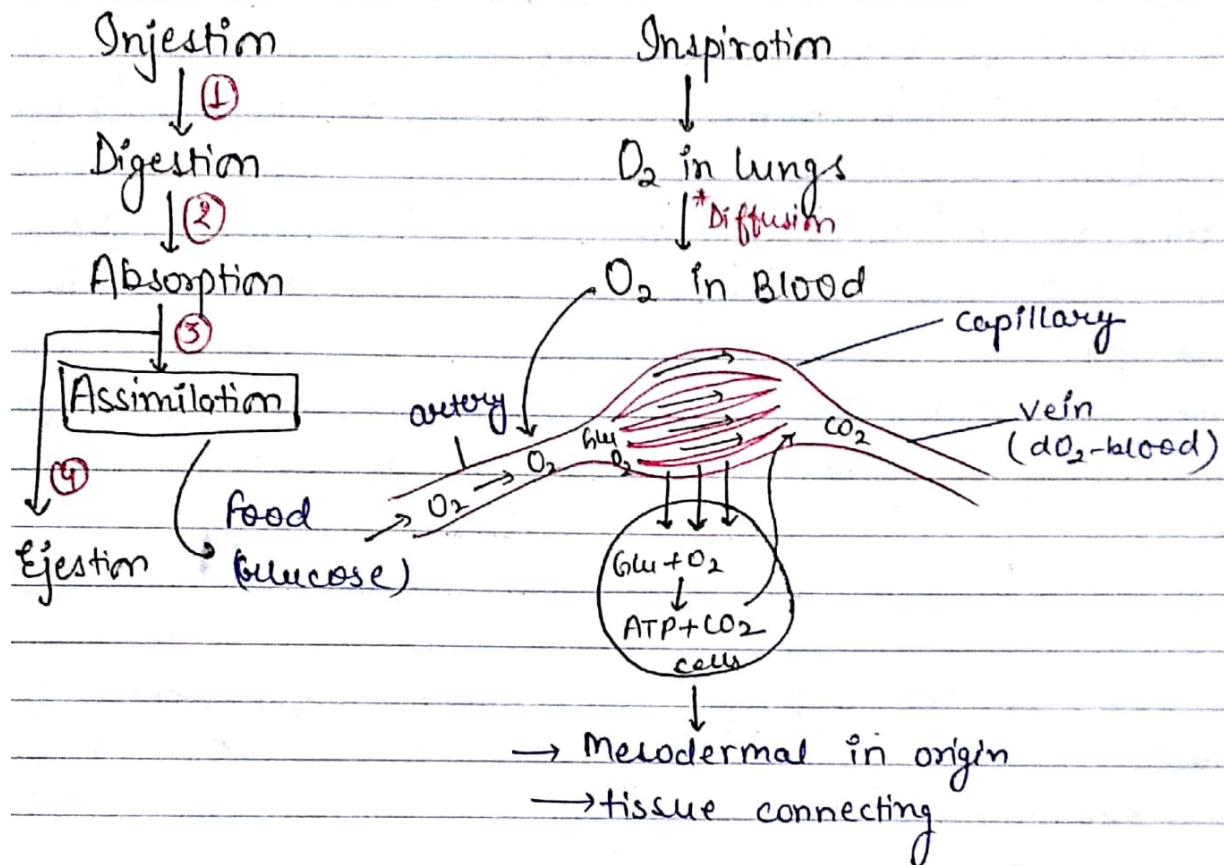
→ Blood ←

- Study - Haematology
- Specialized fluid connective tissue



- Slightly alkaline 7.4 pH.
- viscous in nature.
- The normal total circulating blood volume is about 8% of the body weight.

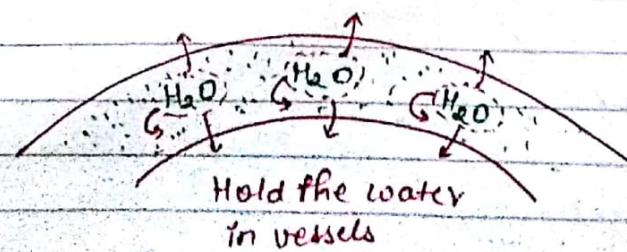
- 5-6 lit blood in human (adult).



