

XL Life Sciences
XL3: Microbiology
Section XL3.1: Historical Perspective

Discovery of microbial world; Landmark discoveries relevant to the field of microbiology; Controversy over spontaneous generation; Role of microorganisms in transformation of organic matter and in the causation of diseases.

Section XL3.2: Methods in Microbiology

Pure culture techniques; Disinfection and Sterilization: principles, methods and assessment of efficacy; Principles of microbial nutrition; Enrichment culture techniques for isolation of microorganisms; Antigen and antibody detection methods for microbial diagnosis; Light-, phase contrast-, fluorescence- and electron-microscopy; PCR, Real-time PCR for quantitation of microbes; CRISPR-Cas.

Section XL3.3: Microbial Taxonomy and Diversity

Bacteria, Archaea and their broad classification; Eukaryotic microbes: Yeasts, molds and protozoa; Viruses and their classification; Molecular approaches to microbial taxonomy and phylogeny.

Section XL3.4: Prokaryotic Cells: Structure and Function

Cell walls, cell membranes and their biosynthesis; Mechanisms of solute transport across membranes; Flagella and Pili, Capsules, Cell inclusions like endospores and gas vesicles; Bacterial locomotion, including positive and negative chemotaxis.

Section XL3.5: Microbial Growth

Definition of growth; Growth curve; Mathematical expression of exponential growth phase; Measurement of growth and growth yields; Synchronous growth; Continuous culture; Effect of environmental factors on growth; Sporulation; Quorum sensing; Bacterial biofilm and biofouling.

Section XL3.6: Microbial Metabolism

Energetics: redox reactions and electron carriers; Electron transport and oxidative phosphorylation; An overview of metabolism; Glycolysis; Pentose-phosphate pathway; Entner-Doudoroff pathway; Glyoxalate pathway; The citric acid cycle; Fermentation; Aerobic and anaerobic respiration; Chemolithotrophy; Photosynthesis; Calvin cycle; Biosynthetic pathway for fatty acids synthesis; Common regulatory mechanisms in synthesis of amino acids; Regulation of major metabolic pathways.

Section XL3.7: Microbial Diseases and Host Pathogen Interaction

Normal microbiota; Classification of infectious diseases; Reservoirs of infection; Nosocomial infection; Opportunistic infections; Emerging infectious diseases; Mechanism of microbial pathogenicity; Nonspecific defense of host; Antigens and antibodies; Humoral and cell mediated immunity; Vaccines; Passive immunization; Immune deficiency; Human diseases caused by viruses, bacteria, and pathogenic fungi.

Section XL3.8:	Control of Micro-organisms: Chemotherapy/Antibiotics
General characteristics of antimicrobial drugs; Antibiotics: Classification, molecular mechanism of mode of action and resistance; Antifungal and antiviral drugs.	
Section XL3.9:	Microbial Genetics
Types of mutation; UV and chemical mutagens; Selection of mutants; Ames test for mutagenesis; Bacterial genetic system: transformation, conjugation, transduction, recombination, plasmids, transposons; DNA repair; Regulation of gene expression: repression and induction; Operon model; Bacterial genome with special reference to <i>E.coli</i> ; Phage λ and its life cycle; RNA ; Mutation in virus genomes, virus recombination and reassortment; Basic concept of microbial genomics; Cell cycle and cell division in lower eukaryotes.	
Section XL3.10:	Microbial Ecology
Microbial interactions; Carbon, sulphur and nitrogen cycles; Soil microorganisms associated with vascular plants; Bioremediation; Uncultivable microorganisms; Basic concept of metagenomics and metatranscriptomics.	