3 dec 2017

To be completed in 2 days.

Biomolecules

* → cells → various molecules → various functions ⇓ Called Cellular Pool.

Molecules

- **Organic** → Protein, Carbon, fats, NAs, AA, Polysaccharides
- **Inorganic** → Min. Ions → 17 essential in Plants; 24 essential in animals
  - H_2O

* **How to detect various molecules in cells ?**

Living cell is taken & grind in TRICHLORO ACETIC Acid

- acid Insoluble pool → Mol. have mol. wt. more than 10,000 daltons
  Ex: Protein, NA (DNA, RNA), Polysaccha, Lipid
- Acid Soluble pool → Mol. have mol. wt. 18 to 800 (1000) daltons.

On the basis of molecular weight

- **Macromolecule** (M.W. more than 10,000 daltons) → Protein, DNA, RNA & Polysachharides
- **Micromolecule** (M.W < 1000) → Monosachharide, AA, Lipids, Nucelotides

Note:-

Lipid :→ Acid Insoluble Pool (macromolecule)

&

∞ Mol. wt. 800 daltons (micro molecules) ∞

Finally, Lipids are considered as micromolecules

1. **Carbohydrates :-**

C : H : O (Saccharides) → sweet Testi Tasting.
1 : 2 : 1

→ C H_2O

(Hydrates of Carbon)

(i) Mono Saccharides (1 unit) Glu, Fru, Galactose
(ii) Di Saccharides (2 units) Lactose, maltose, Sucrose
(iii) oligoSaccharides (3-7 units) Raffinose
(iv) Polysaccharides (many units) Cellulose, chitin, glycogen

MonoSaccharides :-

Carbon No → 3 to 7

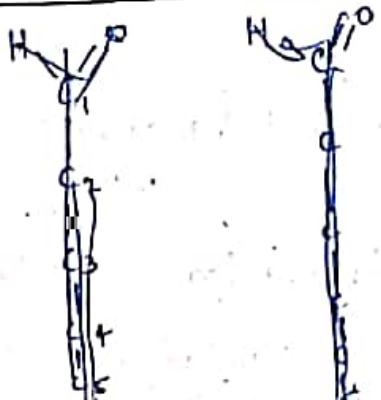
3c → Triose ($C_3H_6O_3$) . Ex. Glyceraldehyde
4c → Tetrose ($C_4H_8O_4$) → Erythrose
* 5c → Pentose ($C_5H_{10}O_5$) → Ribose, Arbinose, deoxyribose
* 6c → Hexose ($C_6H_{12}O_6$) → Glucose, Fructose, galactose
7c → Heptose ($C_7H_{14}O_7$) → Sedoheptulose.

(i) **Hexose Sugars :-**

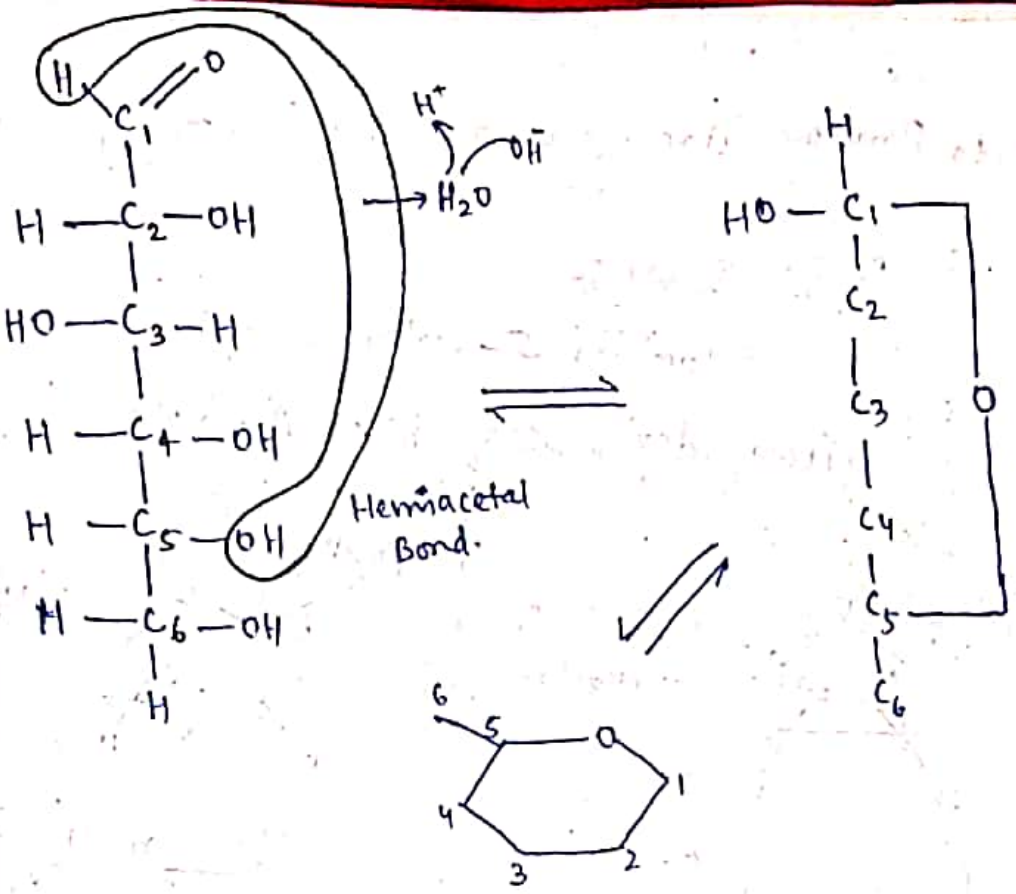
→ Aldehyde or Ketone
↓ ↓
Aldose Sugar Ketose Sugar

→ Polyhydroxy Compound

** **Glucose :- (Aldose)** Open chain ⇌ Ring $C_6H_{12}O_6$



Open chain and Ring structure are interconvertible.



→ Hexagonal

→ Ring → 5 Carbon & 1 O_2 atom. (Pyranose Ring)

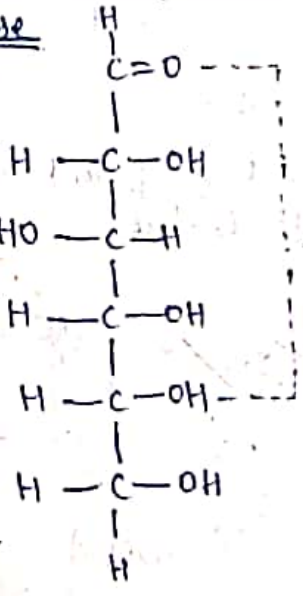
V.V.I Note:-

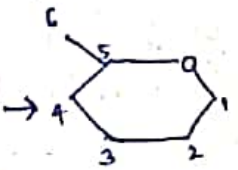
Glycosidic Bond:- Bond formed b/w aldehyde of one glucose molec. and hydroxyl of another glu. molecules is called glycosidic bond.

Hemiacetal Bond:- Bond b/w aldehyde and (-OH) of the same glucose molecule by elimination of water.

Comparison b/w Glucose & fructose:→

Glucose (Aldose) → Blood Sugar





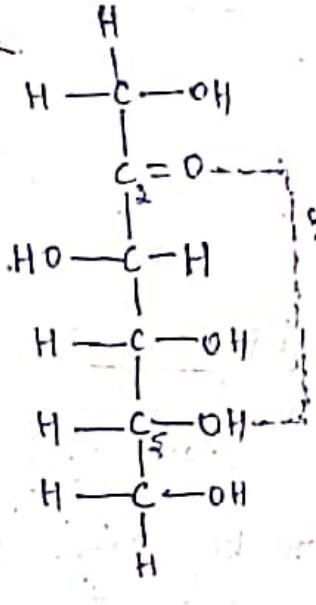
Pyranose

5-C atoms

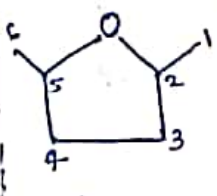
1 O_2 atom

Hexagonal

Fructose (Ketone) → Fruit Sugar



Furanose



Pentagonal

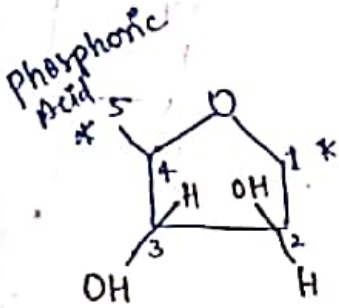
4-C atom & 1 O_2 atom

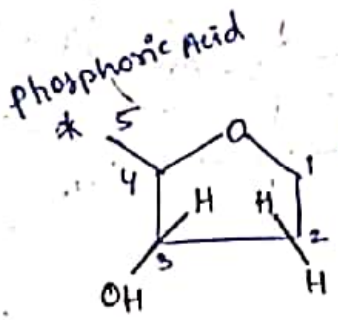
Note:- Glu, Fructose are Reducing Sugars (-CHO/-C=O).

