

AFCAT SCIENCE

BIOTECHNOLOGY (ONE LINE APPROACH)

Concept / Term	One-line Explanation	Example / Extra Info
Biotechnology	Application of biological organisms, systems or processes for human benefit.	Insulin production, gene therapy
Father of Biotechnology	Karl Ereky (1919) – coined the term 'Biotechnology'.	-
Genetic Engineering	Manipulation of DNA to alter genetic makeup of organisms.	Recombinant DNA Technology
Recombinant DNA (rDNA)	DNA formed by combining DNA from two different sources.	Used to produce insulin, vaccines
Plasmid	Small circular DNA in bacteria used as vector in gene transfer.	Commonly from E. coli
Vector	Carrier molecule that transfers foreign gene into host cell.	Plasmid, virus, bacteriophage
Host	Organism that receives the recombinant DNA.	E. coli, yeast
Restriction Enzymes	Enzymes that cut DNA at specific sequences (molecular scissors).	EcoRI, HindIII
Ligase Enzyme	Enzyme that joins DNA fragments.	DNA Ligase
DNA Polymerase	Enzyme that synthesizes DNA from nucleotides.	Used in PCR
PCR (Polymerase Chain Reaction)	Technique to amplify small quantities of DNA.	Developed by Kary Mullis
Gel Electrophoresis	Technique to separate DNA fragments based on size.	Smaller fragments move faster
Cloning	Production of genetically identical organisms or cells.	Dolly sheep
Gene Cloning	Copying of a particular gene for study or application.	Used in rDNA technology
Cell Culture	Growing cells under controlled conditions in lab.	Used in vaccine and antibody production
Tissue Culture	Growth of plant/animal tissues in nutrient medium.	Basis of micropropagation

Micropropagation	Rapid multiplication of plants using tissue culture.	Banana, orchid cultivation
Transgenic Organism	Organism containing foreign gene (transgene).	Bt cotton, transgenic mice
Bt Cotton	Cotton genetically modified with <i>Bacillus thuringiensis</i> gene for pest resistance.	Kills bollworm larvae
Golden Rice	Genetically modified rice rich in Vitamin A.	Biofortified crop
Gene Therapy	Treatment of genetic diseases by correcting defective genes.	Used for ADA deficiency
Human Genome Project (HGP)	International project to map all human genes (completed in 2003).	23 pairs of chromosomes sequenced
CRISPR-Cas9	Gene-editing tool allowing precise DNA modification.	Revolutionary biotechnology method
Stem Cells	Undifferentiated cells that can develop into any body cell.	Used in regenerative medicine
Bioinformatics	Use of computers and software to analyze biological data.	Genome sequencing, protein modeling
Bioreactor	Vessel used for large-scale production of biological products.	Fermenters for antibiotics/enzymes
Fermentation	Process of converting sugars to alcohol or acid by microbes.	Used in brewing, curd, antibiotics
Enzyme Engineering	Altering enzymes for industrial or medical use.	Immobilized enzymes
Monoclonal Antibodies	Identical antibodies produced by hybridoma technology.	Used in diagnosis & cancer therapy
Hybridoma Technology	Fusion of B-cells with cancer cells to produce monoclonal antibodies.	Developed by Kohler & Milstein
DNA Fingerprinting	Technique to identify individuals by their DNA patterns.	Used in forensics, paternity tests
Bioethics	Ethical issues related to biotechnology applications.	Cloning, GM crops debates
Biosafety	Precautions to prevent harmful effects of biotechnology.	Lab safety, GM regulation

Biopesticides	Natural or genetically engineered organisms controlling pests.	Bacillus thuringiensis
Biofertilizers	Microbes that enhance soil fertility.	Rhizobium, Azospirillum
Bioremediation	Use of microbes to clean pollutants from environment.	Oil spill cleanup
Biodegradation	Breakdown of materials by microorganisms.	Composting, waste treatment
Bioleaching	Extraction of metals from ores using microbes.	Thiobacillus ferrooxidans
Biomining	Recovery of minerals using biological agents.	Copper, gold extraction
Bioplastics	Plastics made from renewable biological materials.	Polyhydroxybutyrate (PHB)
Biofuels	Fuels derived from biological sources.	Ethanol, biodiesel
Ethanol Fermentation	Conversion of sugar to ethanol using yeast.	Saccharomyces cerevisiae
Antibiotics	Substances produced by microbes to kill other microbes.	Penicillin from Penicillium notatum
First Antibiotic Discovered	Penicillin (1928) by Alexander Fleming.	Saved millions of lives
Vaccine Production (rDNA)	Use of recombinant DNA to develop safe vaccines.	Hepatitis B vaccine
Gene Bank	Facility to preserve genetic material for future use.	Seed banks, cryopreservation
Cryopreservation	Storing cells/tissues at very low temperature (-196°C).	Uses liquid nitrogen
Biosensor	Device combining biological component with sensor for detection.	Glucometer for blood sugar
Biochip / DNA Chip	Miniaturized device containing DNA sequences for analysis.	Used in gene expression studies