

Unit 10

INTRODUCTION TO BIOTECHNOLOGY

INTRODUCTION TO BIOTECHNOLOGY

I. Overview of Biotechnology

Biotechnology, the term, is a combination of two words 'bio' and 'technology', — 'bio' means biological systems or processes, and 'technology' refers to methods, systems, and devices used to make useful products from these biological systems.

Thus, biotechnology refers to the different technologies that make use of living cells and/ or biological molecules to generate useful products for the benefit of mankind.

II. Historical Background

- Early Developments: Biotechnology has roots dating back to ancient civilizations where people used fermentation processes to produce food and beverages.

We all must have observed our mothers making curd for the entire family. It is a classic example of fermentation technology, which can be conducted right at home.

Fresh Milk
boiled to
100°C and
cooled to
37°C



Add a teaspoonful
of one-day-old curd
and leave
undisturbed for
4-5 hours



Two phase
separation of
curd and whey



Observation: The raw material, milk, has been converted completely into a semisolid sour tasting product.

WHAT HAS ACTUALLY HAPPENED?

Lactobacillus bacteria from the curd react with the milk protein casein. Lactic acid formed as a by-product, denatures the globular proteins and coagulates to produce the solid curds and separates the watery whey protein layer.

Med-Pharma12 Notes

Visit: www.medpharma12.com

- Modern Era: The modern era of biotechnology began in the mid-20th century with the discovery of DNA structure by Watson and Crick and the development of recombinant DNA technology by Paul Berg in the 1970s.

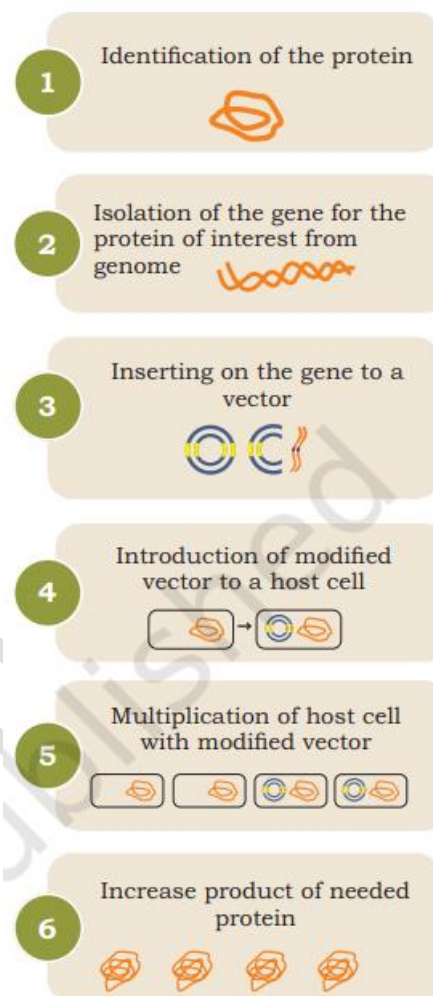


Fig. 1.1: Overview of modern biotechnology

III. Key Concepts in Biotechnology

- **Genetic Engineering:**

Genetic engineering involves the manipulation of an organism's genetic material to achieve desirable traits or produce specific products. Techniques include gene cloning, gene editing (e.g., CRISPR-Cas9), and gene transfer.

- **Fermentation:**

Fermentation is a metabolic process that converts sugars into acids, gases, or alcohol using microorganisms such as bacteria, yeast, or fungi. It is widely used in the production of food, beverages, and biofuels.

Med-Pharma12 Notes

Visit: www.medpharma12.com

- **Bioprocessing:**

Bioprocessing refers to the use of biological systems or living organisms to produce desired products. It involves fermentation, downstream processing, and product purification.

- **Biopharmaceuticals:**

Biopharmaceuticals are medicinal products derived from biological sources, such as proteins, antibodies, or nucleic acids. They are produced using biotechnological methods and have revolutionized healthcare, offering treatments for various diseases.

- **Bioremediation:**

Bioremediation involves the use of microorganisms to degrade or detoxify environmental pollutants, such as oil spills, heavy metals, and pesticides. It offers a sustainable approach to environmental cleanup.

IV. Applications of Biotechnology

1. **Agricultural Biotechnology:**

Agricultural biotechnology aims to improve crop yield, quality, and resistance to pests, diseases, and environmental stresses. Techniques include genetically modified organisms (GMOs), marker-assisted breeding, and tissue culture.

2. **Medical Biotechnology:**

Medical biotechnology focuses on the development of diagnostics, therapeutics, and vaccines for human health. It includes the production of biopharmaceuticals, gene therapy, stem cell research, and personalized medicine.

3. **Industrial Biotechnology:**

Industrial biotechnology involves the use of biological systems to produce chemicals, materials, and energy. Applications include the production of biofuels, bioplastics, enzymes, and bioremediation.

4. **Environmental Biotechnology:**

Environmental biotechnology addresses environmental challenges, such as pollution and waste management. It includes bioremediation, wastewater treatment, and the production of sustainable materials.