D.PHARM • SECOND YEAR

Biochemistry & Clinical Pathology

CHAPTER 11

Introduction to Biotechnology



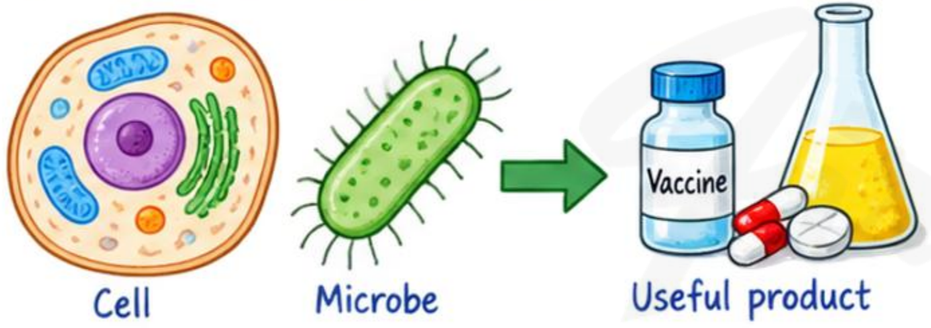
ENGLISH CHAPTER NOTES

DIPLOMA IN PHARMACY

BIOTECHNOLOGY: DEFINITION, SCOPE & HISTORY

DEFINITION

Biotechnology is a multidisciplinary science that uses biological systems, living organisms or their derivatives to develop or modify products and processes for specific uses.



WHO DEFINITION

Any technological application that uses biological systeems, living organisms or their derivatives to make or modify products or processes for specific use.

WHAT DOES IT COMBINE?

Biology + chemistry + genetics + engineering + computer science

CORE IDEA

A biological system becomes a useful technology when it is applied to solve a practical problem.

ROLE IN CLINICAL PATHOLOGY

- disease diagnosis
- detection and measurement of biomarkers or pathogens
- monitoring health conditions and treatment response
- support for targeted therapies

HISTORICAL DEVELOPMENT

TRADITIONAL BIOTECHNOLOGY

ancient practices used whole organisms without direct gene manipulation. Fermentation made bread, alcohol and cheese.



1953

structure of DNA was described.



1970s

recombinant DNA technology developed.



MODERN BIOTECHNOLOGY

deliberately studies or changes cells, genes and biomolecules for precise applications.



BRANCHES OF BIOTECHNOLOGY

RED BIOTECHNOLOGY

MEDICINE & HEALTHCARE

- Vaccines
- antibiotics
- diagnostic tests
- gene therapy

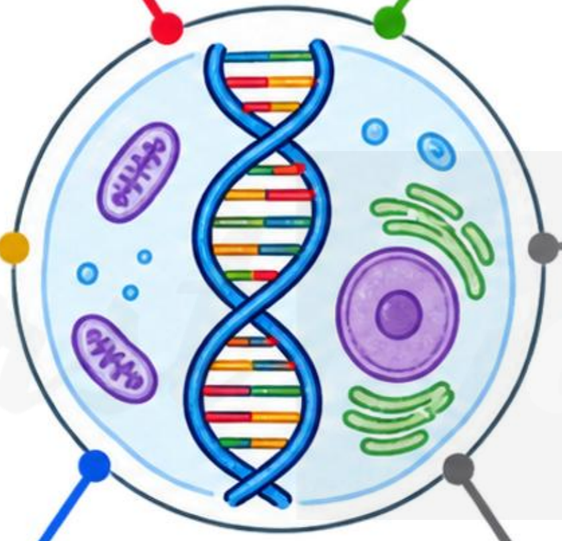


GREEN BIOTECHNOLOGY

AGRICULTURE

- Genetically modified crops
- biofertilizers
- crop improvement





YELLOW BIOTECHNOLOGY

FOOD & NUTRITION

- Fermentation
- probiotics
- food processing



WHITE BIOTECHNOLOGY

INDUSTRIAL PROCESSES

- Industrial enzymes
- biofuels
- bioplastics
- cleaner manufacturing



BLUE BIOTECHNOLOGY

MARINE & AQUATIC USES

- Marine-derived drugs
- aquaculture
- useful products from aquatic organisms



GREY BIOTECHNOLOGY

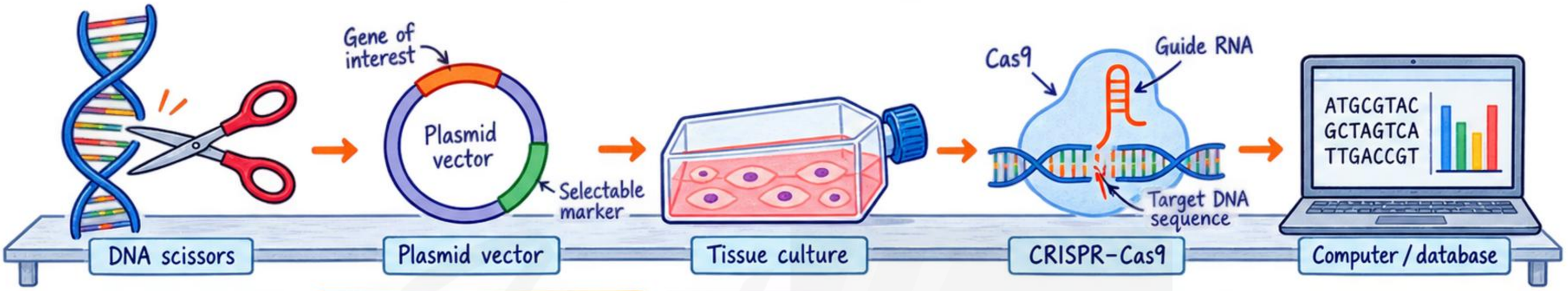
ENVIRONMENT

- Bioremediation
- waste treatment
- pollution control



REMEMBER | The colour names are a convenient classification of application areas. One project may overlap more than one branch.

MAJOR BIOTECHNOLOGICAL TOOLS



1. GENETIC ENGINEERING

Planned alteration of DNA sequences to add, remove or change genetic information.

2. RECOMBINANT DNA TECHNOLOGY

A DNA fragment from one source is joined to a vector and introduced into a host cell. The host can copy the DNA or produce a desired product.

BASIC SEQUENCE

Gene of interest → isolate/cut DNA → insert into vector → transfer to host cell → select useful cells → analyse or produce product

3. TISSUE CULTURE

Growth of cells or tissues in sterile, controlled conditions on a suitable nutrient medium. Used for research, diagnosis and production of biological material.

4. CRISPR–Cas9

A guide RNA directs the Cas9 enzyme to a selected DNA sequence, where Cas9 makes a cut. It is a precise gene-editing tool.

5. BIOINFORMATICS

Use of computers, databases and algorithms to store, compare and interpret biological data such as DNA sequences.

IMPORTANT These tools are selected according to the purpose; they are not a single compulsory sequence.

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