- Blood is considered as connective tissues for a basic reason-
 - 1 → Embryologically it has the same origin (melodermal) as do the other connective tissues
 - 2 → Blood connects body system together bringing the needed O₂, nutrients, hormones etc. and removing the waste.

Blood Composition

- Albumin - Responsible for colloidal osmotic pressure (oncotic pressure).



Blood composition

Blood Plasma
82 (55.1%)

formed elements
(Blood cells - 45%)

→ Water (92%)

→ Major plasma protein (6-7%)

— Albumin (most abundant in plasma - 4%)

— Globulin (~2%)

— Fibrinogen (~1%)

→ Others

— Ions

— Nutrients

— NPN (Non-proteinaceous nitrogenous substances)

— Hormones

— Cholesterol

→ Oncotic pressure or colloidal osmotic pressure - Osmotic pressure exerted by proteins notably albumin in a blood vessel that usually tends to pull water into the circulatory sys.

- Globulin — α -Globulin | Act as carrier transport for hormones
 β -Globulin | Vitamins etc.

γ -Globulin — Immunoglobulin → Adaptive immunity

- Fibrinogen — Role in hemostasis (prevention of blood loss)

- Fibrinogen is the largest among 3 major plasma proteins.
(in size)

NOTE - Major plasma proteins are synthesized in the liver except γ -globulin (synthesized by B-cells)

