Title: Biochemistry and Bioenergetics [2-1-0-6]

Content *:*

Origin of life: Oparin and Haldane hypothesis; Abiotic formation of cellular constituents: Miller-Urey experiment, alkaline hydrothermal vents; Panspermia

Water: Properties of water, essential role of water for life on earth, hydrophobicity and other emergent properties of biomolecules in water

Biomolecules: Structure-function relationships of the building blocks for the four major classes of biomolecules viz., proteins, nucleic acids, carbohydrates and lipids; Relationship of the four sets of building blocks to functions carried out by these four classes of biomolecules; Covalent structure of proteins, nucleic acids and carbohydrates and non-covalent associations in lipids; Ramachandran plot: for peptides and extension to nucleic acids and carbohydrates; Structure-function relationship: myoglobin and hemoglobin.

Bioenergetics: Basic principles; Equilibria and concept of free energy; Coupled interconnecting reactions in metabolism; Oxidation of carbon fuels; Recurring motifs in metabolism

Metabolism and Regulation: Glycolysis and TCA cycle; Energy transducing membranes: plasma membrane, inner membrane of mitochondria, thylakoid membranes: similarities and differences; Chemiosmosis and oxidative phosphorylation; F_1,F_O ATPase as a reversible proton pump; Difference between respiration and fermentation; Anaplerosis; Need for and importance of shuttles across mitochondria; Photosynthesis: temporal relationship of light and dark reactions, photophosphorylation; Pentose phosphate pathway; Glycogen and fatty acid metabolism; Gluconeogenesis; Elucidation of metabolic pathways; Regulation of metabolism

Texts / References:

1. Stryer, L. (2015). Biochemistry. (8th ed.) New York: Freeman.
2. Lehninger, A. L. (2012). Principles of Biochemistry (6th ed.). New York, NY: Worth.
3. Voet, D., & Voet, J. G. (2016). Biochemistry (5th ed.). Hoboken, NJ: J. Wiley & Sons.