JM 202 : Basic Biological Chemistry

3 Credits

A) Concepts in chemistry
   i) Water, acids , bases and buffers
   ii) Thermodynamics
   iii) Stereochemistry
   iv) Bonding and non-bonding interactions – Non-bonding interactions In biological macromolecules
   v) Basic introduction to crystallography

Study material: *Biochemistry*, Voet&Voet, *Physical Chemistry: Principles and Applications in Biological Sciences*, Tinoco Jr., Sauer, Wang, Puglisi, Harbison, Rovnyak,*Proteins: structure and molecular properties*, Creighton

B) Biomolecules
   i) Protein conformation – Ramachandran Map
   ii) Proteins: super-secondary structures and folds – all α, α/β and all β folds
   iii) DNA structure – allowed dihedral angles, A/B/Z DNA conformations, major and minor grooves
   iv) Protein-DNA interaction (major folds taking specific structural examples, helix-turn-helix, β-sheets, Zn-fingers, Leucine zippers)
   v) Protein folding (Levinthal's paradox, Anfinsen's and Creighton's experiments,Wolynes' folding funnel)

Study material: *Introduction to protein structure*, Brandon &Tooze, *Biochemistry*, Voet&Voet, *Structure and mechanism in protein science*, A. Fersht

C) Introduction to Biophysical techniques
   i) Beer-Lambert's law
   ii) Fluorescence spectroscopy
   iii) Circular Dichroism
   iv) Mass spectrometry – including analysis of peptide fragmentation pattern to obtain sequence

Study material: Class notes and hand-outs

D) Enzyme catalysis and kinetics
   i) Catalytic mechanisms
   ii) Chemical kinetics as preamble to enzyme kinetics. Simple first-order and second-order reactions
   iii) Michaelis–Menten kinetics, reversible reactions and Briggs-Haldane relationship, effect of pH, kinetics of inhibition, bisubstrate reactions, Scatchard analysis for ligand binding, co-operativity (positive and negative), allostery, derivation of kinetic models using rapid equilibrium and steady state assumptions

Study material: *Biochemistry*, Voet&Voet, *Biochemical calculations*, Segal, *Enzyme kinetics*, Segal

E) Metabolism
   i) General design principles of metabolism
   ii) Energy metabolism (glycolysis, TCA cycle and oxidative phosphorylation)

Study material: *Biochemistry*, Metzler