Ecology & Evolution

Ecology and Environment

(Q) Basics: Terms related to ecology and environment

(i) Species

(ii) Population

(iii) Community/ Biocoenosis

(iv) Factor

(v) Environment

(vi) Latitudinal diversity of earth

(vii) Atmosphere

(viii) Ecosystem

(ix) Ecology

(x) Autecology Vs. Synecology

(xi) Ecotone / transition zone

(xii) Ecological equivalent

(xiii) Ecosystem services

(xiv) Technoecosystem

(xv) Ecological Foot print / GPP

(xvi) Carbon foot print

(xvii) Carbon Hand Print

(xviii) Carbon sequestration

(xix) Biological succession

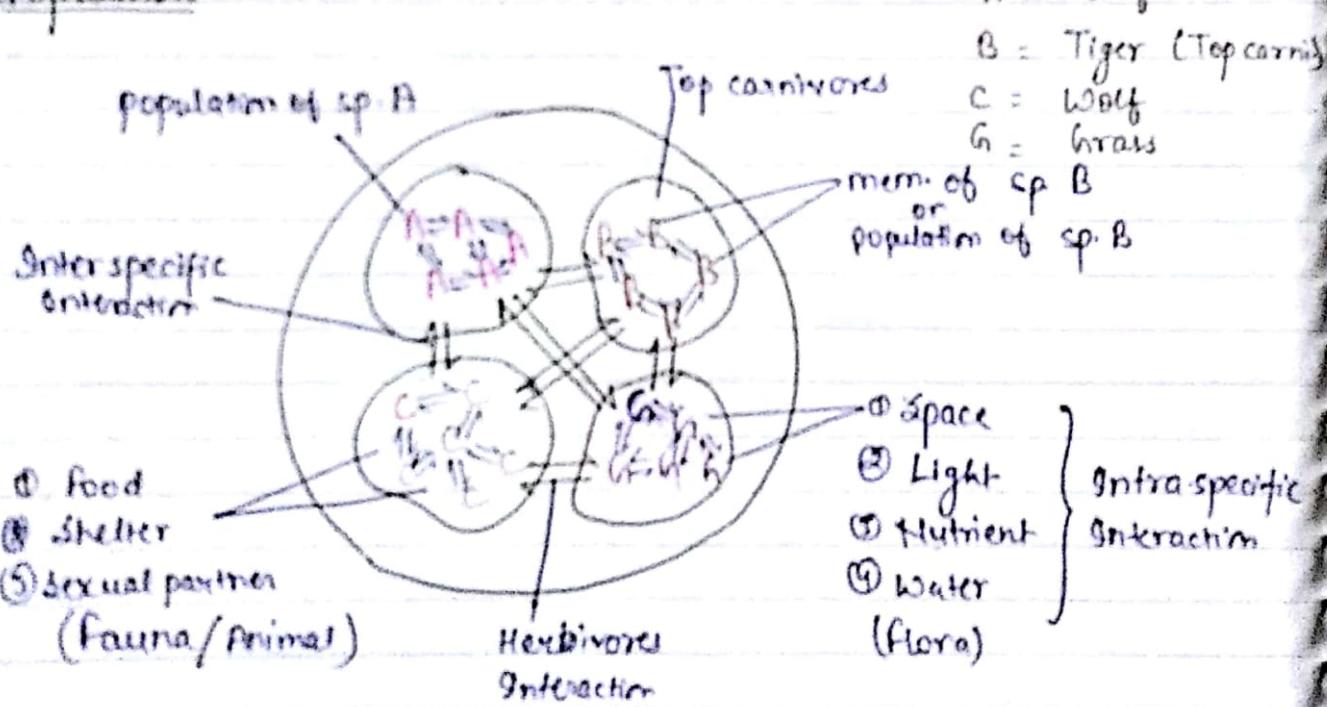
(xx) Transitional Niche

Miscellaneous

1. Species

- There are various concept of spp. like morphological given by Linneaus, genetic given by Lotey and biological given by Mayr.
- In ecology and env. biological spp. concept given by Mayr is widely used.
- spp. is a basic unit of Taxonomy, i.e. deals with nomenclature and classification.
- A/c to Mayr when individual can interbreed/reproduce and can produce fertile offspring then they are said to be mem. of same spp.

2. Population

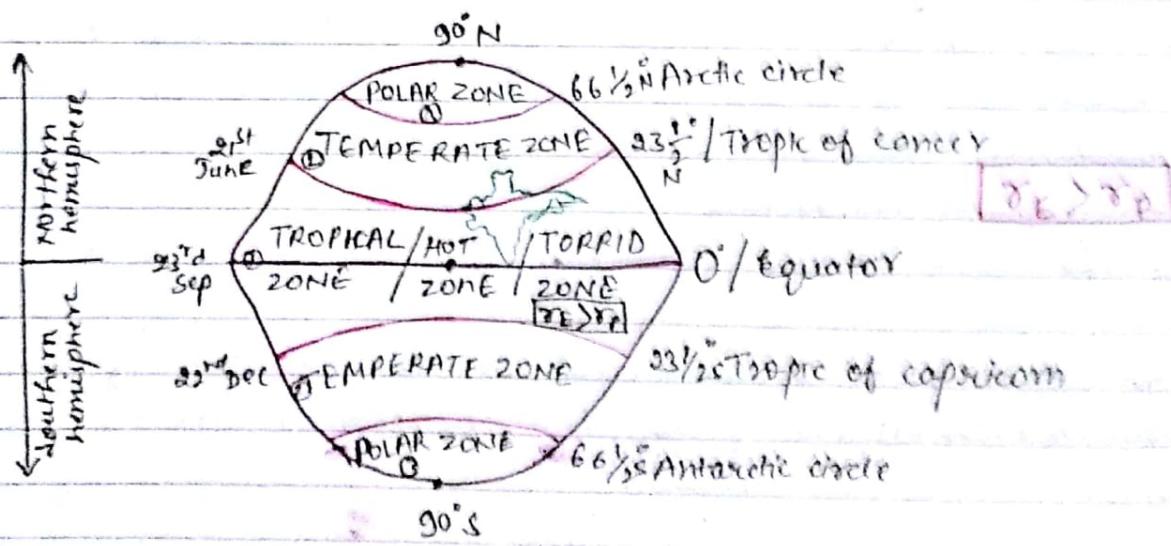


- It is defined as sum of all individuals that belongs to a given spp. in a given area.

3. Community / Biocoenosis

- It is sum of all diff. population in a given area i.e. it

- Includes population of all plants i.e. flora, animals i.e. fauna and micro-organisms.
- Community forms biotic component of the locality.
- Note - Competition can be both inter and intraspecific.
- When there occurs competition among mem. of same spp. it is called **intraspecific**.
- When competition occurs among mem. diff. spp. it is called **interspecific**.
- In flora intraspecific competition can be for light, space, moisture, nutrient.
- In fauna intraspecific competition can be for food, shelter and **societal partners**.
- Competition is exp. of intraspecific interaction.
- Carnivores, Predation, top carnivores are exp. of interspecific interaction.



