

Basics of Microbiology By Agrilearner App Team



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- Enzymes discovered by Eduard Buchner – 1897.
- Protein nature of enzymes discovered by J. Sumner.
- ATP structure – Fiske and Subba Rao.
- Photo synthetic system and aerobic heterotrophic system feed each other and called “Syntrophy” (between Carbon & energy cycle).
- The exchange of O₂ between photosynthetic system and heterotrophic system accompanies “Carbon cycle”.
- In living system ‘S’ is present mainly in the form of “Mercapto” groups in S – containing amino acids.
- Smooth E.R – Lipid synthesis.
- Plasmalemma – Responsible for the uptake and elimination of water maintains homeostasis.
- Cytosol: Site of glyconeogenesis; hydrolysis of fats to glycerol and fatty acids. Cellwall – Shape and rigidity.
- Endomembrane system: Membrane bound enzymes.
- Origin of cellular energy – Solar energy.
- A typical example of double helix – DNA and Amylase.

Triple helix – Collagen.

Single helix - RNA

- In animals nitrogen is not stored as ammonia; it is excreted as urine.
- All the biosynthetic reactions commence with one (or) another of a small group of molecules called “Key precursor metabolites” numbering of 12 – 75 building blocks.
- Assymmetric carbon atom “Chiral” in nature.
- Free energy $G = H - TS$.
H = molar heat energy (or) enthalpy
T = Temperature; S = Entropy.
- If $G = -Ve$ exergonic; $G = +Ve$ – endergonic
 $G = G^0 + RT \ln K_{eq}$
G = Standard free energy.
R = Gas constant = 8.31 J/mol/K.
T = Absolute Temperature

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Ln = Natural logarithm

Keq = equilibrium constant.

· The tendency of any particular atom ion (or) molecule to lose one.

Electron – Red – OX potential.

· An example of active transport is sulphate uptake by plant roots from the soil.

· The uptake of glucose by erythrocytes is passive uptake.

· PGA is transported as DHAP across the chloroplast membrane.

· Hydrophilic molecules move across the membrane as “Hydrophobic tail”

· In animals sugars transport as ‘glucose’.

Plants – Sucrose

Insects – Trehalase.

· Storage – animals – glycogen; Plants – Starch.

· High energy compounds are those which release energy after hydrolysis (or) phosphate bond energy compounds.

· Non – phosphorylated high energy compounds. – Acetyl CoA – Thioester.

· “ketoenol tautomerism” cause high energy in “Enolphosphates”.

· Type of bond in ATP, ADP – pyrophosphate.

Acetyl CoA – Thio ester

Glucose 6 P – 1P – Phosphate ester.

1, 3 diphosphoglycerate – Acyl phosphate.

· Phosphocreatine and phosphoarginine” serve as storage reservoir of chemical energy in muscle. Hydroxyl apatite basic material in bone.

· At C4 – right side OH Glucose; Left side OH galactose.

C2 – right side OH Glucose; Left side OH mannose

C5 – right side OH R - sugar; Left side OH – S - Sugar

· Heteropoly saccharide – heparin – Small molecular weight polysaccharide. Large molecular weight – Hyaluronic acid.

· 5 ring structure – furan; 6 ring – Pyran.

· “Hemiketals” are formed if the sugar contains a “Ketone group” in place of aldehyde.

· “Chair” form is more stable than the boat form.

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- When monosaccharides react with concentration acid like H₂SO₄ “furfural” (or) its derivatives are formed.
- When glucose oxidize with bromine water + KMnO₄ it give gluconic acid with strong oxidizing agent like concentration HNO₃ it gives “glucuronic acid”.
- Galactose give – Mucic acid.