(ii) Pentose Sugar :-

→ Contains 5- carbons.

Ex:- Ribose, ~~dexay~~ deoxyribose, Arbinose





Ribose Sugar ($C_5H_{10}O_5$)

2 functional group

∴ More Reactive molecule

Hence, Not suitable for Genetic material.

Deoxyribose Sugar ($C_5H_{10}O_4$)

→ only 1 functional group

→ less reactive molecule

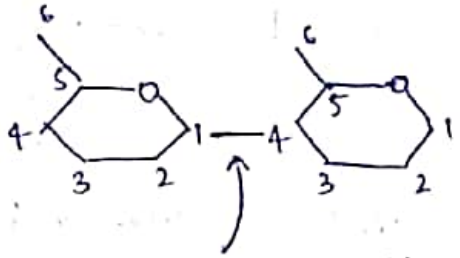
Disachharides :-

(i) maltase :-

↓

(malt Sugar)

Glucose + Glucose



$C_{12}H_{22}O_{11}$

* 1-4, glycosidic Bond

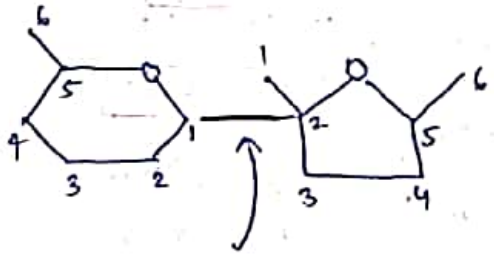
-CHO -OH

∴ Reducing Sugar (bcoz. functional group on other molecule is free)

(ii) Sucrose :-

↓

(Cane Sugar)



glucose + fructose

1-2, glycosidic Bond

∴ Non-Reducing Sugar

(bcoz none of functional group is free).

(iii) Lactose :-

↓

Glucose + galactose

(1-4, glycosidic Bond)

↳ Reducing Sugar

Trisaccharides :-

Ex!- Raffinose :-

↓

Glu + Fruc + galactose

Found in Sugarbeat & coffee.

Polysaccharides :-

① on the basis of Mono units

- Same monounits (Homopolysaccharides)
  - Ex!- Cellulose
- different types of mono units (Heteropolysaccharides)
  - Ex!- F, xylose, Mannose, Arbinose.

② On the basis of function :-

- Storage poly sacch.
  - Ex!- Starch.
- Structural poly saccharides.
  - Ex!- Cellulose

(i) Starch :-

→ Storage polysaccharides

→ Homopolysaccharides (glucose)

Starch made of

- Amylose
  - → 200-2000
  - → 1-4, glycosidic Bond
  - → Linear structure
- Amylopectin
  - → 2000 - 20,000 → Branched
  - → 1-4 glycosidic Bond
  - 1-6 " "

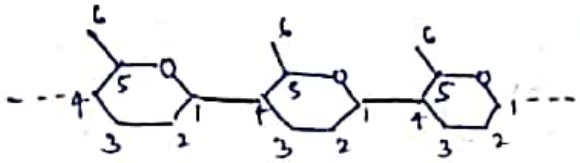
Starch

Amylose

→ 200-2,000 units of glucose

→ 1-4 glycosidic Bond

→ Linear Structure



Linear

Amylopectin

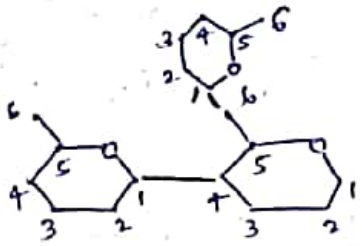
→ 2,000 to 20,000 units of glucose joined.

→ 1-4 glycosidic Bond

↓

1-6 " "

→ Branched Structure



Branched

Note!→

* Ration of | Amylose : Amylopectin | present in starch.
| 1 : 3 |

* Blue-Black Colouration with I_2 is due to amylose.

* The form is which starch is stored is called GRAINS

Simple grain

Compound grain

* Polysaccharides are easily stored due to its compact structure & each time H_2O is eleminated to form poly sacch. Other merit is that poly sacch. are easily breakable or hydrolysed.

∴ food in plants are stored in form of Starch.

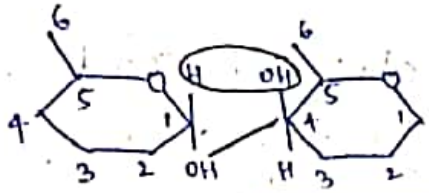
(ii) Cellulose :→

→ Structural polysaccharide.

→ Homo polysacc (glucose)

→ β 1-4, glycosidic Bond is involved.

→ Linear structure.



→ (β) 1-4 glycosidic Bond (The carbon donot have same orientation on the two glucose molecules which is participating in Bond formation)

Cannot be digested by Humans.

Some animals digest with the help of microbes :- (Microbes)

* Termites :- Triconimpha
* Cow :- Rumanococcus

} breaks cellulose with the ~~help~~ secretion of cellulase enzyme.

Uses of Cellulose :-

→ Cotton fibre 90% is Cellulose.

→ Jute, hemp → 40% cellulose

→ Cellulose + Base → RAYON (synthetic fibre)

* → Cellulose Acetate
↳ Shatter proof glass

→ Cellulose Nitrate → Explosive

→ Carboxymethyl cellulose
In making ice-cream.

(iii) Glycogen :-

→ Homopoly. Sacch. (Glucose)

→ Storage polysaccharides.

** → * Animal Starch

→ Stored in liver & Muscles.

→ 1-4 α glycosidic Bond
& many 1-6 " "

→ Red colour with I_2.

(iv) Chitin :-

→ Homopoly Sacch. (N-Acetylglucosamine)

→ Structural polysacch.

** → Found in → Cell wall of Fungi
→ Exoskeleton of arthropods.

~~Inulin → polymer of Fructose~~

(v) Inulin :-

→ Polymer of Fructose

→ Found in roots of Dahlia plant

(vi) Agar-Agar :-

→ Homo polysacc of galactose

→ Used in Culture medium as nutritive medium

** → Extracted from Red Algae
↓
Geledium.

(vii) Hemicellulose :-

→ Heteropolysacch. (G, mannose, Xylose & Arbinose)

(viii) Mucopolysaccharides :- (Slimy Substance)

(i) Pectin :-

→ Made of galacturonic Acid or glucoronic Acid.

→ Found in middle lamella of leaf.

(ii) Heparin :-

→ Natural Anticoagulant.

(iii) Hyaluronic Acid :-

→ Found in joints especially in Synovial fluid.

→ Also found in eye (vitrous Humar)

** (iv) Isubgol :-

→ (Plantago Ovata) ← extracted from this plant

→ Given to old people to treat Constipation.

** (ix) Callose :-

→ Homopolysacch. (glucose)

→ β, 1-3 glycosidic Bond.

→ Found in wall of generative cells of pollen grains.

→ Found in pollen tube as Callose plug to keep the ~~Content~~ cytoplasmic Content at the tip.

(x) Keratin Sulphate / Chondroitin Sulphate :-

→ Mucopolysacch.

→ Found in cornea, Skin & Cartilage.

Amino Acids (AA):-

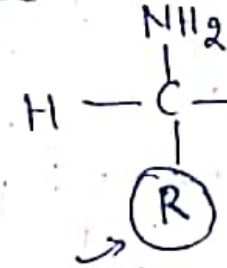
→ 20 AA are rqrd for protein synthesis.

→ 100 AA are rqrd for other function

Ex:- ornithine
Histamine

→ It is a methane derivative

Structure:- Basic



If

* No. of Amino group = No. of Carboxyl group

⇓

Neutral

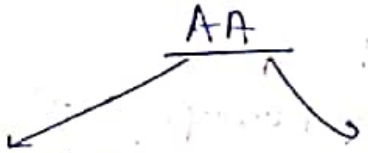
* Amino > Carboxyl ⇒ Basic

* Amino < Carboxyl ⇒ Acidic

Neutral AA :- glycine, Serine

Acidic :- Glutamic Acid, Aspartic Acid

Basic AA :- ~~Histidine~~, arginine
Lysine



Essential AA

→ Must be present in our diet

→ Cannot be synthesized by our body.

Ex:- Trytophan, Methionine, Phenylalanine

Non-Essential AA

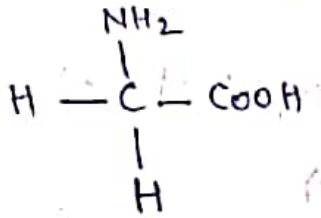
→ Can be synthesised by our body.

Ex:- GA, Aspartic Acid, alanine

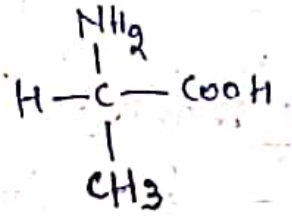
*Semi- Essential AA :→

→ Rqrd only during growth & lactation.