Shape of Earth = GEOID / Oblate spheroid

4. Factor

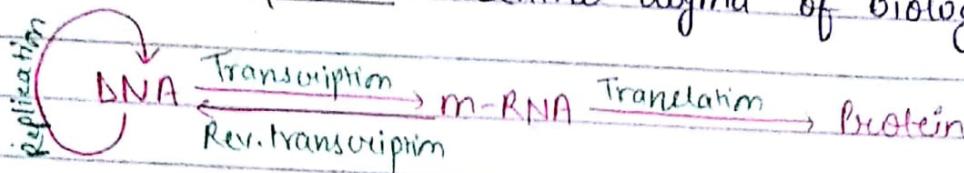
- Factor is defined as any force, substance or condition that effects individual in any way, for ex. light, rainfall, competition.

Pedigree Analysis
Law of inheritance
Binomial theory by Mendel.

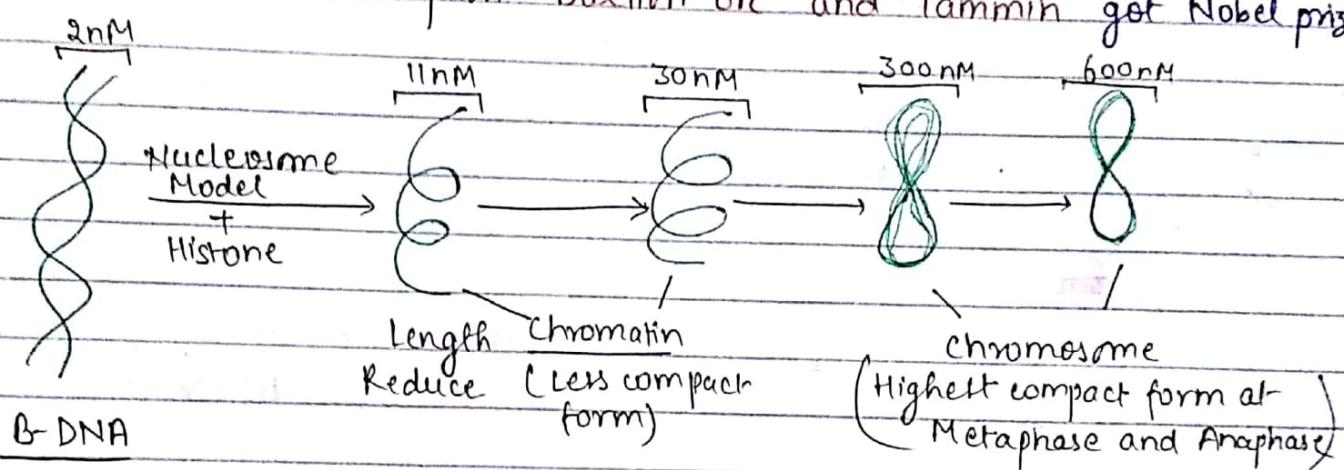
11/07/18

Genetics - Classical / Molecular / Evolutionary

Classical Genetics - Central dogma of Biology



Rev. transcription - Balatonye and Tammin got Nobel prize



In a eukaryotic cell, DNA is tightly around histone proteins (forming chromatin) and when a cell prepares for division, the chromatin coils upon itself multiple times to form compact chromosome.

Q. Which of the following types of chr. is not found in human cells?

- a) Metacentric chr./chromatin
- b) Sub-metacentric chr.
- c) Acrocentric chr.
- d) Telocentric chr.

Ans- d (+ht. in Mouse)

gene - a unit of DNA that is usually about 100 nm and that controls the development of one or more traits. It is the basic unit by which genetic information is passed from parent to offspring.

long arm (q)

short arm (p)

Chromatins / Chromosome

With centromere

(Centromeric chr.)

