

**M.Sc. (Med.) Entrance Examination**  
**GROUP- C (B.Sc. Biotech/ microbiology)**

**BIOTECHNOLOGY/BIOCHEMISTRY**

**50 QUESTIONS**

**Nature of biological material. General properties : organic and inorganic compounds. Suitability of organic compounds for generation of structure, storage of energy and information. Hydrophilic and hydrophobic groups in biological molecules.**

**Classification of biomolecules based on their role in bioprocesses. Molecules involved in generation of mechanical stability—peptidoglycans : polysaccharides and membrane lipids. Analysis of carbohydrates, lipids, proteins and nucleic acid, biosensors and diagnostics**

**Molecules involved in information storage and retrieval—the nucleic acids.**

**Molecules executing mediator and catalytic functions—the proteins.**

**The sign molecules. Biochemical composition of cell Protein, Lipids, Carbohydrates, Nuclear acids and metabolic pool. Nature of genetic material. DNA, replication**

**Perspectives of biological macromolecules : The repeating units in nucleic acid and proteins. Helicity, bending, looping, pleats, salt bridges etc. and their determinants. The basis for intermolecular interaction *e.g.*, enzyme-substrate and antigen—antibody recognition.**

Structure and function of cell organelles : ultrastructure of cell membrane, cytosol, Golgibodies, endoplasmic reticulum (rough and smooth), ribosomes cytoskeletal structures (action, microtubles etc.) Mitochondria, chloroplasts, lysomes, peroxyosomes, nucleus (nuclear membrane, nucleoplasm, nucleolus chromatin,). Cell division and cell cycle (include cell synchrony and its application). Cell-cell interaction.

Cell locomotion (ambeoid, flagellar and ciliary). Muscle and nerve cells.

Cell senescence and death. Cell differentiation of plants and animals.

Mendelian laws of inheritance, gene interactions.

Sex determination in plants and animals; sex-linkage; non-disjunction as a proof of chromosomal theory of inheritance. Linkage; mapping genes; interference; coincidence in pro- and eukaryotes. Chromosomes; chemical composition; structural organization of chromatids, centromeres, telomeres, chromatin, nucleosome organization; eu- and heterochromatin; special chromosomes (e.g. polytene and lampbrush, chromosomes); banding patterns in human chromosomes.

Structural and numerical at aberrations involving chromosomes; evolution of wheat, cotton and rice;

Hereditary effects—Kleinfelter, Turner, Cri-duChat and Down syndromes.

Mutations—spontaneous and induced; chemical and physical mutagens; induced mutations in plants, animals and microbes for economics benefit of man.

Molecular basis of life, Structure of DNA, DNA replication both prokaryotes and eukaryotes.

DNA recombination molecular mechanisms in prokaryot and eukaryot.

Insertion elements and transpons.

Structure of prokaryotic genes.

Prokaryotic transcription.

Prokaryotic Translation.

Prokaryotic gene expression (lac, his, trap, catabolic repression)

Structure of eukaryotic genes.

Eukaryotic transcription.

Eukaryotic Translation.

Eukaryotic gene expression transcription factors etc.

Gene expression in yeast.

Gene expression in protozoan parasites.

Gene organization and expression in mitochondria and chloroplasts.

Post translation regulation of gene expression.

Development and environment regulation of gene expression.

The Immune system and immunity along with historical perspective.

Antigen-antibody and their structure.

The organs and the cells of the immune system and their function.

Antigen-antibody interaction.

Humoral and cell mediated immunity (role of MHC and genetic restriction)

Origin of diversity in the immune system

Effectors mechanisms.

Immunity to infectious of diseases, vaccines.

What is gene cloning and why do we need to clone a gene?

Tools and techniques-plasmids and other vehicles genomic DNA, RNA, CDNA, RT

enzymes and other reagents technique, laboratory requirements.

Safety measures and regulations for recombinant DNA work.

Choice and selection of the tools and the techniques.

Vehicles : Plastids and bacteriophages, available phagemids, cosmids, viruses.

Purification of DNA form bacteria, plant and animal cells.

Manipulation of purified DNA, Introduction of DNA into living cells. Cloning vectors for E.coli. Cloning vectors for organisms other than E.coli., yeast, fungi, plants-agrobact, plant virus animal viruses.

Application of cloning in gene analysis: How to obtain a clone of a specific gene,

studying gene location of structure, studying gene expression.

Gene cloning and expression of foreign genes in research and biotechnology, Production of protein from cloned gene.

