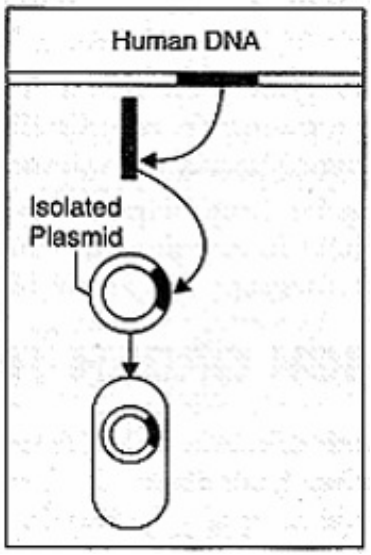
CBSE Test Paper 05

Ch-11 Biotechnology Principles and Processes

1. Plasmid is a
   a. Antibiotic resistant gene
   b. Extra chromosomal DNA
   c. Selectable marker
   d. Phage
2. A piece of gene used to hybridize with vector is called as
   a. Marker b. Gene of interest c. Palindrome d. Nuclease
3. Overhangs produced by restriction enzymes are called as
   a. Palindromic sequences
   b. Blunt ends
   c. Sticky ends
   d. Polymers
4. Transfer of DNA into bacteria by phage is called as
   a. Transformation b. Hybridisation c. Transduction d. Conjugation
5. The X-gal will be converted into a coloured product when
   a. When lactose is available
   b. Gene coding for B- galactosidase is cleaved
   c. When goi is inserted in the vector at the site coding for B- galactosidase
   d. B–galactosidase acts on it
6. The machine used to do PCR is called as
   a. Thermocycler
   b. Temperature regulator
   c. Voltage Regulator
   d. Heater
7. Thermostable DNA polymerase is isolated from bacterium
   a. Rhizobium
   b. Salmonella typhii
   c. Escherichia coli
   d. Thermus aquaticus
8. Before integrating DNA with bacterial plasmid, bacterial cells are treated with

calcium. Why?

9. How many types of restriction endonucleases are found. Why they are called as molecular scissors?
10. Explain the principle of insertional inactivation by giving a suitable example.
11. A recombinant vector with a gene of interest inserted within the gene of α-galactosidase enzyme, is introduced into a bacterium. Explain the method that would help in selection of recombinant colonies from non recombinant ones.
12. Why type II restriction enzymes are used in recombinant DNA technology?
13. Name the source organism that possesses Taq polymerase. What is so special about the function of this enzyme?
14. Name the particular technique whose steps are shown in the following figure. Use the figure to summarise the technique in three steps.



15. During an excursion to a botanical garden, the teacher shows an old tree which was on the verge of extinction. As soon as the teacher advanced with the students, some enthusiastic students climbed up the tree and started cutting the branches, collecting its leaves as the precious collection. Rajesh instead took photographs of the tree from various angles. The boys mocked at Rajesh while the teacher appreciated him.
    i. What values did Rajesh possess?
    ii. Why should we conserve biodiversity?
    iii. How can be biodiversity be conserved?

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Answer

1. b. Extra chromosomal DNA, **Explanation:** Plasmid is a small DNA molecule within a cell that is physically separated from a chromosomal DNA and can replicate independently. Plasmid is most commonly found in bacteria as small circular, double stranded DNA molecule.
2. b. Gene of interest, **Explanation:** The joining of DNA involves several processes. After having cut the source DNA as well as the vector DNA with a specific restriction enzyme,the cut out 'gene of interest' from the source DNA and the cut vector with space are mixed and ligase is added. This results in the preparation of recombinant DNA. Vector is incorporated into recipient cell for cloning to obtain desired product.
3. c. Sticky ends, **Explanation:** Longer overhangs are called cohesive ends or sticky ends. They are most often created by restriction endonucleases when they cut DNA.
4. a. Transformation, **Explanation:** Transfer of DNA into bacterial cell by phage or virus is called transformation. Phage kills the bacterium so called bacteriophage.
5. d. B–galactosidase acts on it, **Explanation:** X-gal is an analog of lactose, and therefore may be hydrolyzed by the β-galactosidase enzyme which cleaves the β-glycosidic bond in D-lactose.
   X-gal, when cleaved by β-galactosidase, yields galactose and 5-bromo-4-chloro-3-hydroxyindole. The latter then spontaneously dimerizes and is oxidized into 5,5'-dibromo-4,4'-dichloro-indigo, an intensely blue product which is insoluble. X-gal itself is colorless, so the presence of blue-colored product may therefore be used as a test for the presence of active β-galactosidase.
   This easy identification of an active enzyme allows the gene for β-galactosidase (the lacZ gene) to be used as a reporter gene in various applications.
6. a. Thermocycler, **Explanation:** A thermocycler is a machine that is used for PCR.