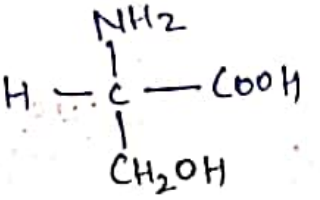
Ex:- Histidine ; Arginine



Glycine
(simplest AA)

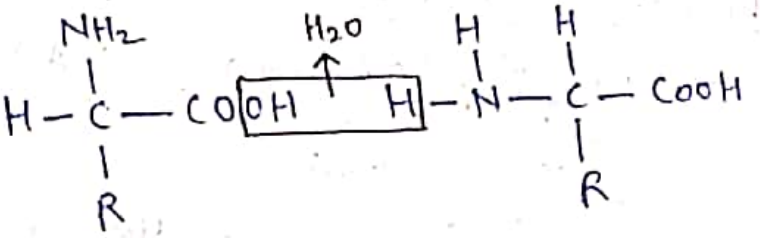


(Alanine)



(serine)

* How is AA are joined?



+(CO-NH)+

" PEPTIDE BOND"

Proteins :→

→ Berzelius suggested the name for the molecules studied by Mulder.

→ Poly-peptide (big) = Protein
chain

Monomeric Protein

→ only 1 type of Polypeptide

Ex:- Lysozyme
myoglobin

Multimeric Protein

→ Many types of polypeptide Chains

Ex:- Haemoglobin :- 2 α chain
2 β chain

Active Insulin :- A/α Chain
B/α chains

Another way of classifying proteins:-

* 1st class protein:→ (complete prot)
  → Have all essential & Non essential AA
  Ex:- → Animal protein

* 2nd class Protein:→ (Incomplete Prot)
  → Lack some A.A
  Ex:- veg./Plant proteins.

On the basis of structure:→

(i) Primary structure:→

→ AA–AA–AA–AA ----- AA
(↑ Peptide Bonds)

→ Primary proteins are Non-functional.

** Exception:-
Insulin (Primary but specially functional).

→ These are structural protein.

(ii) Secondary Protein:→

→ Arises due to Hydrogen bond formed b/w $-\overset{O}{\overset{\|}{C}}-$ and –NH-.

→ It is structural protein, non-functional.

Ex:- Keratin

α-Helix

→ Have Peptide bond
→ H-bonds formed within same chain.

Ex:→ Silk fibre

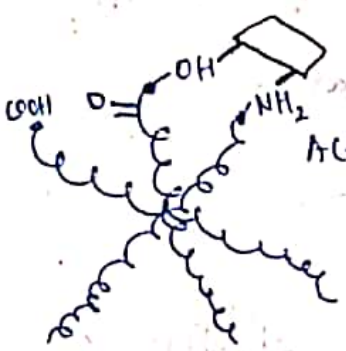
β-pleated

→ H-bonds formed b/w AA of two or more different chains
→ Have peptide bonds

(iii) Tet. Protein :-

→ Specifically functional.

→ They have ACTIVE site to which only a specific substance can bind.

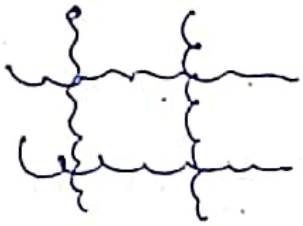


Ex!- = Enzymes

- → peptide Bonds
- → H-bonds
- → Ionic Bonds
- → Disulphide Bonds.

(iv) Quarternary Protein :-

→ 4 polypeptide chains.



→ Ex!- protein part Hb
- 2 · α Chains
- 2 - β Chains

→ Specifically functional.

- Peptide bond
- H-bond
- Ionic
- Disulphide

On the basis of Composition :→

(i) Simple proteins :-

→ Composed of α-AA (An amino acid in which there is an α-Carbon, to which both the functional groups are attached i.e, $-NH_2$, $-\overset{O}{\overset{\|}{C}}-$

Ex!- Albumine :→
- Ovalbumin
- Lactalbumin

Globulins

(ii) Conjugated Protein :→

→ protein + Non-Protein

Ex!-
1. Protein + N·A → Nucleoprotein
2. " + Phosph. → Phosphoprotein
3. " + Mucopoly saech. → mucin (in saliva)
4. Globin prot + Fe → Chromoprotein (Hb)

(iii) Protein Derivatives :→
→ The parts which are derived from the breakage of protein.

Ex!- Peptones, proteases.

On the basis of Function :-

(i) Structural Protein :→
Ex!- Collagen, elastin
→ Help in formation of some str. (like fibrous tissues)

(ii) Storage Protein :→
Ex!- Albumin

(iii) Enzymes :-
→ Most of the enzymes are protein.

(iv) Hormones :→
→ All hormones are not protein but Some are purily protein.

Ex!- Insulin.

(v) Immunoglobulin :→
→ Helps in providing immunity (Ig).

(vi) Clotting Protein :→
→ Blood clotting

Ex!- Fibrinogen → Fibrin , Prothrombin
(soluble) (insoluble)

(vii) Carrier Protein :→
Ex!- → Porins, Aqua Proteins, Na^+/K^+ pump

(viii) Contractile Protein :→
Ex!- Actin, Myosin

(ix) Chromoprotein :→ (mittaloprotein)

→ Helps in transport of gases.

Ex :- Hb in blood.

(x) Glycoprotein :→

→ (Protein + oligo Sacch)

→ Found on plasma membrane.

→ Helps in cell identification.

** MHC (major Histo-Compatibility Complex)

↑ Helps during organ transplantation.

On the basis of Shape :-

(i) Fibrous Protein :→

→ Thread like structure.

Ex :- Collagen & elastin, Tublin

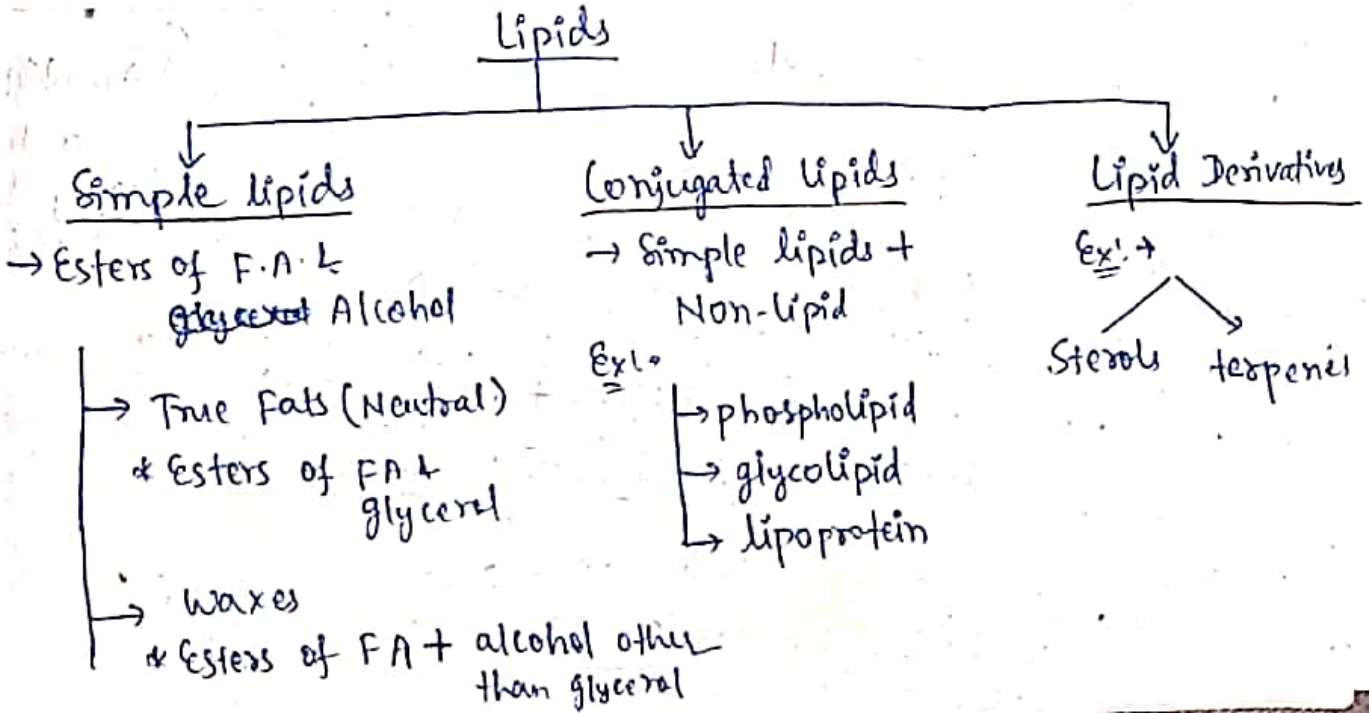
(ii) Globular Proteins :→

→ Spherical structure

Ex :- Globulins.

Lipids :→

→ These are Micro Biomolecules.



True Fats :-

→ "Neutral lipids".

→ Esters of Fatty Acids (FA) & glycerol.

F.A = R–COOH :→

FA → Non-Essential F.A.

