

CH No 3.

Biotechnology

Q1: How do scientist inserts the gene of a desirable protein into a bacterium?

A: 1) In first step gene of interest is identified and insulated.

1) The insulated gene is then attached with Plasmid DNA taken from a bacterium.

2) This attached gene of desired protein and plasmid DNA are collectively called recombinant DNA.

3) The recombinant DNA is inserted back into same bacterium of selected plasmid. This is now called Genetical modified bacterium.

4) Making of desired protein starts under instruction of inserted gene.

Biotechnology

Describe the application of biotechnology in agriculture?

Weed resistant and pest resistant genes are inserted into plants which produce harmful proteins for weeds and pests. The major modified crops are rice, wheat, cotton and potatoes etc.

What is genetic modification? How is it helpful in increasing the amounts of different nutrients in food?

Genetic Modification:-

The change in gene of an organism by using bio-technology is genetic modification.

It is producing high yield of milk and meat and high quality of fruits and vegetables.

Chapter

3

BIOTECHNOLOGY



STUDENTS' LEARNING OUTCOMES

After studying this chapter, students will be able to:

- Define biotechnology.
- Explain how DNA is replicated.
- Describe the relationship between DNA, genes and chromosomes.
- Define bacterium.
- Explain how genes are introduced into a bacterium.
- List some biotechnological products used in daily life.
- Explain that genetic modification in different foods can increase the amount of essential nutrients.
- List general applications of biotechnology in various fields.
- Explain how biotechnology allows meeting the nutritional needs of growing populations.

Application of knowledge in the areas like engineering and medicines, etc., is called biotechnology. The technology in which living things are used in different ways to help benefit human beings is called biotechnology. Microorganisms are used in making bread, yogurt, cheese, vinegar and several medicines. Fermentation, tissue culture, genetic engineering, etc., are the processes and techniques in which microorganisms are used for making many industrial products and in the research work. In this chapter, the principles and techniques used in biotechnology will be introduced. General applications of biotechnology in the fields of agriculture, environment, health, food production and preservation, etc., will also be discussed.

Not For Sale - PEST

QUESTIONS

Circle the correct option.

- (i) The additional circular pieces of DNA present in a bacterial cell are called:
- a. RNA
 - b. nucleotides
 - c. chromatids
 - d. plasmids
- (ii) What may be the objective of genetic modifications of plants?
- a. Production of disease resistant plants
 - b. Improvement in nutritional quality of plants
 - c. Production of herbicide resistant plants
 - d. All of these
- (iii) Plasmid and attached foreign gene with it are collectively called:
- a. recombinant cell
 - b. recombinant DNA
 - c. recombinant plasmid
 - d. recombinant chromosome
- (iv) The organisms whose cells and plasmids are usually used in genetic engineering are:
- a. bacteria
 - b. fungi
 - c. algae
 - d. fungi and algae
- (v) Sections of DNA serving as codes for developing characters in an organism are called:
- a. genes
 - b. nucleotides
 - c. plasmids
 - d. proteins
- (vi) Which of the following is not a biotechnology product?
- a. Insulin
 - b. Quinine
 - c. Beta-endorphin
 - d. Interferon
- (vii) How do genetic engineers get insulin for diabetic patients?
- a. Isolate from human pancreas
 - b. Isolate from pancreas of other animals
 - c. Insulin gene inserted in human pancreas
 - d. Insulin gene inserted in bacteria
- (viii) Biotechnological method for the production of animal organs:
- a. gene therapy
 - b. genetic testing
 - c. cloning
 - d. organ transplant

- (ix) Why do genetic engineers use bacteria in genetic engineering?
- The chromosome of bacteria is made of DNA and proteins
 - Their nucleus is very big and easy to handle
 - They have many chromosomes
 - Bacteria divide very fast and make colonies
- (x) A gene is inserted into a bacterium by
- tissue culture
 - fermentation
 - biodegradation
 - genetic engineering

2 Match the statements of column A with the relevant statements of column B.

A	B
Growth hormone	Viral infection
Beta-Endorphin	Diabetes
Vaccine	stimulating growth
Interferon	Immunity against diseases
Insulin	Pain killer