Alkali

- Glucose = _____ Fructose and Mannose.
Through “Enediol”
- Change in specific rotation is called – Mutarotation.
a and b glucose in the proportion of 33% and 66%.
- Maltose - a 1-4 linkage – in germinated cereals – 2 glucose molecules.
- Isomaltose - a 1-6 linkage; Lactose - b, a (1-4) linkage.
- Sucrose - ab (1-2) Cellobiose -b, 1-4 linkage.
- Insulin is found in the roots of “Dahlia”.
- Main construction of supporting tissue – Cellulose.
- Skeleton of insects – Chitin, It is a polymer of N-acetyl glucose, 2-amine, b - 1-4 linkage.
- Protons which take up are located towards “Stroma”; Which release are located towards “laminar” side.
- Most abundant enzyme in nature – RUBISCO – RUBP carboxylase.
- Cereal husk – Hemicellulase.
- “Heparin” is the powerful inhibitor of blood clotting.
- Sumner crystallized the enzyme “Urease” from Jack bean meal.
- Many reactions which are energetically favourable do not always proceed rapidly due to energy barrier.
- Iso enzymes – These are the multiple molecular forms of an enzyme and may differ in physical and chemical properties.
- Glycolytic enzymes of the Cytosol are also organized as one unit – “Metabolite”.
- Allosteric refers to another space.

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- Michaelis – Menten's equation
- Much more accurate determination of V_{max} and valuable information of enzyme inhibitor – “Eadie – Hof stee plat”.
- Competitive inhibitor increases the apparent K_m for the substrate without effect on V_{max} .
- Inhibition of succinic dehydrogenase by Malonic acid which is a structural analogue of ‘Succinic acid’ example of competitive inhibitor.
- Non-competitive inhibitor reduces the V_{max} .
- Enzyme activity double for every 10°C raise.
- Enzyme activity unit S.I. – Katal.

Enzyme classification:-

- 1st class – II & III type of reaction IV – individual number of enzyme.
- Non-hydrolytic removal of a group enzyme – lyases.
- Formation of C-C; C-O; C-N; C-S bonds – ligases.
- Clarifying agent – Papain.
- Enzyme = Protein (Apoenzyme) + Non-Protein (Co-enzyme).
- Vitamins are structural components of Co-enzyme.
- Co-enzyme – A – Panthothenic acid (Vitamin); Biocytin – Biotin.
- Flavin nucleotides – Riboflavin (B2); TPP – Thiamine (B1).
- Co-enzyme B12 – Cyanocobalamin (B12); (Thiamine pyrophosphate B1)
- Pyridine nucleotide – Nicotinic acid.
- “Avidin” a protein from egg white binds Biotin.
- Cobalamin occurs only in animals.

Vitamin Function

b - Carotene (Provit of Vitamin A) Vision

Chele colciferol (Provit – Vitamin D) Binding of “Ca”.

Tocopherols (Provit – E) Antioxidant.

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Phylloquinone (Vitamin – K) Blood clotting.

- The amino acids react directly with a prosthetic group to form “Schiff’s” base.
- Ascorbic acid utilized mostly in “Hydroxylation reactions”.
- Non – protein amino acids – L.a amino acids.
- Biocytin is the prosthetic group of “Carboxylating enzymes”.
- “Ferridoxin” is the electron donor in NH_3 formation.
- 24 molecules of ATP are required for one molecule of nitrogen fixed.
- Nitrogen fixing gene – “nif gene”.
- Water is ultimate source of electrons in Nitrate reduction.
- “Sirohaem” an iron porphyrin which is embedded in the enzyme protein is involved in electron transfer.
- ‘S’ containing A.A – Cystine; Methionine.
- Succinic acid on transamination gives Aspartic acid, Phenyl alanine,
- Aromatic A.A. – Phenyl alanine.
- Hetero cyclic A.A. – Tryptophan, Histidine.
- Tryptophan contain an Imidole ring and Histidine contain Imidazole ring.
- Imino acids – Proline; Hydroxy proline.
- Dicarboxylic A.A.- Aspartic acid; glutamic acid.
- Amino acid reaction with benzaldehyde produces “Schiff’s base”.
- “Ninhydrin” is a powerful oxidizing agent it causes oxidative decarboxylation.
- The pH at which the AA has a net charges of zero is called “Iso electric point”.
- At this pH the AA has the least water solubility.
- At this pH the AA acquires a special form called “Zwitter ion” (or) “Inner salt form”.
- A molecule that cannot superimposed on its mirror image is called “Chiral molecule”.
- The aromatic amino acids are formed in “Shikimate pathway”.

