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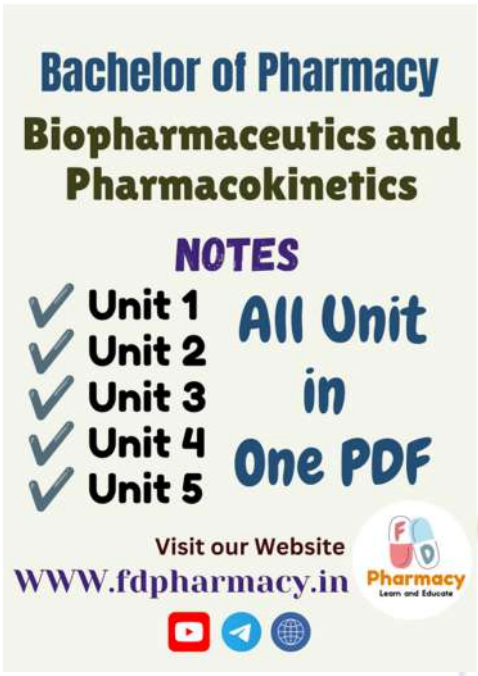
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PHARMACEUTICAL BIOTECHNOLOGY

UNIT 1

TOPIC :

- a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.

Biotechnology

Biotechnology is the branch of science and technology that uses living organisms, cells, microorganisms, or biological systems to develop useful products and processes for human welfare.

It combines subjects like:

- Biology
- Microbiology
- Genetics
- Biochemistry
- Molecular biology
- Pharmacy

Biotechnology is widely used in medicine, agriculture, food production, environmental protection, and industry.

Examples of Products Produced by Biotechnology

- Vaccines
- Antibiotics
- Insulin
- Hormones
- Enzymes
- Monoclonal antibodies
- Biofuels

Historical Background of Biotechnology

Year	Scientist	Contribution
6000 BC	Ancient civilization	Fermentation used for bread, wine, curd
1676	Antonie van Leeuwenhoek	Discovery of microorganisms using microscope
1796	Edward Jenner	Developed first smallpox vaccine
1865	Gregor Mendel	Laws of inheritance
1869	Friedrich Miescher	Discovery of DNA
1928	Alexander Fleming	Discovery of penicillin
1953	James Watson and Francis Crick	Structure of DNA explained
1973	Stanley Cohen and Herbert Boyer	Recombinant DNA technology
1982	Humulin	First recombinant insulin produced
1990	Scientists	First gene therapy trial
2003	Human Genome Project	Human genome sequencing completed
2020	Scientists	Development of mRNA COVID-19 vaccines

Scope of Biotechnology

Biotechnology has wide applications in different fields. It is mainly divided into four branches:

1. Red Biotechnology
2. Green Biotechnology
3. White Biotechnology
4. Blue Biotechnology

1. Red Biotechnology

→ Red biotechnology is related to medical and healthcare applications.
→ It involves the use of biotechnology for prevention, diagnosis, and treatment of diseases.

Applications

- Production of vaccines
- Production of antibiotics
- Manufacturing of insulin and hormones
- Development of monoclonal antibodies
- Gene therapy
- Stem cell therapy
- Diagnostic kits

Importance

- Helps in treatment of chronic diseases
- Improves healthcare quality
- Reduces mortality rate
- Produces safer medicines

2. Green Biotechnology

→ Green biotechnology is associated with agriculture and plant science.
→ It is used to improve crop quality and agricultural productivity.

Applications

- Development of pest-resistant crops
- Production of disease-resistant plants
- Genetically modified (GM) crops
- Plant tissue culture
- Biofertilizers and biopesticides

Importance

- Increases food production
- Reduces crop damage
- Improves nutritional value
- Reduces use of harmful pesticides

3. White Biotechnology

→ White biotechnology is also called industrial biotechnology.
→ It uses microorganisms and enzymes in industrial processes.

Applications

- Production of biofuels
- Preparation of biodegradable plastics
- Production of industrial enzymes
- Waste management
- Fermentation industries

Importance

- Eco-friendly industrial production
- Reduces pollution
- Saves energy
- Produces biodegradable products

4. BLUE BIOTECHNOLOGY

→ Blue biotechnology deals with marine and aquatic organisms.
→ It uses sea organisms for pharmaceutical and industrial purposes.

Applications

- Development of marine drugs
- Production of enzymes from marine organisms
- Aquaculture improvement
- Cosmetic products from sea organisms

Importance

- Source of new medicines
- Useful in cancer research
- Helps marine conservation
- Industrial applications

Applications of Biotechnology in Pharmacy

1. Production of Vaccines

Biotechnology helps in preparation of safe and effective vaccines using recombinant DNA technology.

Examples:

- Hepatitis B vaccine
- COVID-19 mRNA vaccines

2. Production of Antibiotics

Microorganisms are used for manufacturing antibiotics.

Examples:

- Penicillin
- Streptomycin
- Tetracycline

3. Production of Recombinant Insulin

Human insulin is produced using genetically engineered bacteria.

Advantages:

- High purity
- Less allergic reactions
- Large-scale production

4. Gene Therapy

Gene therapy is used to treat genetic disorders by replacing defective genes with healthy genes.

Applications:

- Cancer treatment
- Genetic disease treatment

5. Monoclonal Antibodies

These are laboratory-produced antibodies used for diagnosis and treatment.

Uses:

- Cancer therapy
- Autoimmune diseases
- Diagnostic tests

Advantages of Biotechnology

- Improves healthcare
- Produces better medicines
- Increases agricultural productivity
- Environment-friendly processes
- Helps in disease diagnosis
- Reduces industrial waste
- Improves food quality

Disadvantages of Biotechnology

- Ethical issues
- High cost of research
- Risk of genetic contamination
- Possible environmental hazards
- Misuse of genetic engineering