

GARDEN CITY UNIVERSITY
SEMESTER- I
B.Sc. Biotechnology, Biochemistry, Genetics

Title of the course: Fundamentals of Cell Biology
CODE- 02ABBGR17111

CREDITS: 04

Unit 1. Concepts of Cell Biology

- 1.1 Milestones in cell biology
- 1.2 Cell theory & properties of cell.
- 1.3 Classification of cell, Structural organization of prokaryotic and eukaryotic cell.
- 1.4 Comparative study of microbial, plant and animal cells.
- 1.5 Origin and evolution of cells

Unit 2. Structure and Biogenesis of Cellular organelles

- 2.1 Nucleus and Chromosomes;
- 2.2 Biosynthesis of mitochondria, Chloroplasts (genomes),
- 2.3 Ribosomes; Golgi complex;
- 2.4 Lysosomes (Vacuoles and micro bodies);
- 2.5 Biosynthetic process in ER and Golgi apparatus;
- 2.6 Protein synthesis and folding in the cytoplasm
- 2.7 Degradation of cellular components.

Unit 3. Membrane Biology

- 3.1 Fluid mosaic model of membrane structure, Experimental demonstration, of membrane fluidity
- 3.2 Membrane asymmetry and selective permeability of the membranes,
- 3.3 Types of membrane transport - active, passive, diffusion and osmosis.
- 3.4 Interaction between cell and its environment Types of cell junction,
- 3.5 Liposomes, Freeze-etching and freeze fracture technique for membrane studies.
- 3.6 Principles of microscopy: Working principle & uses of: Light Microscopy; Phase contrast microscopy; Electron microscopy (EM), Scanning EM (SEM), Transmission EM (TEM)

Unit 4. Extracellular Matrix

- 4.1 Composition of molecules that mediate cell adhesion,
- 4.2 Membrane receptors for extra cellular matrix - macromolecules,
- 4.3 Regulation of receptor and function.
- 4.4 Cell Cycle & Cancer Biology: Concept of cell cycle,
- 4.5 Check points and their molecular regulation, Concept of normal and transformed cell, role of proto-oncogene, Tumor suppressor genes.
- 4.6 Metastasis, Carcinogenesis and agents promoting carcinogenesis,
- 4.7 Characteristics and molecular basis of cancer.

Course: BIOLOGICAL CHEMISTRY
CODE: 02ABBGR17112

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Unit 1 Chemical Bonds and Chemical Equilibrium

- 1.1. Structure & function of chemical, ionic bonds, covalent bonds and non-covalent bonds
- 1.2. Types of hydrogen bonds and its importance
- 1.3 Familiarization to the concepts of chemical equilibrium- types of rate of reactions, use of equilibrium constants
- 1.4 Types of Oxidation – reduction reactions
- 1.5 Examples of redox reactions

Unit – 2 Solutions

- 2.1 Solution - Physical properties of solutions, Water as a biological solvent, & solubility
- 2.2 Electrolytes and non-electrolytes
- 2.3 Molarity, Normality, Mole and Percent Solutions.
- 2.4 Preparation of Stock, Working, w/v, v/v and dilute solutions.
- 2.5 Diffusion & Osmosis – biological importance

Unit 3 – Acid and Bases

- 3.1 Properties and strengths of Acids and Bases – Henderson-Hasselbalch equation
- 3.2 Ionization of water
- 3.3 Reactions of acids and bases - Titration of strong and weak acids and bases.
- 3.4 Methods to measure pH, pka and pkb values.
- 3.5 Buffers – Composition & Biological significance

Unit – 4 – Biomolecules- Structure & biological importance of:

- 4.1 Types & roles of Carbohydrates – Disaccharides
- 4.2 Types & roles of Lipids – fatty acids, waxes, fats and oils
- 4.3 Types & roles of Proteins and amino acids – formation of peptides,
- 4.4 Elucidation of the Protein structure: primary and secondary levels
- 4.5 Components of nucleic acids – DNA double helix

Title of course: Classical Genetics
CODE: 02ABBGR17113

CREDITS: 04

Unit I: Mendelian Inheritance

- 1.1 Selection of material, characters for genetic studies, familiarization with phenotype, genotype, locus, allele, homozygote, heterozygote Pure line, filial generation, reciprocal cross, back cross and test cross.
- 1.2 Mendelian Laws: Law of segregation - Monohybrid cross with examples. Law of Independent Assortment - Dihybrid cross and with examples.
- 1.3 Variations to Dominance - Co-dominance & Incomplete dominance, Pleiotropism
Lethal and Sub Lethal Genes: Dominant and recessive lethal; Balanced lethal: *Drosophila*.
Para mutation: Mottling phenotypes in maize, Segregation distortion, Sd gene in *Drosophila*.
- 1.4 Features of Quantitative Inheritance: Additive effect, Kernel color in Maize, skin color, height and IQ in man
- 1.5 Multifactorial inheritance: Hypertension, Diabetes mellitus

Unit – 2 Mendelian Genetics

- 2.1 Different types of Epistasis with examples. Supplementary & complementary gene interaction
- 2.2 Multiple alleles: Theories of multiple allelic inheritance, Eye colour in *Drosophila*
Coat colour in mice and rabbits, ABO blood groups, Blood group incompatibility in transfusion.
- 2.3 Extra chromosomal inheritance - *Paramecium*, Yeast, *Drosophila*, Sex linked inheritance: X-linked & Y-linked traits.
- 2.4 Sex determination in man - Bridge's genic theory
- 2.5 Dosage compensation – in man & *Drosophila* Gynandromorphs.

Unit –3 Organellar inheritance

- 3.1 Variegation in leaves of higher plants: *Mirabilis jalapa*.
- 3.2 Maternal inheritance: Poky mutants in *Neurospora*, shell coiling in snails, Leber's optic atrophy
- 3.3 Uniparental inheritance: Mutations in extra nuclear genes in *Chlamydomonas*
Red fiber disease Kappa particles Male sterility in Maize Plasmid
- 3.4 Transposable elements - IS elements.
- 3.5 Mitochondrial and Chloroplast genomes

Unit 4 - Introduction to evolutionary genetics

- 4.1 Evolutionary significance. Darwinism, Mutation theory and Neo Darwinism
Synthetic Theory.
- 4.2 Evolution at molecular level: Nucleotide sequence.
- 4.3 Isolation Pre-mating and post mating isolating mechanisms, Role of isolation in speciation.
- 4.4 Speciation: Methods of speciation - Allopatric Sympatric Peripatric, Parapatric & quantum speciation