It can be set to run in patterns, heating and cooling the DNA samples. PCR involves denaturation, primer annealing and extension of primers.

7. d. Thermus aquaticus, **Explanation:** Taq polymerase is a thermostable DNA polymerase named after the thermophilic bacterium Thermus aquaticus from which it was originally isolated by Chien et al. in 1976.Its name is often abbreviated to Taq Pol or simply Taq. It is frequently used in the polymerase chain reaction (PCR), a method for greatly amplifying the quantity of short segments of DNA. It remain active during high temperature induced denaturation of double stranded DNA.

8. DNA is a hydrophilic molecule which cannot pass through the cell membrane, so to make it competent to take up DNA, bacterial cells should be treated with divalent cations or calcium so that DNA can enter through the pores of cell wall.

9. Restriction enzymes are classified biochemically into three types. These are designated as Type I, Type II, and Type III. A major type of Type II enzymes are sometimes referred to as Type IV enzymes.

   Restriction enzymes are also called 'molecular scissors' as they cleave DNA at or near specific recognition sequences known as restriction sites. These enzymes make one incision on each of the two strands of DNA and are also called restriction endonucleases.

10. In this method a recombinant DNA is inserted in the gene which inactivates the functioning of gene. Insertional inactivation is a efficient method to identify transformants. Example: Blue white selection method - In this method cloned DNA is inserted into the lac Z gene present on the vector. After insertion the lac Z gene is inactivated. The lac Z gene forms b-galactosidase enzyme which can break X-gal into a blue coloured product. Thus transformants will contain interrupted lac Z-gene which will not produce b-galac tosidase, appear in white colonies in the presence of X-gal.

11. The method is based on colour reaction (blue - white selection). The α galctosidase enzyme can cleave a colourless, synthetic substrate, X-gal into a blue coloured product if the gene is inactivated by insertion of gene of interest into it, the development of blue colour will be prevented.

12. Because they can be used in vitro to recognize and cut within specific DNA sequence typically consisting of 4-8 nucleotides.

13. Taq polymerase is a thermostable DNA polymerase enzyme isolated from Thermus aquaticus bacteria.

    It is thermostable and can withstand at high temperature $(> \ 90^{\circ}C)$

    As it is resistant to denaturing. Hence it is used in PCR techniques for amplifying short DNA segments and at the same time be stable to high temepratures used in the technique.

14. Recombinant DNA technology / Genetic engineering
    Three steps are:

    i. Isolation of human DNA with a desirable gene.
    ii. DNA segment is incorporated into the bacterial plasmid to form recombinant DNA.
    iii. Recombinant DNA is introduced in a bacterial cell, which makes protein directed by human DNA.

15. i. Respect for nature, scientific attitude with a vision of the future
    ii. We should conserve Biodiversity since it provides us
        a. The main source of food
        b. Source of economically important fibres (cotton, flax, hemp, jute etc)
        c. Plant products (gum, resin, dye, fragrance, waxes, wool, leather, honey, lac, pearl, ivory, silk, horns)
        d. Drugs and medicine
        e. Sports and recreation
        f. Aesthetic value
        g. Cultural value
        h. Scientific research
        i. Ecosystem services
        j. (More points may be added)
    iii.

Ginkgo biloba

In situ conservation: Sacred Grove, Biosphere reserve (Terrestrial and Marine), National park and Wildlife and sanctuaries etc.

Ex situ conservation: a) Sacred plants, home gardens b) Seed banks, gene bank, cryopreservation c) Botanical garden, zoological garden, Aquaria etc.

Special note:

UNDP has developed a new Biodiversity and Ecosystems Global Framework for the period 2012-2020, positioning the organization to respond to future challenges – which include implementing the global Aichi Biodiversity Targets set out in the CBD Strategic Plan and advancing the sustainable development agenda the emerged from the Rio+20 Summit.