|  |  |  |  |
| --- | --- | --- | --- |
| **At the end of this section you should be able to ….** | Y | | N |
| Define Genetic engineering | |  |  |
| Describe the process of genetic engineering to include some or all of the following:  Isolation, cutting (restriction ), transformation (ligation), introduction of base sequence changes, expression | |  |  |
| **Contemporary issues**  **Give 3 applications of genetic engineering: one plant, one animal, one microorganism** | |  |  |

**Genetic engineering – Summary**

**Genetic Engineering** is a process of manipulating and altering the genetic material.

Genetic engineering also known as **recombinant DNA technology** involves removing a specific piece of DNA (gene) from one organism and joining this DNA to the DNA in another organism.

**Example:**

A gene for the production of insulin can be removed from a human cell and inserted into a bacterial cell. The bacterial cell containing the human gene can now produce human insulin.

**Genetic Engineering** involves some or all of the following steps:

* Isolation,
* Cutting (restriction ),
* Transformation (ligation)
* Introduction of base sequence changes,
* Expression

**Production of human insulin**

1. **Isolation of a specific gene:**

* The specific length of DNA (gene) is first identified and located in the human cell e.g. gene for insulin production.

**A plasmid is removed from a bacterial cell.**

1. **Cutting (Restriction)**

* Enzymes are used to cut the human DNA containing the desired gene.
* Enzymes are also used to cut open the plasmid

1. **Transformation**

* The human gene is taken up by the plasmid.

1. **Ligation**

* Enzymes join the lengths of human DNA and plasmid DNA together.

1. **Introduction of base sequence changes**

The

The

tT

* The plasmid containing the human DNA is placed back into a bacterial cell
* The order of bases in the bacterial plasmid is now changed and contains **recombinant DNA.** The bacterial cell has been genetically modified and is known as a **Genetically Modified Organism** (GMO)

1. **Expression**

Each time the bacterial cell divides the inserted human gene is activated to produce its protein product

**Applications:**

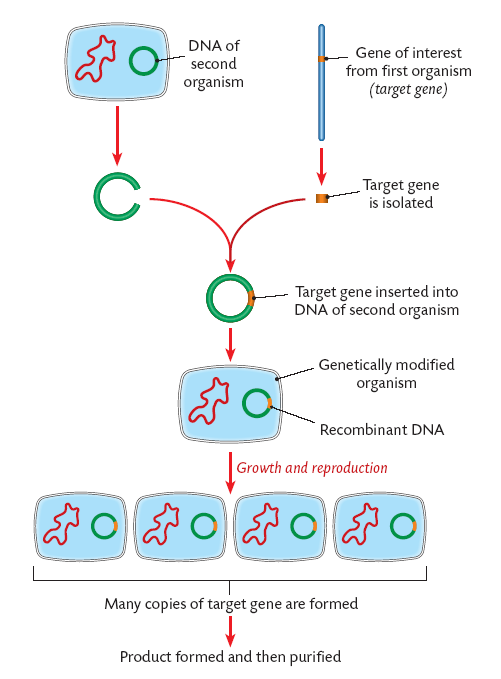
* **Microorganism:**
  + Humulin, human insulin produced by genetically modified bacteria, was the first recombinant DNA drug approved for use in humans.
* **Plant**
  + Genetically modified corn.

The corn plants carry a bacterial gene that enables them to resist infestation by an insect.

* **Animal:**
  + Genetically modified sheep produce human clotting factor in their milk.

DNA removed from human cell (first organism)

Plasmid removed from bacterial cell (second organism)



Plasmid

Removed from bacterial cell