

## Chapter 12 – DNA Technology and Genomics

DNA technology has revolutionized many areas of science such as: forensics, genomics, and agriculture

### Bacterial Plasmids and Gene Cloning.

Plasmids can be used to customize bacteria in order to replicate genes of interest through the use of **recombinant DNA technology** (combining genes from different sources)

Plasmids are small, circular, self-replicating pieces of DNA isolated from bacteria. A gene can be inserted into a plasmid then added to a bacterium for replication, a process called **gene cloning**.

#### Steps for gene cloning:

1. Isolate plasmid from bacterium
2. Isolate gene of interest from another cell
3. Insert gene of interest into plasmid (now called a **recombinant DNA**)
4. Bacterial cell takes up plasmid containing gene of interest through a process called transformation
5. Bacterial cell divides along with the plasmid and forms a **clone** of cells (genetically identical cells)

The bacteria are grown in culture to produce many copies of the isolated gene of interest (the gene is cloned) or its protein product.

**Genetic engineering** (the direct manipulation of genes) uses the cloning technique for practical purposes. Genetic engineering has promoted the development of an industry called **biotechnology**, which manipulates organisms or their components to make products for human use.

Examples: Human insulin, human growth hormone

**Genetically modified organisms (GMOs) are transforming agriculture.**

Genetically modified organisms are being developed by agricultural scientists using DNA technology in an effort to improve plants and animals.

Examples: calcium rich tomatoes, fruits that ripen slowly and resist spoilage, Round-Up Ready™ soybeans and cotton.

**Transgenic organisms** are those that have had foreign DNA inserted into their genome

Many transgenic plants that are currently in field trials have received genes for herbicide resistance (Round-Up Ready™ soybeans and cotton, *Bt* corn). Other plants are being engineered to be resistant to pathogens and pest insects. The hope is that this will reduce the need for the application of chemical insecticides

Transgenic animals are also being developed. Some areas of research is in improved wool in sheep, more leaner meat from beef cattle, transgenic chickens are being engineered to produce pharmaceutical products.

### Is this of Concern to You?

Scientists in the United States and in other countries have developed safety guidelines to minimize the risks involved in genetic engineering.

Guidelines for restricting working with virulent pathogens and lab safety procedures.

A multinational agreement was negotiated in 2000 requiring all **GM** food products shipped to other countries be identified, which would allow the receiving country to decide if the GM products posed a health or environmental risk.

Concern has been expressed over cross-pollination of wild plants with GM plants, which may lead to "superweeds" that will be difficult to control

#### **Key Terms**

recombinant DNA technology  
DNA technology  
genomics  
transformation  
plasmid  
biotechnology

recombinant DNA  
gene cloning  
genetic engineering  
genetically modified organism (GMO)  
transgenic organism

# Chapter 12 Dna Technology Genomics Study Guide

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