Genetics

Biology Dep.3rd Stage

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GENETIC ENGINEERING

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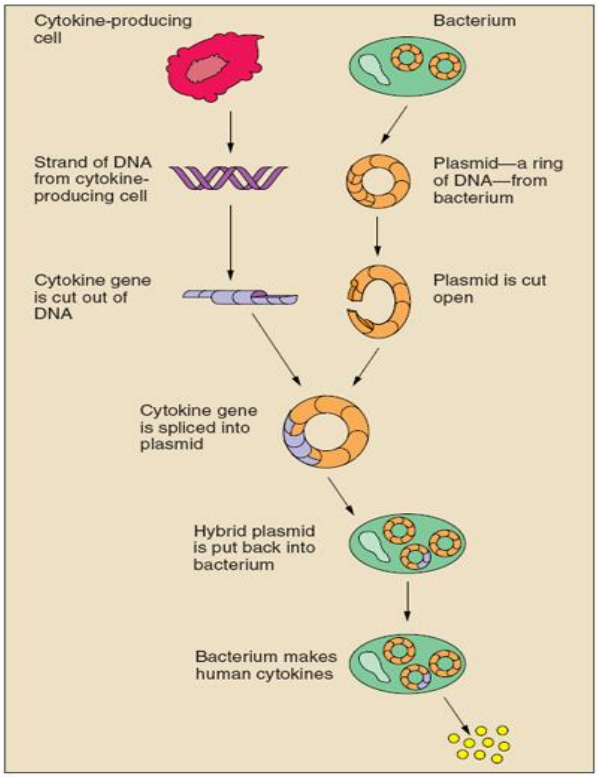
May be described as the introduction of manipulated genetic material in to a cell in such a way as to replicate and be passed on to the progeny cell.

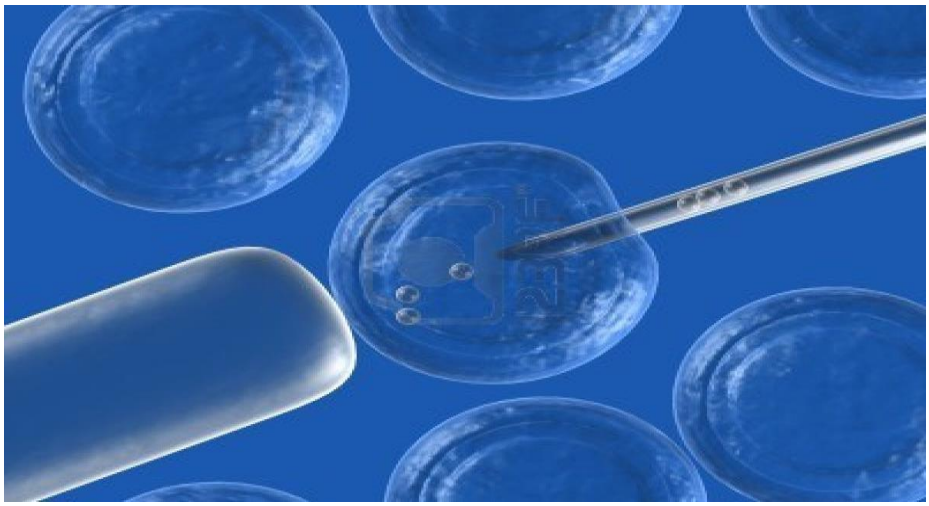
Genetic Engineering Technique



Gene Manipulation: Gene manipulation is defined as the formation of a new combination of a heritable material by the insertion of nucleic acid molecules (DNA molecules) **into** bacterial plasmid or any other vector so as to allow their