Gene cloning in medicine : Pharmaceutical compounds, artificial insulin gene, recombinant vaccine, diagnostic reagents.

General metabolism

Special secondary metabolites/products (Insulin, Growth hormone, Interferon, plasminogen activator, factor VIII etc.)

Expressing cloned proteins in animal cells. Over production and processing of chosen protein.

The need to express in animal cells

Production of vaccines in animal cells

Production of monoclonal antibodies

Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1 IL-2, NGF, erythropietin etc.)

Bioreactors for large-scale culture of cells.

Transplanting cultures cells.

## GROUP – C (B.Sc. Biotech/ microbiology)

### BIOTECHNOLOGY/MICROBIOLOGY

50 QUESTIONS

Microbial metabolism fermentation products. A survey of products from microorganisms.

Strains Improvement by enrichment, selection and recombinant DNA methods.

Production of heterologous protein in interest in microorganisms.

Nature of biochemical reactions underlying biosynthesis and degradation. Role of enzymes in such reactions. Protein and non-protein enzymes. Kinetics of enzyme catalyzed reactions. *In vitro* activity of purified enzymes and their applications in industry. Various uses of enzymes—enzymes on food processing, medicine, diagnostics and production of new compounds., Enzymes as research tool—ELISA methods, modification of biological compounds with the help of enzymes

Development of microscopy (optical, TEM and SEM).

Pasteur's experiments disproving spontaneous generation.

The concept of sterilization. Methods of sterilization (Dry heat wet heat, radiation, chemical and filtration etc.)

Concept of microbial species and strains.

The various forms of microorganisms—PPLOS, cocci, bacilli and sprilla.

Genetic homogeneity in clonal populations.

Spontaneous and induced variation arising in microbial population.

Gene transfer in microorganisms.

Nature of the microbial cell surface. Gram positive and gram negative bacteria. Kinds of flagella. Stereotypes.

Prokaryotic and eukaryotic microbial cells.

Nutritional classification of microorganisms.

Microbes in extreme environments—the thermophiles and alkalophiles.

Pathogenic microorganisms. Defense mechanism against microorganisms.

Symbiosis and antibiosis among microbial populations.

N<sub>2</sub> fixing microbes in agriculture.

Microbial metabolism fermentation products. A survey of products from microorganisms.

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Cell as a basic unit of living systems. The cell theory. Pre-cellular evolution : artificial creation of “cells”. Broad classification of cell types : PPLOS, bacteria, eukaryotic microbes, plant- and animal cells. A detailed classification of cell types within an organism. Cell, tissue, organ and organism as different levels of organization of otherwise genetically similar cells. Ecological amplitude of cells in high, altitude, sediments, arctic, hot spring, and brackish and fresh-water environments. Ultrastructure of the cell membrane.

Basic-microbial genetics conjugation, transduction, transformations; isolation of auxotrophs, replica plating techniques, analysis of mutations in biochemical pathways, one gene- one enzyme hypothesis.

Extra chromosomal inheritance, mitochondrial and chloroplast genetic systems.

Population genetics : Hardy-Weinberg equilibrium, gene and genotypic frequencies.

Energetics of living body sources of heat limits to temperature. Heat dissipation and conservation. Lambert—Beer law. Spectrophotometry and colorimetry Primary events in photosynthesis. Strategies of light reception in microbes, plants and animals.

Correction of vision faults. Electrical properties of biological compartments. Electricity as a potential signal



General principles; buffers; electroanalytical methods: potentiometric and conductometric; photometry; chromatographic methods of separation : gel permeation, ion exchange, reverse phase and affinity chromatography, HPLC and

FPLC : centrifugation; radiotracer technique: gel electrophoresis techniques : electro blotting and electroelution. capillary electrophoresis. API-electrospray and MALDI-TOF mass spectrometry.

History developed of cell cultures. The natural surrounding of animal cells.

Metabolic capabilities of animal cells. Simulating natural condition for growing animal cell.

Importance of growth factors of the serum.

Primary cultures. Anchorage dependence of growth. Non-anchorage dependent cells.

Secondary cultures. Transformed animal cells – Established/continuous cell lines.

Commonly used animal cell lines—their origin and characteristics.

Growth kinetics of cells in culture.

Application of animal cell culture for studies on gene expression.

Organ culture

Transfection of animal cell : **Selectable markers**. HAT selection. Antibiotic resistance etc.

Cell fusion : Transplantation of cultured cells. Differentiation of cells.