Biomolecules..

Biomolecules → All organic Carbon compounds in a living tissue.

Experiment →

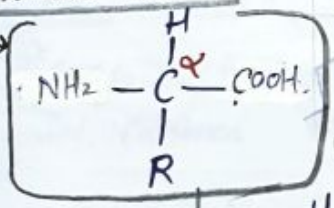
Step-1 → Trichloro-acetic acid CCl_3COOH

Step-2 → lipid

Biomacromolecule
→ acid insoluble pool.
→ protein
→ polysaccharide
→ Nucleic acid
RNA DNA
wt → >1000 Da
→ polymers

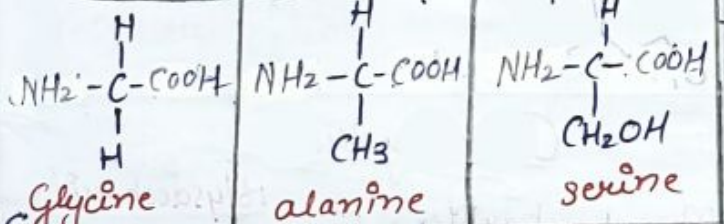
Biomicromolecule
→ acid soluble pool.
→ amino acids.
wt → (18-800 Da)
< 1000 Da.
→ monosaccharide
→ Oligosaccharide
→ nucleotide
→ lipid **

Amino Acids → 20 aā forms protein



Substituted methane

Chiral Carbon



Optically inactive

Amino acids →

① In neutral Medium → acid and base will automatically reduce itself → Zwitter Ion

② In Acidic Medium → It will act as base

③ In Basic Medium → It will act as acid.

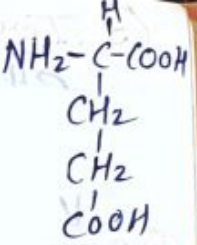
Amino Acids are amphoteric in nature.

Types of Amino Acids →

① Neutral aā → Valine, Glycine, Alanine

② Alcoholic aā → Serine

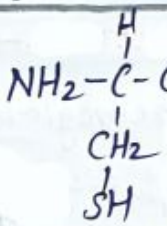
③ Acidic aā → Glutamic acid,



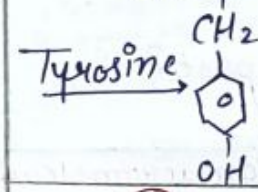
④ Basic aā → Lysine

⑤ Sulphur Containine aā →

Cysteine



⑥ Aromatic aā → Tyrosine → precursor of melanin, thyroid hormone, epinephrine, nor-epinephrine.



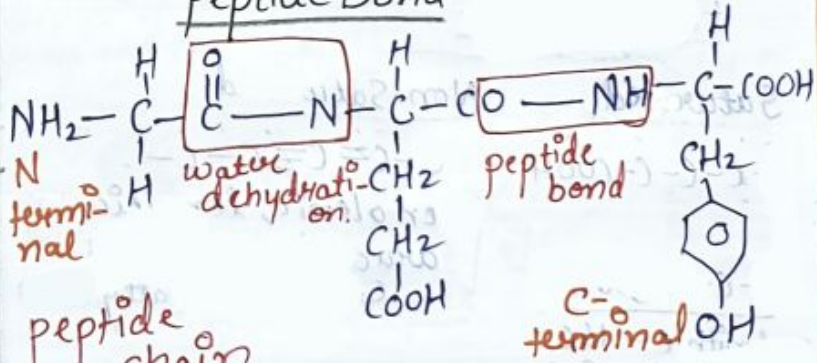
phenylalanine, tryptophan

⑧ Essential aā → taken from diet

H Histidine
I Isoleucine
L Leucine
L Lysine
M Methionine
T Tryptophan
V Valine
T Threonine
A Arginine
P Phenylalanine

Non essential amino acids → prepared by body

Peptide Bond



protein → polypeptides

① primary structure → linear sequence of amino acids

② Secondary structure →

α-Helix → H Bonding → Right Handed Helix → Keration

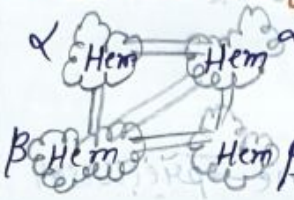
β-pleated → H bonding → fibrous protein → Silk

③ Tertiary Structure →

- H-bonds
- Di-Sulphide linkage
- Electrostatic interaction
- Vander Waal forces

eg- Enzymes
Hormones
Myoglobin

④ Quarternary Structure →

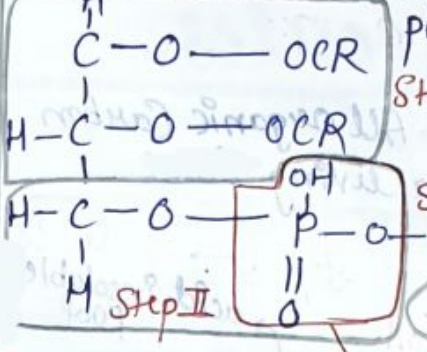


eg- Haemoglobin

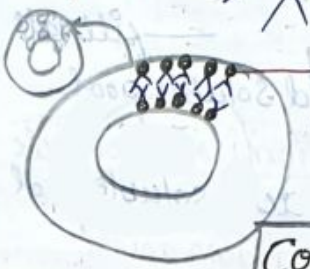
→ Glut-4 → enable glucose transport into cells

Collagen - Most abundant protein in animals.