Monocentric

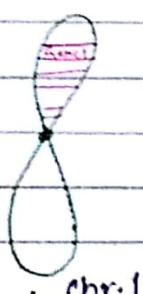
Polycentric

Metacentric

Sub-metacentric

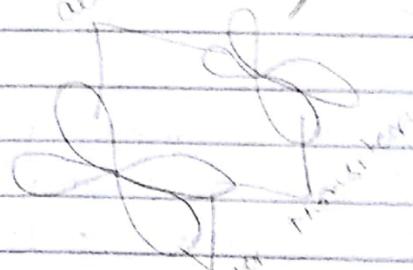
Acentric

Telocentric



1 - Chr = 1 DNA

(alternative form of genes called Alleles)



Human cell (Diploid)

46 chr.

↓

Autosomes = 44 chr.
(other than X & Y chr.)

Allosomes = 2 chr.
(Sex chr. X & Y chr.)

Human cell (Diploid)

46 chr.

Homologous chr.

#1 #11

#10 #18

Non-Homologous
chr.

#1, #5
#7, #10

Homologous
chr.

#X #Y

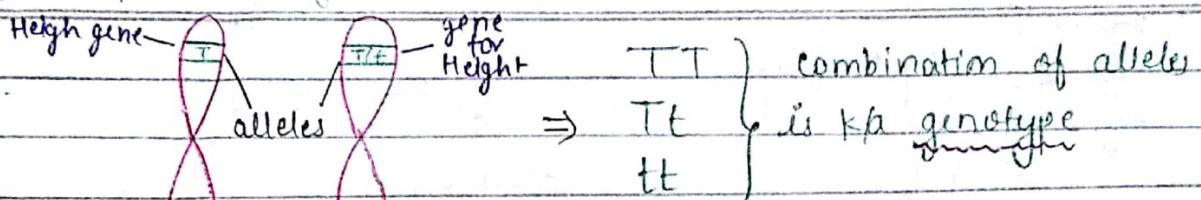
Gene \rightarrow height

allele - TT

Multiple alleles - TT, Tt, tt (genotypes)

Physical appearance by alleles - phenotype

Height gene



T = Dominant form

t = Recessive form

Genotype - TT — Tall

Tt — Tall

tt — Dwarf

Physical appearance (Phenotype)

Phenotype is governed by genotype

Q- Which of the following is the right position of Retinoblastoma gene in human chr.

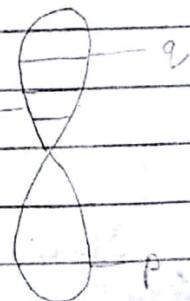
a) 17 q 18.2

b) 13 q 14.2 ✓

c) 13 p 14.2

d) 17 p 14.2

Ans - B Subba Rao Region I



Q. Find out the right statement for any diploid cell.

a) There are two pair of chr.

b) There are two chr.

c) There are the two basic sets of chr.

d) There are 23 pairs of chr.

(i) A + C

(ii) Only a

(iii) Only C ✓

(iv) C and d

Ans - (iii)

(1)

→ Enzymology ←

Enzymes are biocatalyst which have efficiency, specificity & regulation.

→ Efficiencies

- Collision theory states that the rate of reaction is directly proportional to effective collision.
- Most of the reaction are slow due to the ineffective collision.
- Max. collision possible / sec is k_{1a} diffusion limit. which is $10^8/\text{sec}$.
- Catalase have efficiency constant of 6×10^7 which is very close to the diffusion limit. 6×10^7

→ Specificity

- There are 3 type of specificity

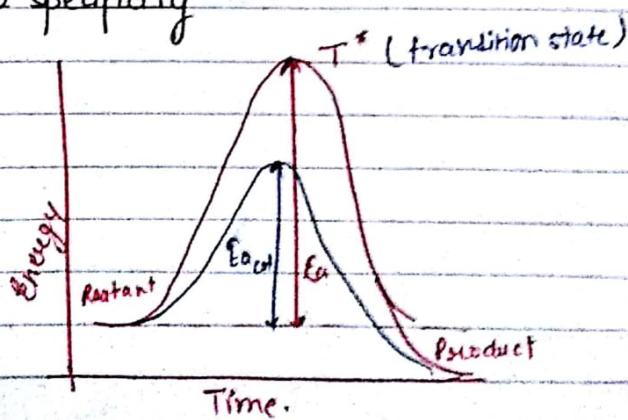
(a) Bond specificity.

