

KARACHI EDU COACHING

Grade 10 Biology • Sindh Textbook Board

Chapter 8: Biotechnology

Principles, Processes, and Applications in Modern Biology

SIGNIFICANCE

Major Fields & Significance of Biotechnology



Healthcare

Human insulin, interferons, and gene therapy for disorders.



Agriculture

Transgenic pest-resistant crops and abiotic stress tolerance.



Environment

Bioremediation to clean oil spills and toxic industrial wastes.

Genetic Engineering & Recombinant DNA

TOOL 01

Restriction Enzymes

Molecular scissors cutting DNA at precise palindromic sequences.

TOOL 02

DNA Ligase

Molecular glue sealing sugar-phosphate backbones to form rDNA.

TOOL 03

Vectors

Plasmids or bacteriophages carrying genes into host cells.

Steps in Gene Cloning & Production

01

Isolation

Isolate target gene from source DNA.

02

Insertion

Splice gene into vector plasmid.

03

Transformation

Introduce plasmid into E. coli.

04

Cloning & Harvest

Mass replicate and purify protein.

SCALE UP

Industrial Fermentation Processes

Bioreactor Design

Stainless steel vessels engineered for bulk cultivation of microorganisms.

Key Controls

Cooling jackets, spargers for aeration, and automated pH probes.

Metabolite Yield

Large-scale production of penicillin, citric acid, and enzymes.

Plant Tissue Culture & Micropropagation

Totipotency

Unique genetic ability of a single plant cell to regenerate an entire organism.

Callus Formation

Unorganized mass of actively dividing cells grown on nutrient agar.

Mass Propagation

Rapid production of disease-free clones and rare endangered species.

Agricultural Biotechnology & Transgenics

Bt Crops

Insect-resistant crops expressing bacterial crystal toxins to stop bollworms.

Herbicide Tolerance

Engineered resistance allowing effective weed clearing without harming cash crops.

Golden Rice

Biofortified rice synthesizing Beta-carotene to combat Vitamin A deficiency.

Bioethics & Future Horizons

Balancing scientific breakthroughs with ecological biosafety and ethical responsibility.

Biosafety Controls

Gene Editing Ethics