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PHARMACEUTICAL BIOTECHNOLOGY

UNIT 2

TOPIC :

- c) Application of r DNA technology and genetic engineering in the production of:
 - i) Interferon
 - ii) Vaccines- hepatitis- B
 - iii) Hormones-Insulin.



The logo features a stylized 'F' in pink and a 'D' in light blue, both enclosed within a thin purple outline. Below this graphic, the word 'Pharmacy' is written in a large, bold, yellow sans-serif font. Underneath 'Pharmacy', the phrase 'Learn and Educate' is written in a smaller, grey sans-serif font.

Pharmacy

Learn and Educate

Application of rDNA Technology And Genetic Engineering In Production of Interferon, Hepatitis-B Vaccine and Insulin

- Recombinant DNA (rDNA) technology and genetic engineering are important tools in biotechnology used to produce therapeutic proteins, vaccines, and hormones by introducing desired genes into host organisms.

Applications include:

1. Production of Interferons
2. Production of Hepatitis-B Vaccine
3. Production of Human Insulin

i) PRODUCTION OF INTERFERON

- Interferons are glycoproteins produced naturally by body cells in response to viral infection. They help protect cells against viruses and regulate immune responses.

Types:

- Interferon- α (Alpha)
- Interferon- β (Beta)
- Interferon- γ (Gamma)

Production of Interferon by rDNA Technology

Step 1: Isolation of Interferon Gene

- Human cells producing interferon are selected.
- mRNA for interferon synthesis is isolated.

Step 2: Formation of Complementary DNA (cDNA)

- Reverse transcriptase enzyme converts mRNA into cDNA.

Step 3: Insertion into Vector

- Interferon gene is inserted into plasmid vector using:
 - Restriction endonucleases
 - DNA ligase

Recombinant plasmid is formed.

Step 4: Transfer into Host Cell

- Recombinant plasmid is introduced into host cells.

Common hosts:

- *Escherichia coli* (*E. coli*)
- Yeast cells

Step 5: Production and Purification

- Host cells multiply and produce interferon protein.
- Interferon is extracted and purified.

Uses of Interferon

- Viral infections
- Hepatitis treatment
- Multiple sclerosis
- Certain cancers

II) Production Of Hepatitis-B Vaccine By rDNA Technology

- Hepatitis-B is a viral liver disease caused by Hepatitis-B virus (HBV).
- Recombinant Hepatitis-B vaccine is prepared using genetic engineering methods.

Production Process

Step 1: Isolation of HBsAg Gene

- Gene coding for Hepatitis-B surface antigen (HBsAg) is isolated.

HBsAg = Hepatitis-B Surface Antigen

Step 2: Insertion into Vector

- HBsAg gene is inserted into plasmid vector.

Enzymes used:

- Restriction endonuclease
- DNA ligase

Step 3: Introduction into Host Cell

Recombinant plasmid is transferred into yeast cells.

Common host:

- *Saccharomyces cerevisiae*

Step 4: Expression of Antigen

- Yeast cells produce Hepatitis-B surface antigen protein.

Step 5: Purification and Vaccine Preparation

- Antigen is purified.
- Purified antigen is formulated into vaccine.

Advantages of Recombinant Hepatitis-B Vaccine

- Safe and highly pure
- No live virus used
- Reduced side effects
- Effective immune protection

Uses

- Prevention of Hepatitis-B infection
- Prevention of liver cirrhosis
- Reduces risk of liver cancer

III) Production Of Human Insulin By rDNA Technology

Insulin is a peptide hormone produced by β -cells of pancreas.

Function:

- Controls blood glucose level.

Human insulin produced by recombinant DNA technology is called recombinant human insulin.

Production Process

Step 1: Isolation of Human Insulin Gene

- Human insulin-producing gene is isolated.

Step 2: Preparation of Recombinant Plasmid

- Plasmid vector and insulin gene are cut using restriction enzymes.
- DNA ligase joins insulin gene with plasmid.

Recombinant plasmid is formed.

Step 3: Transfer into Host Cell

Recombinant plasmid is introduced into bacterial cells.

Common host:

- *Escherichia coli* (*E. coli*)

Sometimes yeast cells are also used.

Step 4: Multiplication of Host Cells

- Bacteria multiply rapidly.
- Large quantities of insulin protein are produced.

Step 5: Purification

- Insulin is extracted and purified.

Purified insulin is used for treatment.

Uses of Recombinant Human Insulin

- Treatment of Diabetes mellitus
- Control of blood glucose level

Advantages of Recombinant Human Insulin

- Highly pure
- Less allergic reaction
- Large-scale production
- Safer than animal insulin