3 Give short answers.

- What is biotechnology? *Pg 31*
- What is genetic testing? *Pg 41*
- Name at least two life saving products of biotechnology. *1) Insulin 2) vaccines*
- Briefly describe gene therapy. *Pg 41*

4 How do scientists insert the gene of a desirable protein into a bacterium?

5 Give diagrammatic explanation of biotechnological process for the preparation of insulin.

6 Describe the application of biotechnology in agriculture.

7 What is genetic modification? How is it helpful in increasing the amounts of different nutrients in food?

8 Describe the application of biotechnology in health and environment.

Online Learning

www.pitb.gov.pk

www.uic.edu/classes/bios101/genes

<http://www.discoveryeducation.com>

http://www.ucsusa.org/food_and_environment/biotechnology (The Union of Concerned Scientists Website)

www.sciencedaily.com/news/plants_animals/biotechnology/

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Genetic Modification:-

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3.4.3 Health

Q. Describe application of Biotech in health and environment

(Biotechnology techniques are also used for curing diseases and improving health. The diseases for which previously no adequate treatment was available can now be treated using biotechnology techniques. Identification of root causes of diseases, production of medicines for fighting against diseases and curing and correction of genetic defects, etc., are the major roles of this technology in developing better health. Various biotechnology products which are used to save lives include:

Insulin:

useful for diabetics

Vaccines:

used against many infectious diseases

Growth hormone:

useful for stimulating growth

Beta-Endorphin:

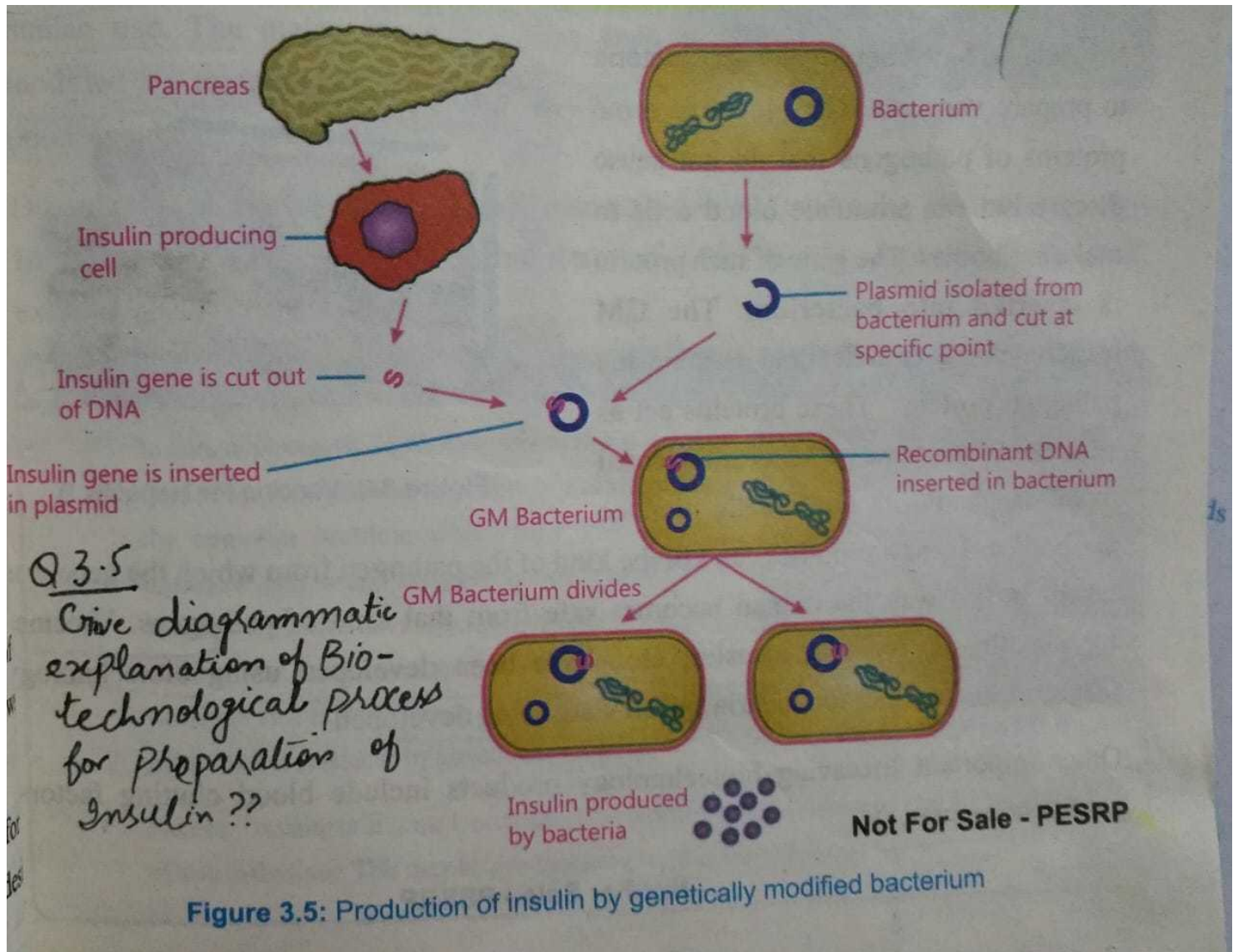
a pain killer drug

Interferon:

anti-viral proteins

Q 3.8

Biotechnology techniques



Q 3.5

Give diagrammatic explanation of Biotechnological process for preparation of Insulin??

Figure 3.5: Production of insulin by genetically modified bacterium

QUESTIONS

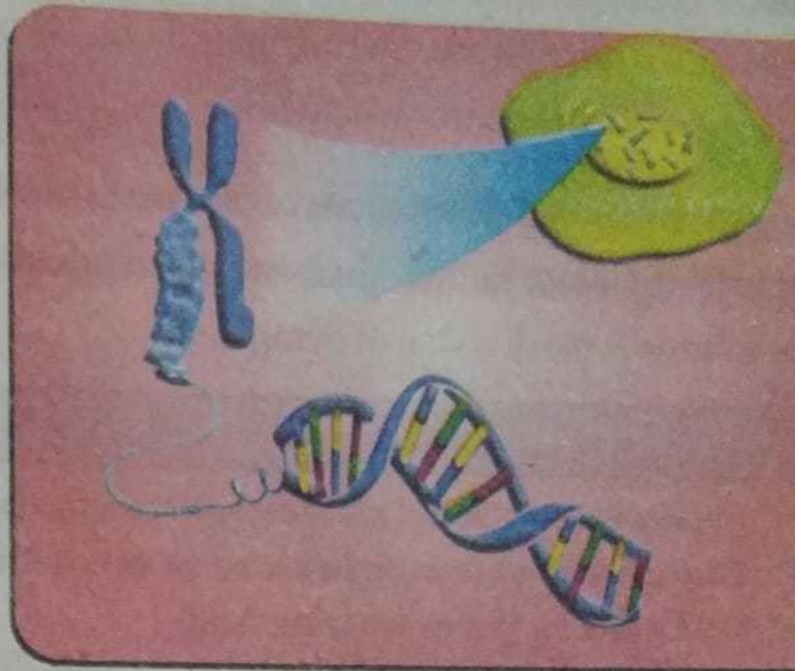
Encircle the correct option.

- (i) Cell makes copies of its chromosomes during:
- a. interphase b. nuclear division of mitosis
c. nuclear division of meiosis d. cytokinesis
- (ii) The section of DNA which has information for making a specific protein is called:
- a. DNA strand b. nucleotide
c. chromosome d. gene
- (iii) Chromosomes are made of:
- a. DNA only b. proteins only
c. DNA, proteins and fats d. DNA and proteins
- (iv) The characters which are passed from parents to offspring:
- a. inheritable characters b. non-inheritable characters
c. environmental characters d. natural characters
- (v) An event that occurs during interphase:
- a. division of nucleus b. division of cytoplasm
 c. duplication of chromosomes d. formation of cell wall
- (vi) Reduction of chromosomes takes place during:
- a. mitosis b. meiotic-I
c. meiotic-II d. both mitosis and meiotic-II
- (vii) In humans, a sperm has 23 chromosomes. Egg cell has:
- a. 23 chromosomes b. 46 chromosomes
c. no chromosomes d. 69 chromosomes
- (viii) Zygote is formed by the fusion of:
- a. two sperm cells b. two egg cells
c. two somatic cells d. sperm cell and egg cell
- (ix) In humans, the eye colour is developed due to the effects of:
- a. diet b. environment
 c. genes d. both 'a' and 'b'