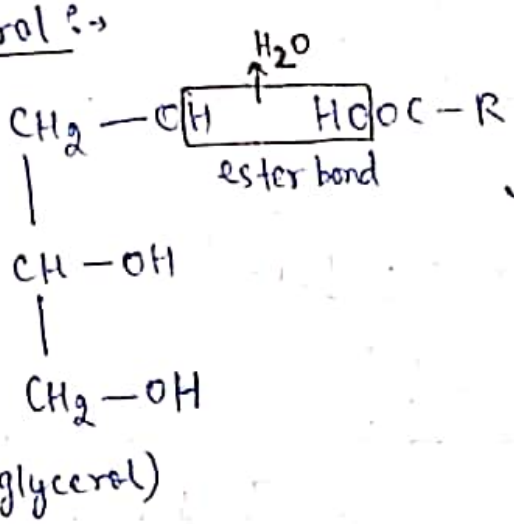
FA → Essential F.A. :

Ex :-
1. Linoleic Acid (Omega-6)
2. α-Linoleic Acid (omega-3)
3. Archidonic Acid (can be converted from Linoleic Acid)

FA → Saturated → All Single Bonds.

FA → Unsaturated → double & triple Bonds

Glycerol :→



(glycerol)

Omp.

Glycerol → Hydrophilic
F.A → Hydrophobic

↑ Amphipathic molecules (Having Hydrophobic & philic ends).

(i) Monoglyceride fats :- (Glycerol + Only 1 F.A)

(ii) Diglyceride fats :- (Glycerol + 2 FA)

(iii) Triglyceride Fat :→ (glycerol + 3 F.A)

* Saturated fats :-
→ (Glycerol + Saturated Fat)
→ Solid at room temperature
Ex :- Ghee. → Found in Animals.

* Unsaturated Fats :→
→ (Glycerol + Unsaturated FA)
→ liquid at room temp.
Ex :- oil.
→ Unsaturated is healthier than saturated fats. bcoz

Unsat. Fat —Hydrogenation→ Saturated Fat.

→ Found in plants oil.

Functions of Neutral fats :→
* Subcutaneous fat (Act as Insulator)
* deposited around organs & protects from shock.
* Reserved form of energy.

Waxes :-
→ Esters of FA & alcohol other than glycerol.

(i) Plant waxes :→
with cutin → cuticle (Hydrophytes)

(ii) Bee waxes :→
↳ secreted by wax glands in the last abdominal segment of worker bees.
→ Soft, yellow

(iii) Ear Wax :→

→ called as "CERUMEN"

→ protection of pimpanic membrane or ear drum.

(iv) Sebum (oil) :→

→ Subaceous gland.

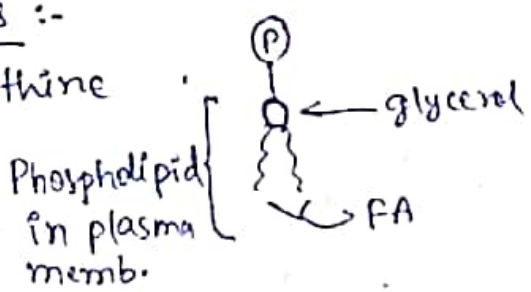
(v) Lanolin (wool wax) :→

Ex:- sheeps have Lanolin

Conjugated lipids :-

(a) Phospholipids :-

Ex:- lecithine



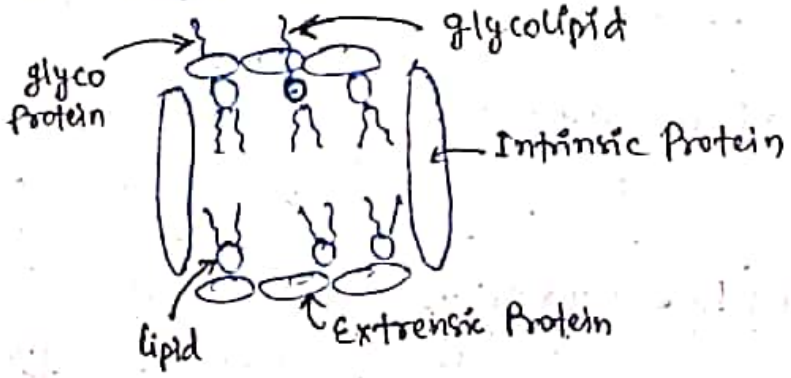
(b) Glycolipids :-

(lipids + Casbohydrates)

→ found on Plasma membrane

→ Protective in nature

Ex:- Singer & Nicolson model of P.M :-



Fluid & Mosaic model of P.M.

(c) Sphingo lipids :-

→ (lipid + N_2 base)

→ found in nervous tissue, or Plasma mem.

(d) Lipoprotein :-

→ (lipid + protein)

Derived lipids :→

Sterols (Steroid ☆ alcohol)

① Plant origin (Phytosterols)

Stigmasterol
→ obtained from Soyabean
→ Can be converted to progesterone

Sitosterol
→ obtained from wheat germ oil.

② Ergosterol (from fungi)
→ found in P.M. of fungi

** ③ Zoosterol (Animal origin)

V.V.I — Ex:- Cholesterol
→ Extracted from gall stone
→ white crystalline substance
→ MP → 149° - 150°C.
→ Acts as Insulator.

④ Bile Acids :-
→ Cholic Acid
→ deoxycholic Acid
→ chemodeoxycholic Acid

⑤ Steroid Hormone :-
→ Progesterone
→ Testosterone

⑥ Adrenal Corticoids

⑦ Vitamin - D :-
↳ Cholesterol helps in Synthesis of Vit-D.

Terpenes
→ derivative of 5-Carbon Compound.
↓
Isoprene ←

Ex:-
(1) → Natural Rubber (Polyterpene)
(2) → Vitamin A
(3) → Carotenoids

* Terpenes impart special odour to camphor, Eucalyptus, menthol.

Note!:- Sterols are derived from a 4 ring Compound

→ Phenanthrene

→ 3 six mem. Ring + 1 Five memb. R

4 ring Comp.

Nucleotides!:→

↳ Made of

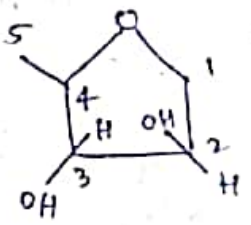
(i) Pentose Sugar

(ii) N_2 Bases

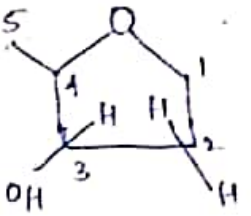
(iii) Phosphoric Acid or phosphate.

* Pentose Sugar!:-

→ Ribose Sugar



→ Deoxy Ribose Sugar



* N_2 Bases:-

Purines

→ Dicyclic

→ 4 N_2 atoms at 1, 3, 7, 9 position

* Adenine (A)
  Guanine (G)

Pyrimidines

→ Monocyclic

→ 2 N_2 atoms at 1 & 3.

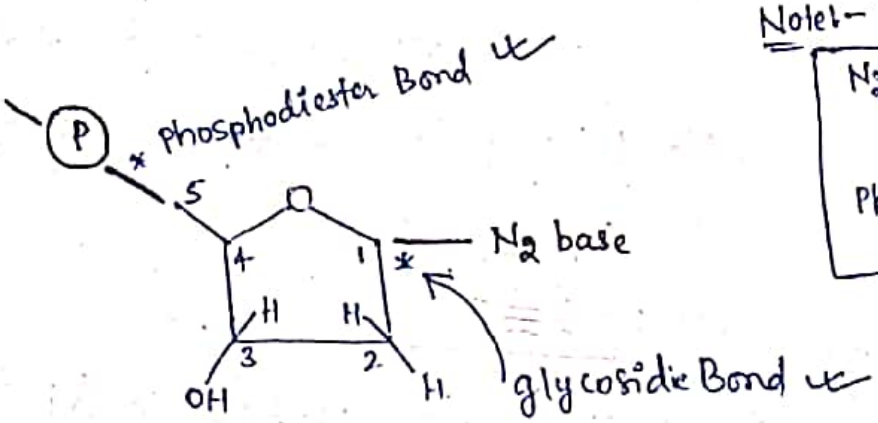
* Cytosine (C)
  Thymine / Uracil (T), (U)

Note!:-

DNA → ~~Contains~~ doesnot have Uracil rather Thymine is there.

RNA → Has Uracil.

Nucleotide Structure:-



Note:-

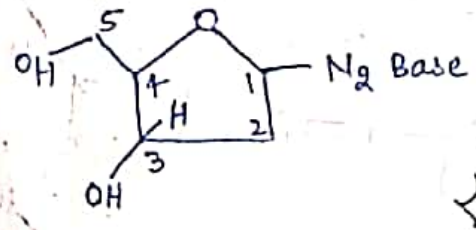
N2 Bases arranged at Carbon no. 1.

Phosphate arranged at Carbon no. 5.