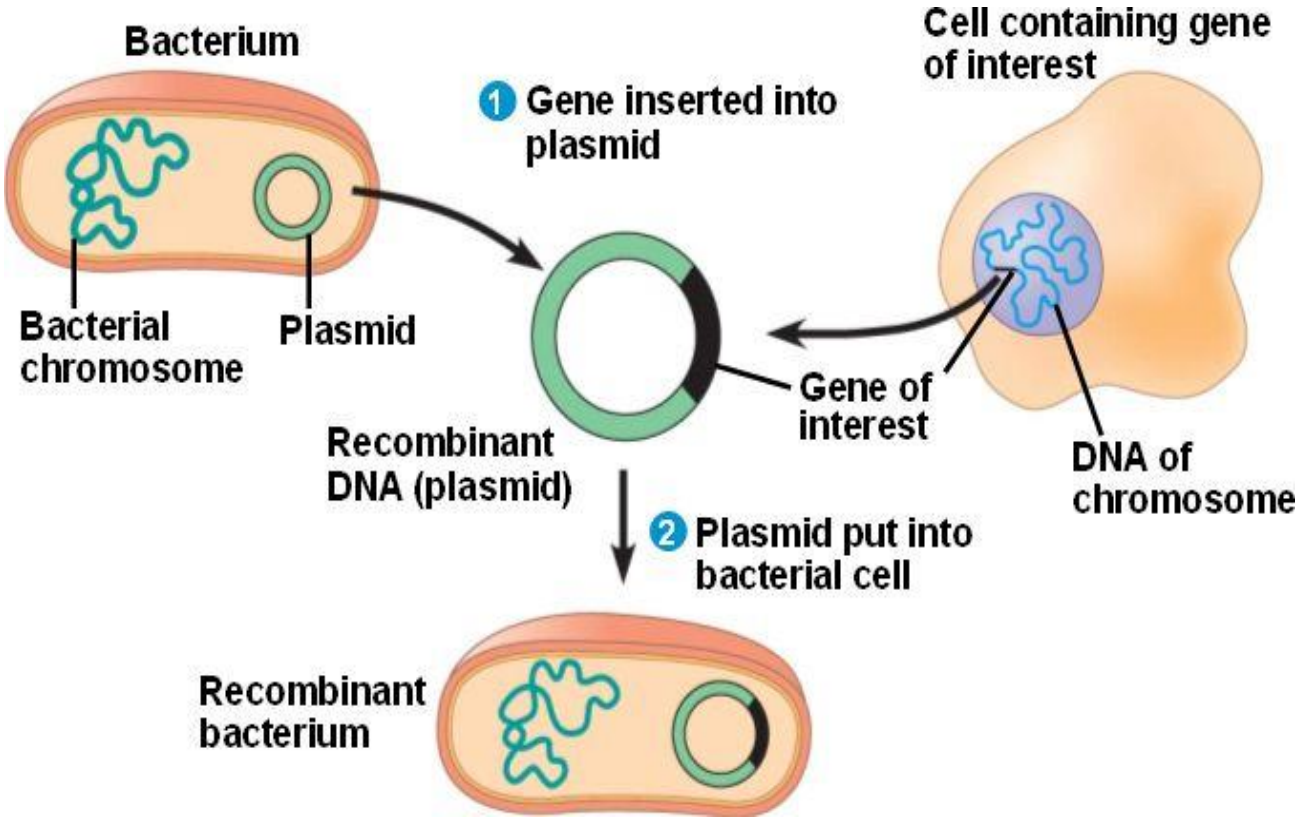
incorporation in to the host organism, in which they are capable of containing propagation.

Microinjection Technique



Gene Cloning: The insertion of a fragment of DNA carrying a gene into a cloning vector and subsequent propagation of recombinant DNA molecules into many copies is known as gene cloning.

Gene Cloning Technique



BASIC STEPS OF GENE CLONING

- **Construction of recombinant DNA molecule**
- **Transport of the recombinant DNA to the host cell**
- **Multiplication of recombinant DNA molecule**
- **Division of the host cell**
- **Numerous cell division resulting in a clone**
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Gene cloning requires specialized tools and techniques:

Vehicles: The central component of a gene cloning experiment is the vehicle, which transport the gene into the host cell and is responsible for its replication. To act as a cloning vehicle a DNA molecule must be capable of entering a host cell and, once inside, replicating to produce multiple copies of itself.

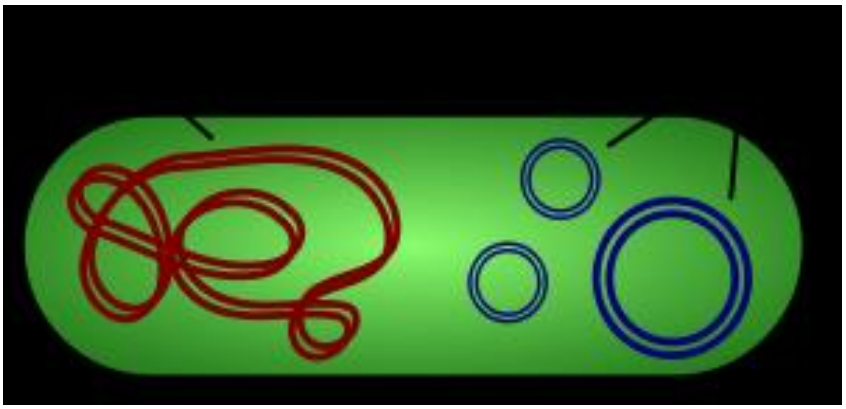
Vector: A DNA molecule, capable of replication in a host organism, into which a gene is inserted to construct a recombinant DNA molecule.