RuBisCO → Most abundant protein in Earth



Amphipathic → Hydrophilic part, Hydrophobic part



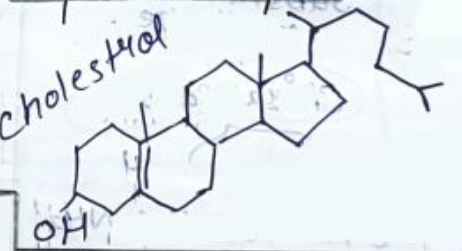
Lecithin
↳ not a Biomacromolecule

Conjugate Lipid

Lipid — not biomacromolecule, still comes in acid Insoluble pool.

- **Simple Lipid**
  - fatty ā
    - palmithic ā [16C]
    - Arachidonic ā [20C]
  - Glycerol
  - esters of glycerol
    - Monoglyceride
    - Diglyceride
    - Triglyceride → fats, ginglycoil (low melting point)
- **Conjugate lipid** — lipid + non lipid; phospholipid; eg- Lecithin
- **Derived lipid** — lipid like proteins; eg- steroids, cholesterol.

Deprived lipid →

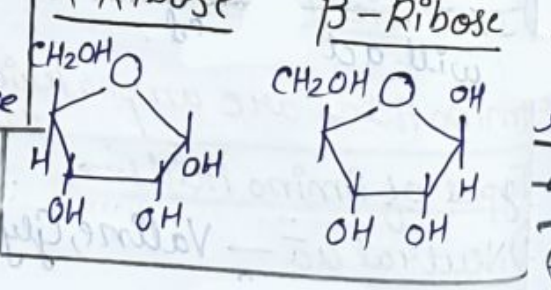


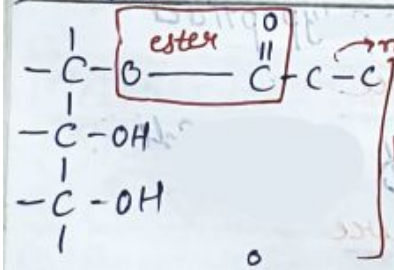
Fatty acids

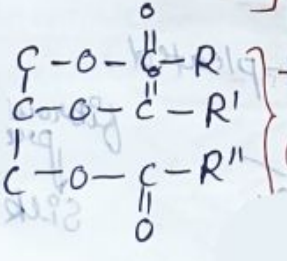
- **Saturated**
  - C-C-C-C-COOH
  - C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-COOH
  - palmithic - 16C
  - archidonic - 20C
- **Non-Saturated**
  - C-C=C≡C-C-
  - [Lenolenic, lenoleic, arachidonoic acids] ↳ essential fatty acids

Carbohydrate

- **Monosaccharide** (sugar)
  - Triose
  - Tetrose
  - Pentose
  - Hexose
  - Heptose
  - Ribose, Glucose, fructose, galactose
- **Oligosaccharide** (10>)
  - Disaccharide — Lactose, Sucrose, Maltose
  - Trisaccharide
  - Tetrasaccharide
- **Polysaccharide** (10<)

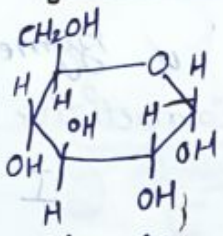




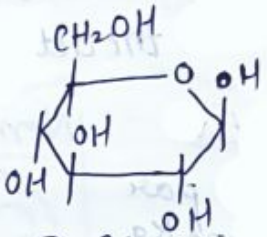


Triglyceride (common fats and oils)