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- The biological activity of protein depend on the maintenance of “folded structure”.
- Secondary structure of proteins in the form of a - Helix and b - pleated.
- Contractice protein – Myosin, Transport protein – Haemoglobin.

Structural protein – Collages, Hormones – Insulin.

Toxin – Ricin, Protective proteins – Antiboides.

Enzyme – Hexakinase.

- Solubility of proteins is increased by addition of salts like NaCl is salting in.
- There is tendency of denaturated proteins to come together and form a large precipitation, which comes out of the solution and this is called “Coagulation”. Eg: blood clotting.

Lipids:

- Lipids are stored in animals in ‘adipose tissues’.
- Complex lipids contain fatty acids; simple lipids do not contain fatty acids.
- Fatty acids are the fundamental building blocks of stored fats. Many structural units are straight chain “aliphatic monocarboxylic acid”.
- In plants triacyl glycerols are stored in the oil bodies as “Spherosomes” of seeds. In animals fats are stored in the “Adipose tissue”.
- Deficiency of essential fatty acids cause disease called “phrynoderma”.
- All double bonds are “Cistype”.
- The alcohol of acyl lipids is “Sphingosine” (or) its derivaties.
- Cutin and suberin (Waxes) are the polymers of “Hydroxy fatty acids”.
- Major lipids of gram +ve bacteria are phosphotidyl glycerol and ‘Phosphotidyl ethanolamine”.
- Starting material for fatty acid synthesis – Acetyl COA.
- Fatty acid synthesis is in “Cytosol” in animals and in “Plastids” in plants.
- All the enzymes employed in the synthesis of “triacyl glycerol” are present in E.R.
- “Phosphotidic acid” is the precursor for all acyl glucerol.
- Any phenols are formed from the amino acid “Phenyl alanine”.

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- Colourful anthocyanins of fruits – “Flavonoids”.
- Tannins are astringent phenols.
- Toxic substance “Bona” is present in the Lankapappu (or) Kesari pappu

Toxic effect of Bona – Lathyrus.

- Catabolic pathways are generally regulated by “Feed back inhibition”.
- In animals β oxidation occurs in Mitochondria and in plants in glyoxysomes.

Bits:-

- The monomer composition of the protein polymer constitutes the primary structure.
- In the β -pleated sheet the H-bonding is perpendicular to the axis of the chain.
- Sickle cell anaemia is due to the substitution of glutamic acid in the β -chain of haemoglobin by – Valine.
- Number of double bonds in steric acid – 0; oleic acid -1; Linoleic -2, Linolenic acid -3.
- The ‘N’ base in Lecithin is – Choline.
- The co enzyme pyridoxal phosphate is involved during catabolism of amino acids and for transamination.
- The source of protein nitrogen in ruminants is urea.
- Type of bond in triacyl glycerol – labile bond.
- The major components of the total energy of system which can do work under isothermal condition is known as “Enthalpy”.
- The major components of cutin and suberin are the products of the omega oxidation.
- The chemical substance involved in the transmission of nerve impulses is “Acetyl choline”.
- The metabolism of foreign compounds – Xenobiotic metabolism.
- In the fatty acid biosynthesis plants add further double bonds between the existing double bond and the methyl end in animals Hydroxyl group.
- Isoprenoids, the polymers of C-5 units are synthesized by Mevalonate pathway.
- Chemical which interfere with chlorophyll formation are used as Laser herbicides.
- AA’s are joined by a peptide bond with the elimination of water molecule.

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- The reactions which do not proceed of their own and require an external source of energy are called “Coupled reactions”.
- Non-reducing sugar – Sucrose.
- The double bonds in fatty acids are separated by Methylene group.
- The building block of terpene is IPP.
- A typical example of non-nucleic acid caffeine.
- Tryptophan synthetase – Gibberellin.

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