Many enz. req. specific bond in the substrate for catalysis.
for eg. Proteases req. amide bond, Glycosidases req. ether linkage.
Lipases req. ester linkage, Nucleases req. phosphoanhydride bond.

(b) Group specificity

Many enz. req. specific grp in the substrate for catalysis. for eg.
Kinases req. hydroxyl gp.

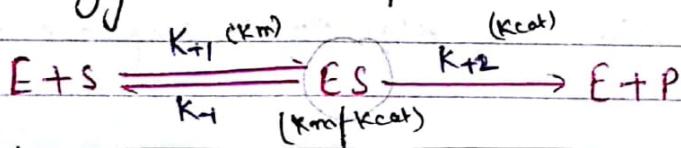
(c) Stereo specificity



v_0 = initial velocity of the Reac
 v_{max} = maximal rate of Reac

- According to the transition state theory most of the reactions are slow b/c of the "unavailability of activation energy."
- Activation energy is the energy diff. b/w transition state and substrate.
- Enz. facilitate the rate of react. by -
 - (i) Stabilizing the transition state -
 - (ii) By producing the binding energy
 - (iii) Enz. does not alter the energy of reactant and product hence does not have any effect on equilibrium const.
- Enz. also has stereospecificity which shows that if enz. recognizes L amino acid it will not recognize D-amino acid and vice versa.
- Stereospecificity in the enz. arises due to the gp. topology of effective active site.

Enzyme Kinetics



↓ Equilibrium state

1. Enz. follows saturation kinetics

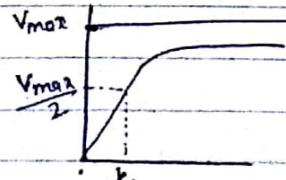
2. $K_1 \gg K_{cat}$, that means there is equilibrium in form of ES complex and breakdown.

↓ Steady state

Enz. follows saturation kinetics

2. $K_{cat} \gg K_1$, in this condition there is a establishment of steady state of ES complex - i.e

$$\frac{d[ES]}{dt} = 0$$



$$V_0 = \frac{V_{max}[S]}{K_m + [S]}$$

$$K_m = K_s + \frac{K_{cat}}{K_{cat} + K_1} \Rightarrow \frac{K_{cat} K_1}{K_{cat} + K_1}$$

$$V_0 = \frac{V_{max}[S]}{K_s + [S]}$$

$$K_s = \frac{K_1}{K_{cat}}$$

$$y = \frac{V_0}{x} \quad x = [S]$$

Kinetic parameter

There are 4 kinetic parameter

- (i) K_m (ii) V_{max} (iii) K_{cat} (iv) $\frac{K_{cat}}{K_m}$

1. K_m - K_m gives idea about how much substrate conc. is req. to achieve a fraction of V_{max} .

$$V_o = \frac{V_{max} + [S]}{K_m + [S]}$$

$$\boxed{\frac{V_o}{V_{max}} = \frac{[S]}{K_m + [S]}}$$

$$V_o = \frac{1}{2} V_{max}$$

$$\frac{\frac{1}{2} V_{max}}{V_{max}} = \frac{[S]}{K_m + [S]}$$

$$\frac{1}{2} = \frac{[S]}{K_m + [S]}$$

$$K_m = [2S] - [S]$$

$$\boxed{K_m = [S]}$$

$$\boxed{K_m = 0[S]} \quad \text{when } V_o = \frac{1}{3} V_{max} \quad (\text{or } 33\% \text{ } V_{max} \text{ achieved})$$

$$\boxed{K_m = \frac{1}{3}[S]} \quad \text{when } V_o = \frac{3}{4} V_{max} \quad (\text{or } 75\% \text{ } V_{max})$$

OR.

$$\boxed{K_m = 0.33[S]}$$

Cell Biology

Cellular Organization

- a) Transporters - Active and Passive
- b) Intracellular trafficking - Cytosol
 - Mitochondria
 - Chloroplast
 - ER-Golgi
 - Plasma membrane (PM)
 - Lysosome etc.
- c) Cytoskeleton movement
- d) Plasma membrane - Components
 - Cholesterol
 - Fluid mosaic model
 - FRAP etc.