Glucose → Hexose



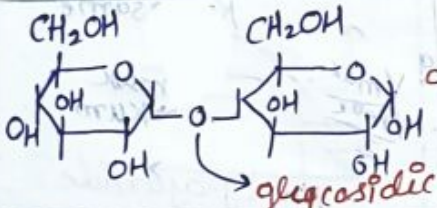
α-Glucose



β-Glucose

Disaccharide

Maltose	Sucrose	Lactose
Glu + Glu	Glu + fructose	Glu + Galactose



α 1,4 Glycosidic bond

glycosidic bond

Polysaccharide

Heteropolysaccharide — eg- peptidoglycan NAG-NAM-NAG

Homopolysaccharide

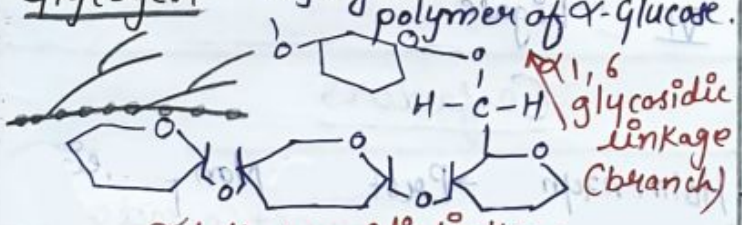
Storage

- (α glucose) → Glycogen (animals, bacteria) — Bacterial cell
- (α glucose) → Starch (plants)
- → Inulin (Dahlia) (fructose)

Structural

- → Cellulose (β-glucose)
- → chitin — N-acetyl glucosamine (NAG) — fungal cell

Glycogen → Highly branched, polymer of α-glucose.



α 1,6 glycosidic linkage (branch)

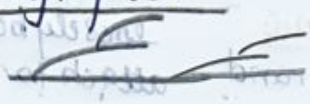
α 1,4 glycosidic linkage

Starch → polymer of α-glucose

Amylose

Blue Colour

Amylopectin



Cellulose → polymer of β-glucose.

β 1,4 glycosidic

Most abundant Carbohydrate - Cellulose

Nucleic Acid → polymer of Nucleotide

DNA RNA

Nucleotide → phosphate, Sugar, Nitrogenous base

Nucleotide

- Adenylic ā
- Thymidylic ā
- Guanylic ā
- Cytidylic ā
- Uridylic ā

Nucleoside

- Adenosine
- Guanosine
- Thymidine
- Cytodine
- Uridine

nucleoside

→ phosphodiester bond (characteristic bond)

Rest in Molecular Chapter.

Enzymes

- Intro
- Co-factor
- Activation energy
- Factors affecting enzyme activity
- Enzyme Inhibitors
- Enzyme Classification

Enzyme → almost all enzymes are protein

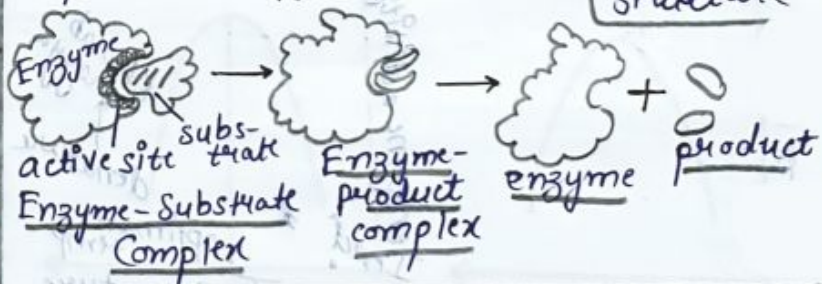
Biocatalyst

Sensetive to temp and PH.

exception

RNA, Ribozyme, Ribonuclease

Tertiary structure



Metabolism

↳ all chemical reactions in the body are called metabolic reactions

- anabolic reactions
- Catabolic reactions

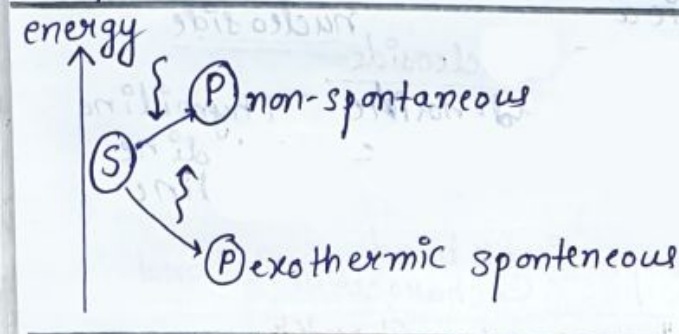
→ all metabolic reactions are enzyme catalysed.

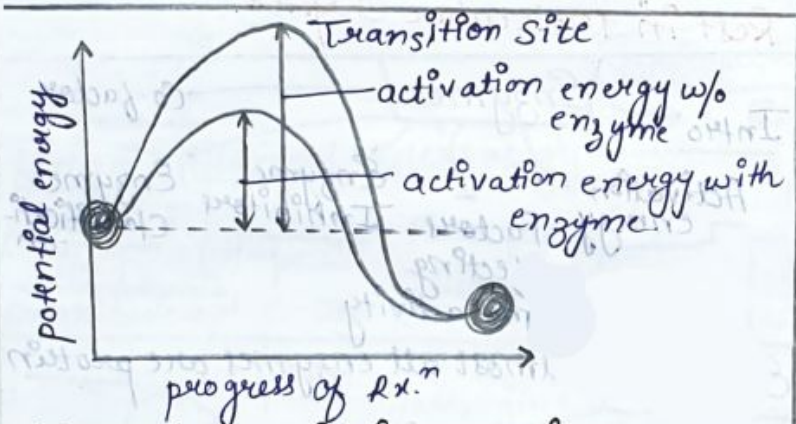
Enzymes increase speed of already occuring reactions.

$$\text{Speed} = \frac{\text{No. of product molecule}}{\text{Time}}$$

Substrate $\rightleftharpoons$ Product.

