GENETIC ENGINEERING

Genes are segments of DNA which comprise the fundamental basis of all life and determine the properties of all living forms of life.
Recombinant DNA techniques, popularly termed 'gene cloning' or 'genetic engineering', offer potentially unlimited opportunities for creating new combinations of genes that at the moment do not exist under natural conditions. These techniques allow the splicing of DNA molecules of quite diverse origin, and when combined with techniques of genetic transformation, etc., facilitate the introduction of foreign DNA into other organisms. The foreign DNA or gene construct is introduced into the genome of the recipient organism host in such a way that the total genome of the host is unchanged except for the single manipulated gene.
Thus, DNA can be isolated from cells of plants, animals or microorganisms (the *donors*) and can be fragmented into groups of one or more genes. Such fragments can then be coupled to another piece of DNA (the *vector*) and then passed into the host or recipient cell, becoming part of the genetic complement of the new host. The host cell can then be propagated in mass to form novel genetic properties and chemical abilities that were unattainable by conventional ways of selective breeding or mutation.
Life forms containing 'foreign' DNA are termed '*transgenic*'.
The basic molecular requirements for the *in vitro* transfer and expression of foreign DNA in a host cell (gene transfer technology) are as follows:
The vector or carrier system – Two broad categories of vector molecules have been developed as vehicles for gene transfer, namely *plasmids* (small units of DNA distinct from chromosomes) and *bacteriophages* (or bacterial viruses). Plasmids have been found in an increasingly wide range of organisms, e.g. bacteria, yeasts and mould fungi; they have been studied mostly in Gram-negative bacteria.
Splicing genes – Site-specific *restriction endonuclease enzymes* produce specific DNA fragments that can be joined to any similarly treated DNA molecule using another enzyme, DNA *ligase*. Restriction enzymes are present in a wide range of bacteria.
Introduction of vector DNA recombinants – The new recombinant DNA can now be introduced into the host cell by *transformation* (the direct uptake of DNA by a cell from its environment) or *transduction* (DNA transferred from one organisms to another by way of a carrier or vector system) and if acceptable the new DNA will be cloned with the propagation of the host cell. Novel methods of ensuring DNA uptake into cells include *electroporation* and *mechanical particle* ***delivery*** or *biolistics*.

1 *Match these words from* Genetic engineering *with the definitions below:*

biolistics – electroporation – gene – genetic engineering – genome – in vitro – plasmid – transduction – transgenic organism – vector

a. Section of DNA that codes for a defined biochemical function: .....
b. Directed manipulation of genes: .....

c. The DNA sequence of all the genes of an organism: .....

d. DNA segment that allows another piece of DNA to be 'cloned' using recombinant DNA techniques: .....

e. Organism that has been altered to contain a gene from another organism, usually from another species: .....

f. Latinism literally meaning 'in glass', which is translated to mean 'in the test tube', 'in the laboratory': .....

g. Small, easy to manipulate piece of DNA extensively used in genetic engineering as the basis for vector molecules: .....

h. Genetic technique which consists in transferring a piece of DNA from one organism to another via natural DNA exchange processes: .....

i. Manipulating cells by exposing them to a strong electrical field - .....

j. Method which consists in mixing DNA with small metal particles. These are then fired into a cell at very high speed. They puncture it and carry the DNA into the cell - .....

2

Why do you think these fruits and vegetables are genetically engineered: melons and peaches, potatoes, sweet corn, strawberries, tomatoes? *Choose among the options below.*

a. ..... is/are genetically engineered to be thicker, enhance flavour, contain more solids, more vitamins and more lycopene.

b. ..... is/are genetically engineered to be more disease resistant, contain more starch and less water in order to absorb less oil when fried.

c. ..... is/are genetically engineered to stay sweet longer by preventing sugars from turning to starch.

d. ..... is/are genetically engineered to improve flavour and sweetness in fruits produced for the winter market.

e. ..... is/are genetically engineered to produce plants that can withstand frosts and berries that can be home frozen without turning to pulp.

3

Which one is a cloned *animal and which one is a* transgenic *animal?*

a. A ..... animal is an animal whose hereditary traits have been permanently altered by genetic engineering techniques leading to an incorporation of new gene or inactivation of gene sequencing.

b. A ..... animal is an animal that is genetically identical to the animal it is derived from. Identical twins is an example of how nature can do so.