Bioinorganic Chemistry

Schedule:

Week 1: The basic composition of biological systems. Essential, beneficial, and toxic elements. Selection and enrichment of essential elements. General biological roles of essential trace elements.

Week 2: Complex equilibria and factors influencing stability. Types of complex compounds and ligands. Coordination properties of amino acids, peptides, proteins, nucleic acids, and macrocycles; porphyrin-based complexes.

Week 3: Characteristics of enzymes; classification, composition, and mechanisms of metalloenzymes. Enzyme kinetics and inhibition.

Week 4: Membrane structure and transport processes. Ionophores and ion pumps. Complexing properties of alkali metal ions; selectivity; biological roles of Na^+ and K^+.

Week 5: Coordination properties of alkaline earth metals. Biological role of calcium: transport, muscle function, Ca-binding proteins, coagulation, and bone formation. Magnesium-containing metalloproteins/enzymes and the role of Mg in photosynthesis.

Week 6: Structure and activation of O_2; O_2 as a ligand; types of bonding. Biological roles of O_2. Coordination chemistry and biological roles of iron; hemoglobin, myoglobin, and other O_2 transport systems.

Week 7: Electron-transport proteins: cytochromes, P450, iron–sulfur proteins. Iron storage/transport: ferritin, hemosiderin, transferrin, siderophores. Iron absorption, deficiency, overload.

Week 8: Coordination chemistry and biological roles of molybdenum, chromium, tungsten, nickel, manganese, and cobalt. Enzymes: oxotransferases, nitrogenase, nickel enzymes, Mn enzymes, vitamin B_{12}.

Week 9: Coordination chemistry and biological role of copper. Copper proteins and blue-copper proteins. Key enzymes: SOD, tyrosinase, cytochrome c oxidase. Hemocyanin, ceruloplasmin, copper metabolism and disorders.

Week 10: Coordination chemistry and biological roles of zinc. Zinc enzymes, metallothionein, zinc fingers, zinc metabolism, toxicity, supplementation.

Week 11: Biological and coordination chemistry of Al, V, Se, Si, Tl, Pb, Sn. Toxicity and medical relevance.

Week 12: Supplementation of trace elements and removal of toxic metals. Selectivity of complexing agents. Metal-based chemotherapeutics. Diagnostic inorganic compounds and radioisotopes. Environmental aspects; removal of toxic elements from soil/water.