Nucleosides

→ Pentose Sugar + N_2 Base

→ Slighty ~~Acid~~ Basic.



Nucleosides

P. Sugar + Adenine → Adenosine

P.S + Guanine → Guanosine

P.S + Cytosine → Cytidine

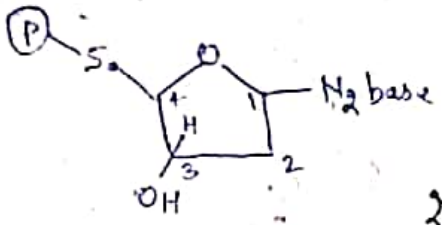
P.S + Thymine → Thyamidyne

P.S + Uracil → Uridyne

Nucleotides

→ Pentose + N_2 Base + Phosphoric Acid

→ Slightly Acidic.



Nucleotides

PS + Ⓟ + A → Adenylic Acid

PS + Ⓟ + G → Guanylic Acid

PS + Ⓟ + T → Thymidylic Acid

PS + Ⓟ + C → Cytidylic Acid

PS + Ⓟ + U → Uridylic Acid

DNA (B DNA) :-

* By watson & crick
  - → double stand Structure
  - → double Helix
  - → 2 strands are groped antiparallel.

→ Backbone (skeleton) of DNA is Pentose sugar & phosphate.

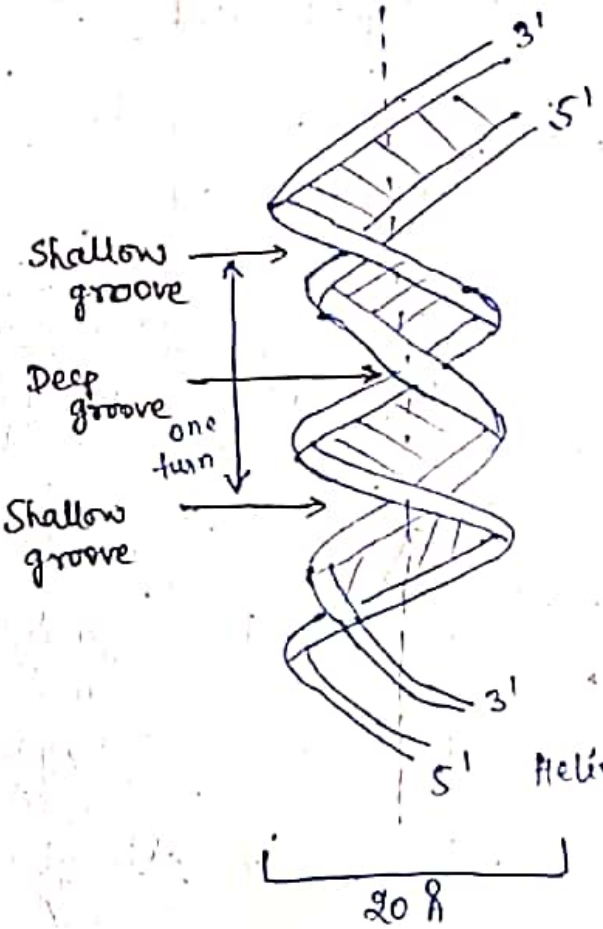
→ N_2 bases pair a/c to <u>BASE PAIR RULE</u>

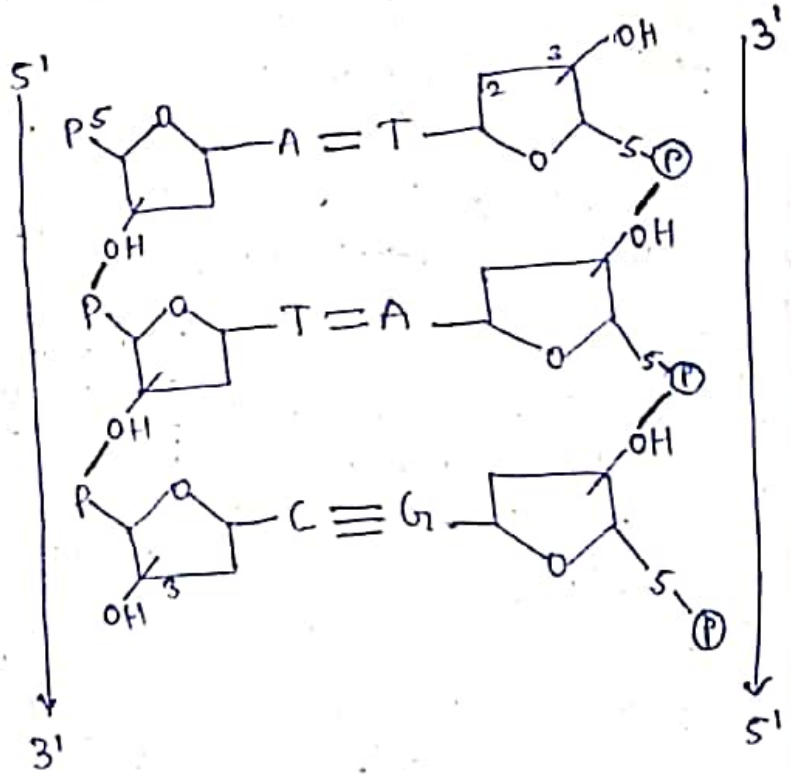
A = T
G ≡ C

→ one turn (360°) of Helix = 34 Å

→ 10 Base pairs in one turn

→ Distance b/w 2 consecutive B.P is = 3.4 Å





<u>DNA, Straight Structure</u>

<u>Types of DNA:-</u>

	DNA A	DNA B	DNA C	DNA D	DNA Z
B.P/turn	11	10	9.33	8	12
Coiling	R	R	R	R	L

↑ In syllabus.

RNA :-

(i) mRNA (5%)

(ii) tRNA (20%)

(iii) rRNA (80%)