→ Transport across PM in animal cells - ① To understand the movement of mol. across the PM / lipid bilayer, protein free PM was used.

② Permeability of diff. mol. was tested which is as follows:

- (i) Hydrophobic mol. like steroids hormones rapidly diffuses
- (ii) Hydrophobic gases like O_2 , CO_2 , NO & CO also rapidly diffuses.
- (iii) Small polar unchanged mol. like H_2O , urea and glycine diffuses slowly.
- (iv) Large polar unchanged mol. like glucose shows restricted movement.

(v) Synthetic lipid bilayer was completely impermeable to charged ions like Na^+ and K^+ . No matter what is the size of the ions.

* Therefore, above exp. proves that lipid bilayer of the PM is selectively permeable. For the mov. of charged ions transporters are tnt in the PM.

* Smaller the size of hydrophobic mol. higher will be the diffus.

Q. Two hydrophobic mol. are used for cancer treatment. Mol A is 5 kilo dalton and mol B is 200 kilo dalton. It was seen Mol. B can not cross PM. Explain?

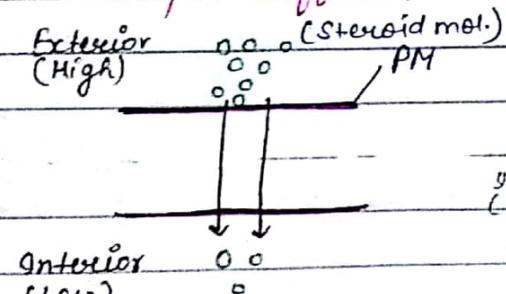
A. Size and shape of the hydrophobic mol. is imp for crossing the PM.

Types of Mol movements -

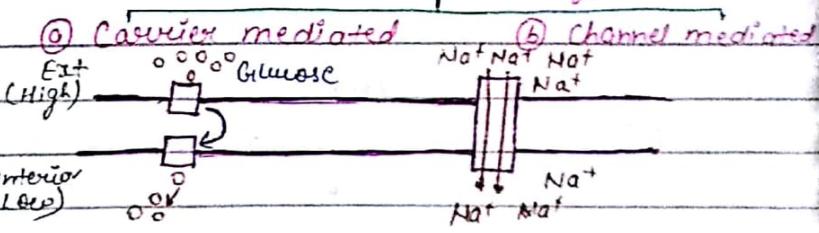
(right) \rightarrow (down hill)

Passive Movement (or along the conc. gradient)

Simple diffusion



Facilitated diffusion



CARRIERS - GLUT (protein)
(Glucose Fructose)

- Aquaporins
(H_2O , NH_3 , etc.)

CHANNELS - Na^+ , K^+
 Cl^- , Ca^{2+} etc.

(less stereo)
selective

Ap Passive Movement - • It is an energy independent process
• It involves mov. of the mol. along the conc. gradient / down hill.

along - High \rightarrow Low

- It may involve transporters for the mov. of charged ions.
- Broadly it is classified into two different types -
 - (a) Simple diffusion -
 - It involves movement of hydrophobic mol. across PM. They are non-saturable in nature b/c they do not involve ^(protein) transport.
 - (b) Facilitated diffusion -
 - It is a type of passive mov. which involves PM protein.
 - It is further categorised into two diff. types -
 - (i) Carrier mediated transport -
 - A carrier is a protein also k/a permease which interacts with its target solute in a stereospecific manner.
 - Binding of solute induces conformational change in the carriers and is responsible for the mov. of solute along the conc. gradient.
 - Carriers are saturable in nature that means if all carriers are bound to the solute, rise in solute conc. will not 1st the movement.
For exp. GLUT (glucose transport) for transporting glucose, fructose
 - Aquaporins transported H_2O , NH_3 etc.
 - (ii) Channel mediated transport
 - They are less stereospecific in nature and allows the mov. of charged ions. for ex - Na^+ , K^+ , Cl^- , Ca^{2+} etc.
 - Aquaporins - H_2O , NH_3 etc.
(water transporter)

