XL Life Sciences

XL1: Biochemistry

Section XL1.1 Structure and Function of Biomolecules

Organization of life; Importance of water; Structure and function of biomolecules: Carbohydrates, lipids, proteins, and nucleic acids; Protein structure, folding/misfolding, and function; Myoglobin, hemoglobin, lysozyme, ribonuclease A, carboxypeptidase, and chymotrypsin.

Section XL1.2 Enzymes and General Principles of Metabolism

Enzymes: catalysis, specificity, and regulation, kinetics (up to two substrates), enzyme inhibitors; Regulatory Enzymes; Vitamins and coenzymes; General principles of metabolism, hormonal regulation of metabolism; Generation and utilization of ATP.

Section XL1.3 Metabolic Pathways and Associated Disorders

Glycolysis, TCA cycle, pentose phosphate pathway, oxidative phosphorylation, gluconeogenesis, and fatty acid metabolism; Metabolism of nitrogen-containing compounds: nitrogen fixation, amino acids, and nucleotides. Photosynthesis, photophosphorylation, Calvin cycle. Metabolic disorders (Sugars, amino acids, and lipids).

Section XL1.4 Analytical Techniques

Buffering against pH changes in biological systems, the Henderson-Hasselbalch equation; Ion exchange, size exclusion and affinity chromatography, Thin layer and paper chromatography, centrifugation; Characterization of biomolecules by electrophoresis; Analytical methods to study DNA-protein and protein–protein interactions; Lambert-Beer law, UV-visible, and fluorescence spectroscopy; next-generation DNA sequencing, PCR, and site-directed mutagenesis. Antibody-antigen interaction; Immunological techniques: immunodiffusion, immune-electrophoresis, RIA and ELISA, flow cytometry; monoclonal antibodies and their applications.

Section XL1.5 Cell Structure and Function

Cell structure and organelles; Biological membranes; Transport across membranes; Membrane assembly, Protein targeting and degradation; Biosignalling; Receptor-ligand interaction; Two-component system, hormones and neurotransmitters; Toxins and ion channels.

Section XL1.6 Gene Expression and Its Regulation, and DNA Repair

DNA replication, transcription, and translation; DNA damage and repair; Nuclease accessibility methods; Biochemical regulation of gene expression.