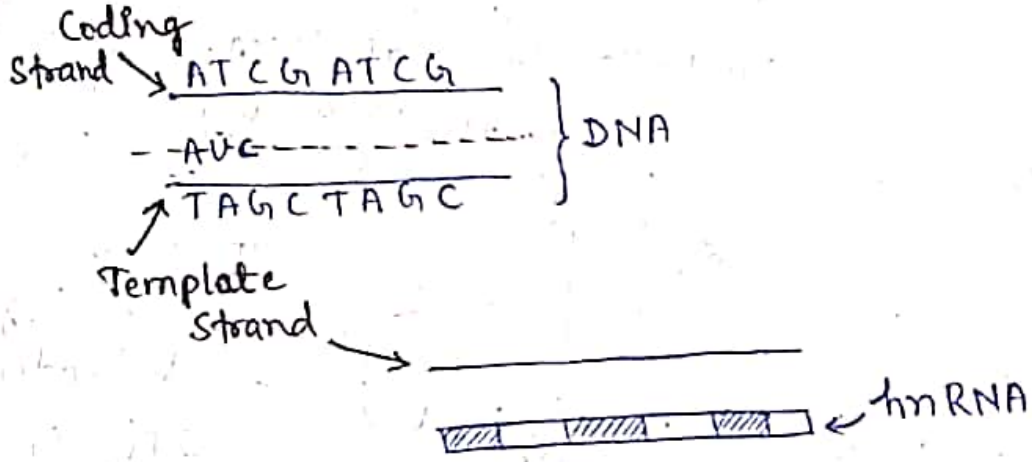
(i) m-RNA :-

DNA $\xrightarrow{\text{Transcription}}$ mRNA

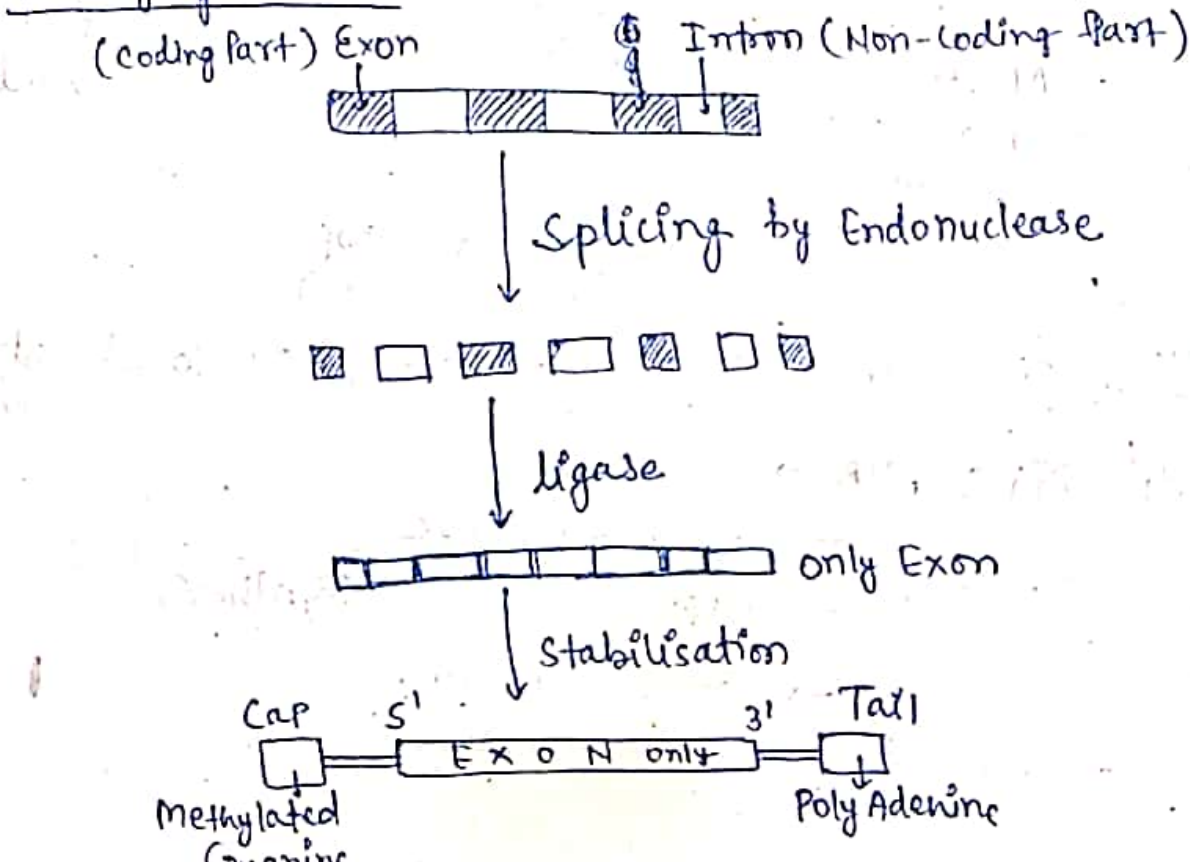
Actually,

DNA $\xrightarrow{\text{Transcription}}$ hnRNA $\xrightarrow[\text{+ Tailing}]{\text{Caping}}$ mRNA

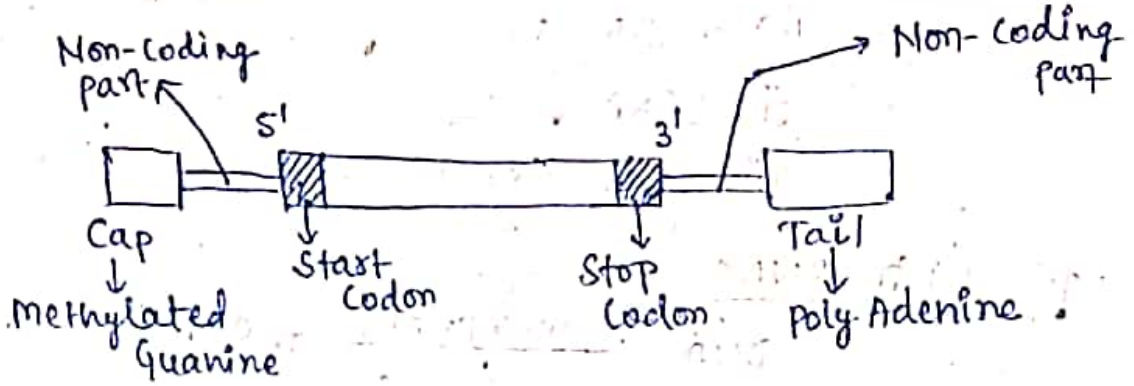
(Primary Transcripts)



Enlarging hnRNA :-



Structure of ~~tRNA~~ mRNA :-

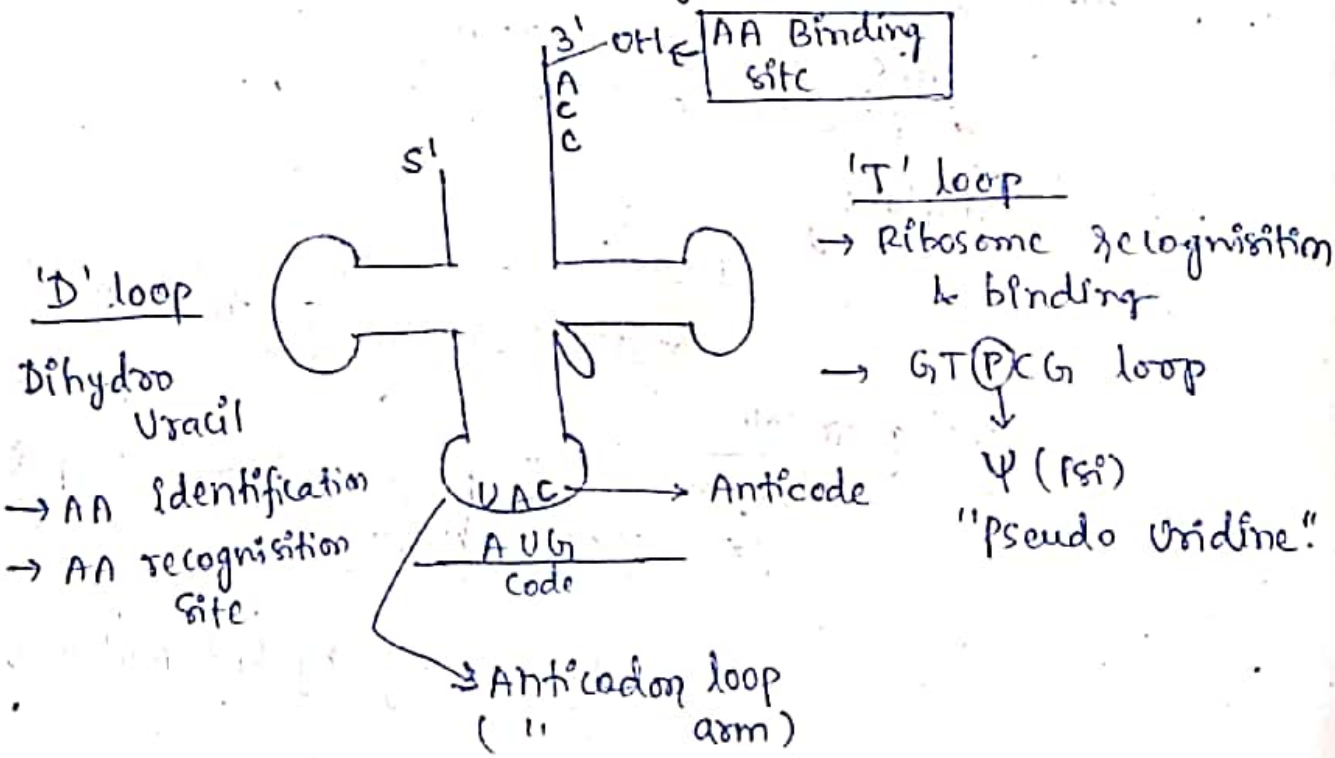


Cap → Non Coding part → Start codon → Exons only → Stop codon → Non-coding part → Tail

(ii) t-RNA :-

→ SRNA (Soluble RNA)

→ Smallest among all RNA.



Note:- Codes are always read from 5' to 3' end.

(iii) r-RNA :->

→ Coiled structure

→ Helps in protein Synthesis.

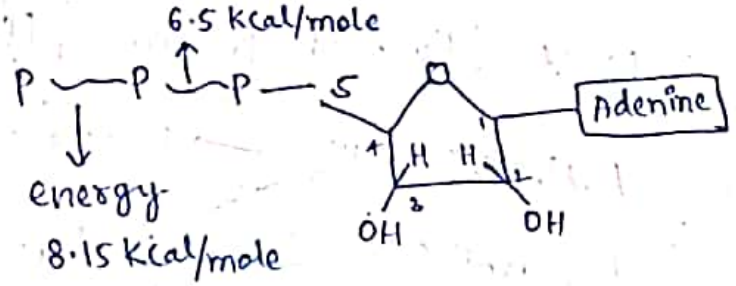
→ Protein + rRNA.

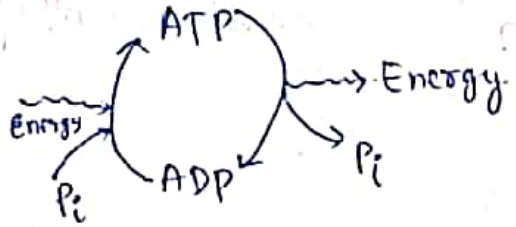
ATP :-

→ Adenosine Triphosphate.

→ Slightly modified version of Nucleotide.

→ Composed of
- (i) Pentose Sugar (Ribose)
- (ii) N$_2$ Base (Adenine)
- (iii) 3-Phosphates.





→ Lohmann discovered ATP molecule

→ Lipmann gave energy possessing property of ATP (father of ATP cycle).