Chapter

2

CELL DIVISION



STUDENTS' LEARNING OUTCOMES

After studying this chapter, students will be able to:

- Differentiate between mitosis and meiosis.
- Identify DNA and chromosomes in the cell diagram.
- Define heredity and recognize its importance in transferring of characteristics from parents to offspring.
- Identify the characteristics that can be transferred from parents to offspring.
- Compare characteristics related to ear and eye colour.

Q. Name 2 non-inheritable characters.

A: 1) If an organ is lost due to disease it is non-inheritable.

2) If an organ becomes weak due to disease, it is also inheritable.

Q. What are haploid cells?

A. A cell having half of the number of chromosomes is haploid cell.
e.g. gametes (sperm, egg)

- (x) Which statement is correct?
- ✓ a. DNA has instructions for making proteins
 - b. Protein has instructions for making DNA
 - c. Both of these
 - d. None of these

2 Match the words of column A with the relevant words in column B.

A	B
DNA	Haploid cell
Cytokinesis	Diploid cell
Free earlobe	Division of cytoplasm
Zygote	Gene
Egg	Hereditary character

3 Give short answers.

- (i) Name two inheritable characters. ¹⁾ Eye colour ²⁾ Skin colour
- (ii) Name two non-inheritable characters. Pg 25
- (iii) What is a gene? 23
- (iv) Define heredity. Pg 22
- (v) What are haploid cells?

Describe mitosis. Pg 20

Describe meiosis. Pg 21

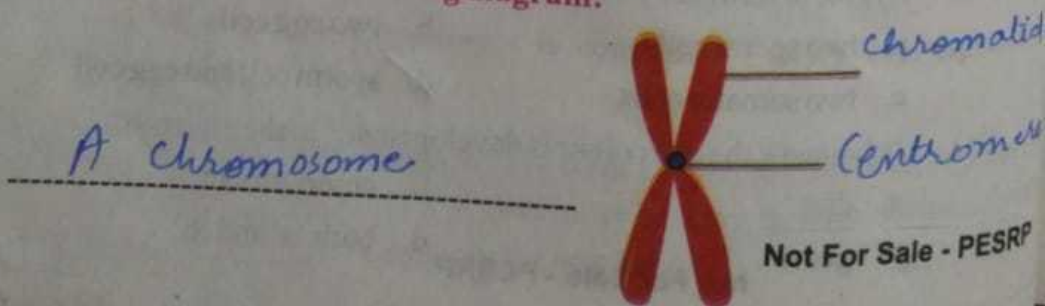
Define heredity and describe its importance in transferring of characteristics from parents to offspring. Pg 22

Describe the characteristics that can be transferred from parents to offspring.

Write notes on:

- (a) DNA
- (b) Chromosomes
- (c) Genes

Identify and label the following diagram:



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Describe characteristics that can be transferred from parents to offsprings.

Such characters which can be transferred from parents to offsprings are called "Inheritable Characters"

These characters are

- 1) Eye Colour
- 2) Skin Colour
- 3) Height
- 4) Intelligence
- 5) Free and attached earlobes etc

Write Note on:

DNA

DNA (Deoxyribonucleic Acid) is called heredity material. Genes are sections of DNA, located on chromosome. Different sections of DNA (gene) are set of information for development of different characters in an organism. DNA and proteins are components of chromosomes.

Chromosomes:-

Chromosomes are thread like structure found in the nucleus of a cell. A typical chromosomes consists of two arms called chromatids which are attached to the same part called centromere. DNA and Protein are the components of chromosomes.

Genes:-

The basic physical and functional unit of heredity is called gene. Gene act as instruction to make molecules called proteins. Genes occur in pairs. Every heredity characters in an organisms e.g., tallness, dwarfness, eye colour, free earlobe, attached earlobe, etc is controlled by a pair of genes. Genes are the section of DNA and are located in chromosomes.