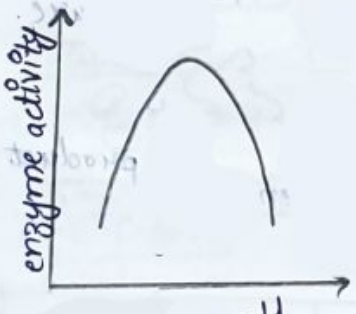
enzymes never change equilibrium, and will help reach equilibrium faster.

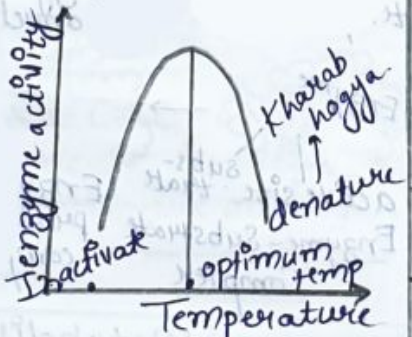




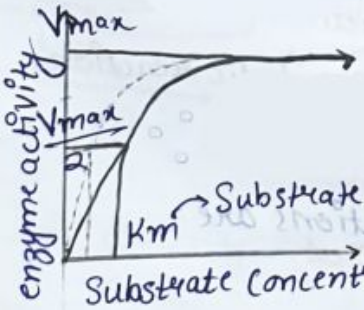
→ Concept of activation reaction

Effect of change →





for every 10°C, enzyme activity doubles.



Lesser the Km, more efficient is enzyme

Enzyme Inhibitors

Stop/reduce the activity of enzyme

Competitive

active site par same shape Ka inhibitor rasta roKK de, toh Substrate Ko enter Karneme time lagega

numbers Ka game

→ Jo zyada hoga enzyme/Inhibitor Vo affect Karega

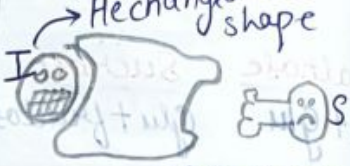
→ Inhibitor → Km ↑ Ise

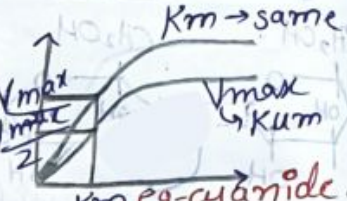
e.g → malonate (Inhibitor XX) succinic dehydrogenase

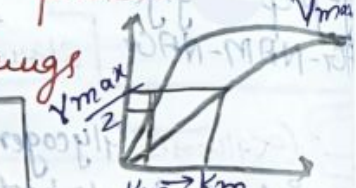
Succinate → product

eg → sulpha drugs

Non-Competitive







Classification

I O Oxidoreductase
II T Transferase
III H Hydrolase
IV L Lyase
V I Isomerase
VI L Ligase

Co-factors

Holoenzyme → Protein + Non protein
Whole — Apoenzyme + Co-factor

Co-factors → Metal ion (Zn) carboxypeptidase

Co-factors → prosthetic group → Organic → tightly and permanently bound to apoenzyme → Heme → Catalyse peroxidase

Co-factors → Co-enzymes → organic → loosely bound → attach to apoenzyme only when needed → NAD and NADP

Primary and Secondary Metabolites →

- primary metabolites have identifiable functions and play known roles in normal physiological processes.
- Secondary metabolites do not aid directly in the growth and development of plants but are required for their survival in environment.

Some secondary metabolites have ecological importance.

Some Secondary Metabolites →

pigments → Carotenoids, anthocyanins..
Alkaloids → Morphine, Codeine
Terpenoids → Monoterpenes, Diterpenes..
Essential Oils → Lemon grass oil..
Toxins → Abrin, Ricin
Lectins → Concanavalin A
Drugs → Vinblastin, Curcumin...
Polymeric substances → Rubber, gums, cellulose

The living state is non equilibrium steady-state to be able to perform work. Without metabolism no living state.
↳ synonym of metabolism.

Blood conc. of glucose in normal Healty person → 4.5-5.0 mM ⇒ Hormones → nanograms mL.

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