Primary & Sec. metabolites :-

↓ whose functions are Specific & well understood

↳ whose functions are not Specific & not well understood

Primary Metabolites

1. Protein
2. AA
3. Cabohydrates
4. Fats
5. NA < DNA, RNA

Secondary Metabolites

1. Pigments → Carotene
2. Morphene, Caffene, Codine
3. Nicotene
4. Rubber
5. Oil

Mineral Elements < 17 essential in plants
24 " " animals

Note:-
Most abundant element → Ca
Most " in cellular pool → K^+
" " " Body Fluid → Na^+
Most abundant Protein in Living world → RUBISCO
Artificial Silk → Poly-saccharide
Natural Silk → Protein
Most abundant protein in animal → Collagen

Enzymes:→

Discovery (100 years Ago)

By Louis Pasteur
called ferments.

→ Later, Edward Buchner isolated from Yeast.

→ Termed by (Kuhne) → Enzyme

→ Enzymes can enhance or degrade the rate of rxn.

Ex:-

$CO_2 + H_2O \xrightarrow[\text{of Enzyme}]{\text{in absence}} H_2CO_3$
(200/hr)

$CO_2 + H_2O \xrightarrow{\text{Carbonic Anhydrase}} H_2CO_3$
(6 Lakh/sec)

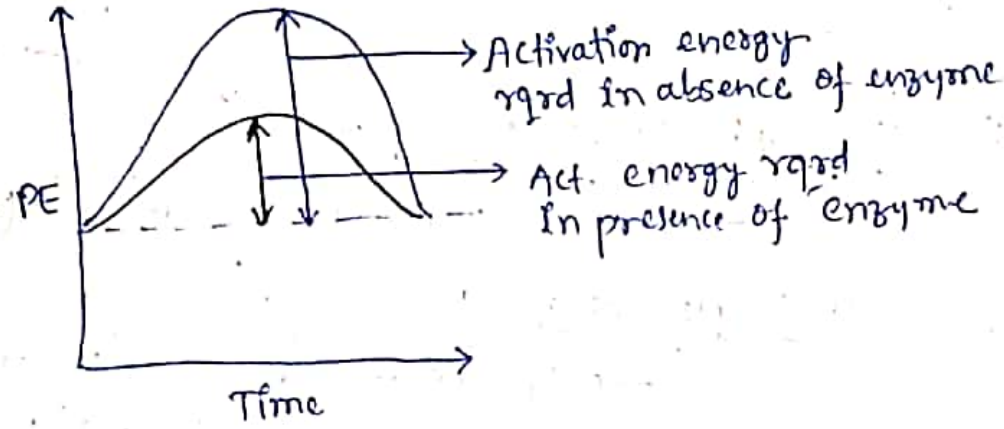
↓
Fastest enzyme

Role of Enzyme in enhancement of rate of rxn :-

→ Enzymes help in enhance the rate of Rxn.

→ Enzymes lower the activation energy.

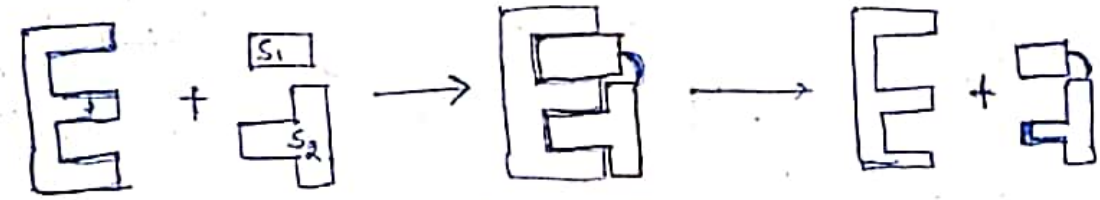
Substrat + Enzyme ⟶ Enzyme-Substate complex → Product + Enzyme



Mode or Mechanism of Enzymes Action :-

(I) Lock & Key Mech :→

→ Given by Fisher.



(II) Induced Fit Mechanism :-

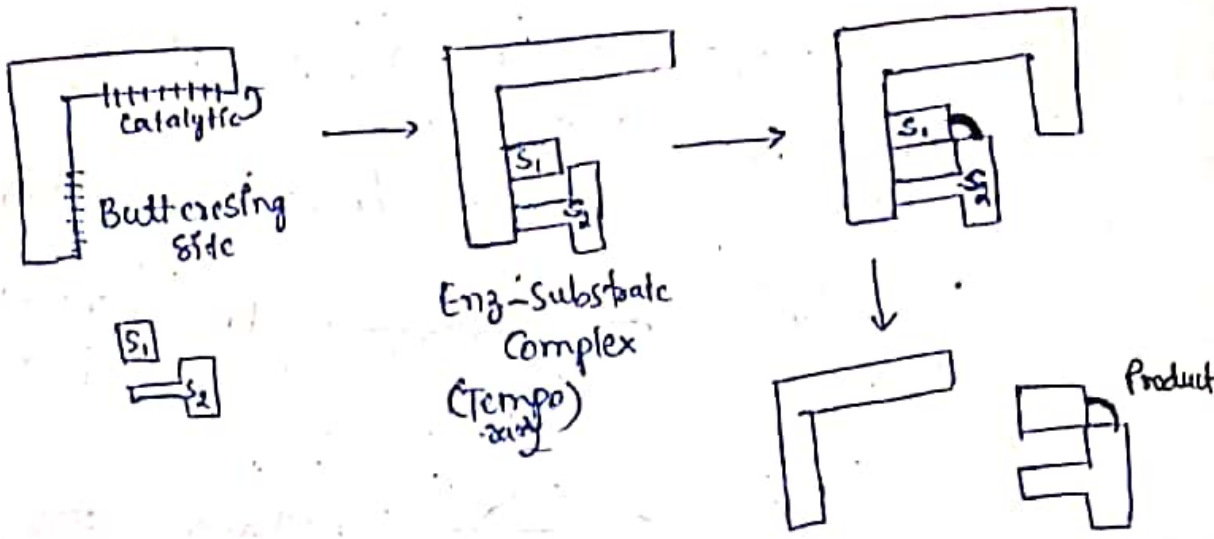
→ Given by Koshland.

→ A/c to it, there are two types of Active Sites.

Active sites

- **Catalytic site**
  * To break old bond & make new bonds
- **Butteressing site**
  * Helps in attachment of substrate (bond Formation)

Ex!-



Chemical Nature of Enzymes :-

→ Most enzymes are Specific & tertiary protein.

(i) Simple Enzyme :-

→ only protein part itself works as an enzyme. No any external element binds.

Ex!- Pepsin, Trypsin

(ii) Conjugated Enzymes :->

Protein + Non-Protein → Holoenzyme (Functional) enzyme
↓ ↓
Apoenzyme + Co-factor

Co-Factor
- Organic Non-Protein
  - Easily Separable → Co-Enzyme
  - Cannot be separated → Prosthetic group → permanent part.
- Inorganic Metallic Ion → Activators

Site of Action of Enzyme :-

(i) Inside the cell
↓
Endogenous Enz / Intracellular Enzymes

(ii) Outside the cell
↓
Exogenous Enz / Extracellular Enzyme

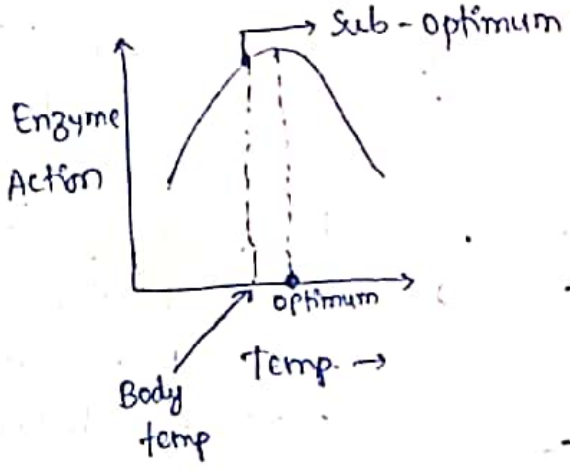
Factors affecting Enzymetic Action :-

(1) Temperature :→

→ Range 25°c - 40°c

There are three cardinal points :-

- Min^m (temp at which enzyme action is very low)
- Optimum (temp at which enzyme action is maximum)
- max^m (temp at which enzyme action is very low)



→ with ↑ in temp, the enzymetic activity first ↑es & then decreases.

→ At a high temp, enzyme gets denatured.

→ Low temp deactivates enzyme.

→ High temp. denatures enzyme.

→ There are some thermophilous archeobacteria which have evolved their enzymetic action only at high temp.