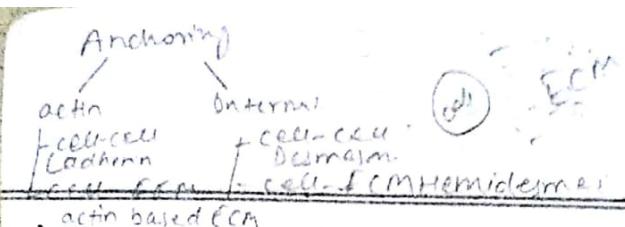
Cell comm., cell signalling, Cancer, Immunology.

①

CELL COMMUNICATION

- a) Cell - cell attachment
- b) Cell - ECM attachment
- 1) Homophilic interaction
- 2) Heterophilic interaction

- Cell communication is a process in which cell attach with each other, exchange signals, regulate gene expression etc. ②
- The two imp. building processes in animals are
 - 1. Extracellular Matrix (ECM) - It is a complex network of proteins and polysaccharides secreted by animal cells. It provide strength to the organisms.
protein & polysaccharide
 - 2. Cell-cell adhesion - Several intracellular cytoskeleton proteins participate in this process and provides strength to the organism by holding large no. of cells together.
cytoskeletal protein
- In plant cells strength is provided by cell wall instead of ECM.
- Two imp. tissues in animals are -
 - 1. Connective tissue - It includes bones and tendons.
(muscle with bone)
 - 2. Epithelial tissue - It is tnt as the lining of gut, epidermal covering of skin etc.
epithelium | ECM
basal lamina
- ECM is limited k/a basal lamina / basement membrane.
- Large no. of cells involves cell to cell adhesion.
- Diff. types of cytoskeleton filaments are tnt inside the cell which communicates with cell adhesion molecules (CAM)
- Two diff. modes of interactions are tnt b/w cells and cell + ECM.
- 1. Homophilic interaction - Same protein in the adjacent is involved.
for eg - Cadherins.
• It occurs in cell to cell attachment.
cadherin



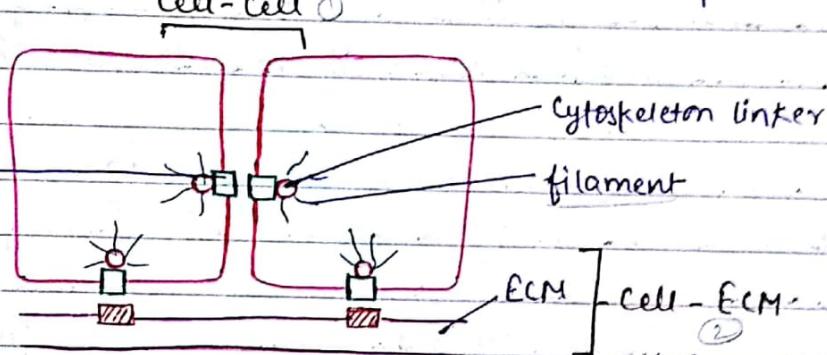
Anchoring junctions
 Cadherin → cell-cell / cell-ECM
 Occluding → Occludin / claudins → cell-cell
 Channel → Connexin → cell-cell
 Signal → cell-cell

2. Heterophilic interaction - 2 diff. proteins interacts with each other.
- It is common in cell and ECM attachment.

- On the basis of architecture and protein involvement 4 diff. types of junctions are there -

1. Anchoring junction - It involves cell to cell adhesion and cell to ECM attachment.

- Different cytoskeleton proteins participates in the process.



On the basis of filament two diff. types of anchoring junctions are there.

- (a) Actin filament attachment

(i) Cell - Cell → adherens junction

(ii) Cell - ECM → Actin based ECM adhesion

- (b) Intermediate filament

(i) Cell - Cell → Desmosomes

(ii) Cell - ECM → Hemidesmosomes

2. Occluding Junction - It involves tight junctions which seals the gap b/w epithelial cells.

- They are responsible for maintaining impermeable barrier b/w epithelial cells.

- Protein like occludins and claudins participates in the process.

- It is a cell to cell attachment.