** Ex :- Thermus Aquaticus (Releases enzyme Taq Polymerase)

(ii) pH :→

Ex:- Salivary Amylase → 6.8

Pepsin → 1.2 – 1.8

Trypsin → 8.6 – 8.8

Different enzymes have different optimum pH. (pH optima)

All pH have same (temp. optima)

(iii) Concentration of Substrate :→

enzyme have many active site let (1000) + Substrate ↑ ⟶ Product

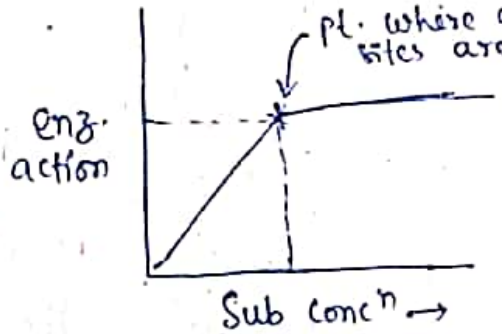
100 ⟶ 100

200 ⟶ 200

500 ⟶ 500

1000 ⟶ 1000

1100 ⟶ 1000



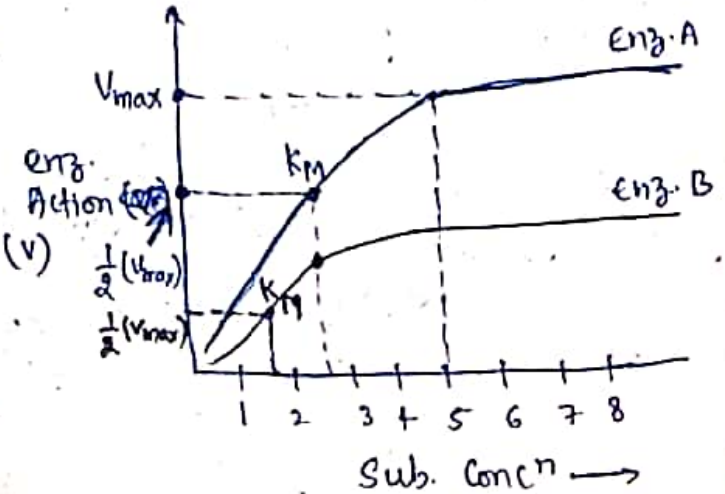
→ with the ↑ in Sub Conc^n, the rate of enzymatic activity inc., then becomes constant.

$\frac{K_m}{\text{or}}$ ← Michaelis Constant

$\frac{1}{2}(V_{max})$

→ lower the K_m, higher is the affinity of Substrate towards enzyme.

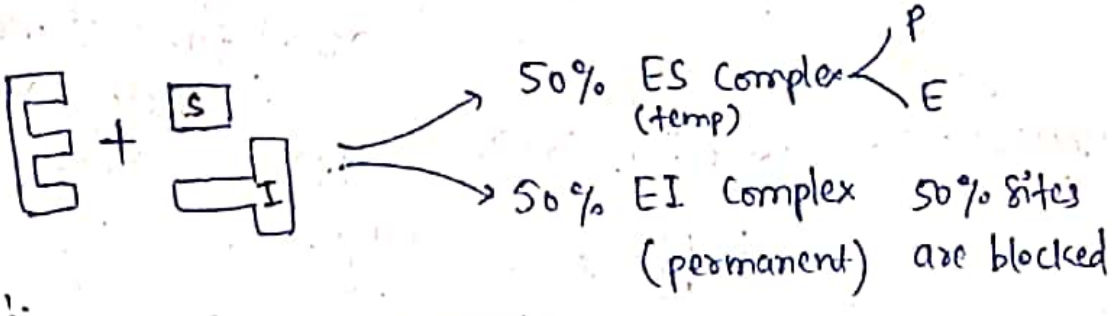
(v)



Inhibition of Enzyme Action :→

(i) Competitive Inhibition :→

→ Competition b/w Substrate & Inhibitor to bind with active site



e.g.:-

① Succinate $\xrightarrow[\text{Dehydrogenase}]{\text{Succinate}}$ Fumarate

↙ Malonate
[Inhibitor]

② Use of sulpha drugs in treatment of bacterial infection

PABA $\xrightarrow[\text{Synthatase}]{\text{Folic Acid}}$ Folic Acid (Acid for normal growth & repro of bact.)

↙ Sulpha Drugs
[Inhibitor]

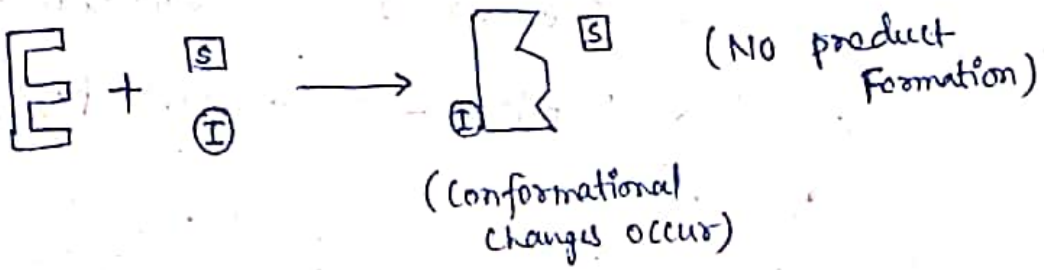
* PABA = Para Amino Benzoic Acid.

Note:-

** Competitive Inhibition is a reversible mechanism, which can be achieved by Inc. Substrate Concn.

∴ Doctors prescribe doses for atleast 3-4 days.

(ii) Non-Competitive Inhibition :→



Subs. gets force

Ex:- ① Cyanide binds to Cytochrome Oxidase. (imp. role in cellular resp)

② Penicillin (Non-comp. inhibitor of enzyme reqrd for cell wall formation in bacteria)

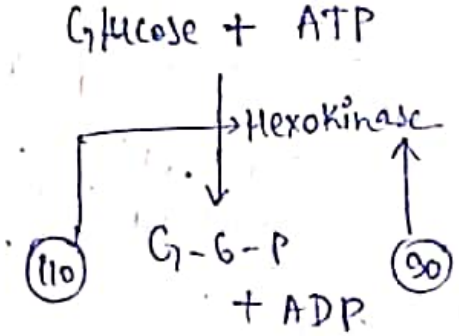
Note:→ Non-competitive Inhibitors are irreversible.

(iii) Allosteric Inhibition :-

or (Feedback Mechanism)

→ Most of the enzymatic activity in our body works on feedback mechanism.

Ex:-



Nomenclature of Enzymes :-

(i) Suffix 'ase' to root word :→

Ex: Maltose ⟶ Maltase

Sucrose ⟶ Sucrase

(ii) On the basis of Source :-

* Bromalin / or Bromalain } → obtained from pineapple 'Bromeleacea' family.

* Papain ⟶ obt. from Papaya

(iii) 2 to words.

1st → Substrate

2nd → Type of Rxn

Ex!→ Pyruvate decarboxylase.

(iv) By IUB (International Union of Biochemistry) :-

→ All enzymes are given a special EC No. (Enzyme Commission no.)

→ Total 6 EC groups.

① EC 1 → oxido-redutase.
② EC 2 → Transferase
③ EC 3 → Hydrolase
④ EC 4 → Lyase
⑤ EC 5 → Isomerases
⑥ EC 6 → Ligase

* Oxido-reductase :-

→ Helps in oxidation-reduction rxn.

Ex!- Cytochrome Oxidase
(helps in ETC in transfer of e^- during cellular resp)

Phosphoglyceraldehyde dehydrogenase

$$3PGAL + NAD^+ \longrightarrow 1\text{-}3, DPGA + NADH_2$$

* Transferases :-

Ex!- glutamic Acid + Pyruvate $\xrightarrow{*}$ Alanine + α-keto glutarate

(* ↑ glutamat pyruvate Transaminase)

* Hydrolases :→

→ Breaks the bond by addⁿ of H_2O.

→ All digestive enzymes comes under this.

Ex:-

Starch $\xrightarrow{\text{Amylase}}$ Maltose + Isomaltose + limit dextrins.

* Lyases :-

→ Breaks the bond without addⁿ of H_2O.

Ex:→

F-1,6-diphosphate $\xrightarrow{\text{Aldose}}$ 3PGAL + DHAP

* Isomerases :→

→ Convert one isomer into another

Ex:- G6P $\xrightarrow{\text{Hexoseisomerase}}$ F6P

* Ligases :→

→ Joining enzymes by formation of bond.

Ex:-

$PA + CO_2 \xrightarrow[\text{carboxylase}]{\text{Pyruvate}} OAA$

Some Important Informations :→

(i) Inactive Enzyme :→

→ Also called as 'Prochzyme' or "Zymogens"

(ii) Isoenzyme or Isozyme :→

→ Have slightly diff. molecular structure but act on same rxn.

Ex:-

PA $\xrightarrow[(5\ \text{enzymes})]{\text{Lactic dehydrogenase}}$ LA

(iii) Rennet Tablets :-

→ Gastric juice obtained from Stomach of Calves.

Rennet — Rennin, Proteases, Chymosine

→ Commercially, used for cheese making.

(iv) Turnover No :-

→ No. of Substrate molecule acted upon by 1 enzyme molecule in a minute.

→ For Carbonic Anhydrase, it is 36 Million/min.

* Fastest Enzyme → Carbonic Anhydrase
* Slowest Enzyme → Lysozyme
* largest Enzyme → Catalase } Peroxisome
* smallest Enzyme → Peroxidase }