Characteristic of a Vector

- It must be able to replicate
- There must be some way to introduce vector DNA into a cell
- There must be some means of detecting its presence, preferably by plating test in petridishes

PLASMID Characteristics:

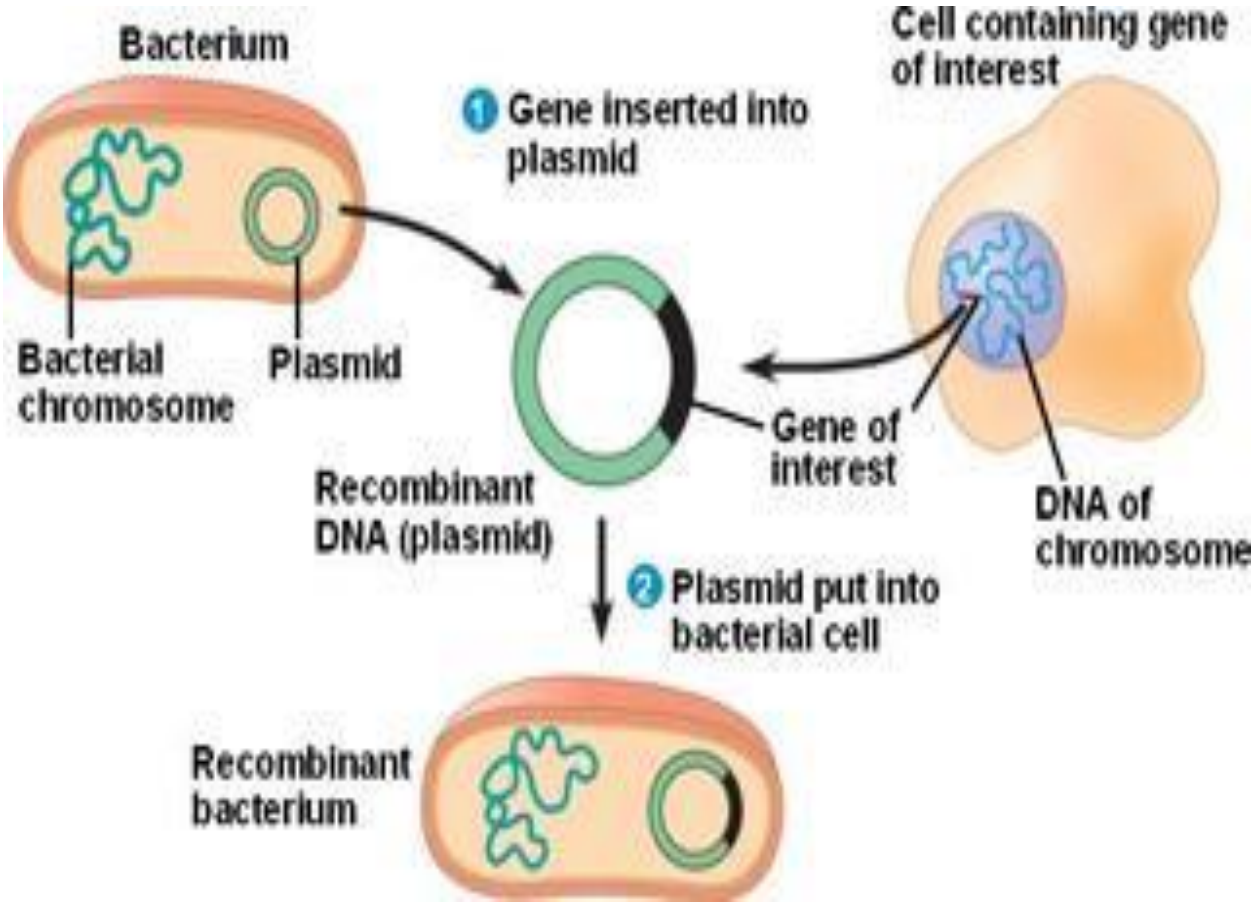
- They are small and contain 3-5 kb of DNA
- They are contain a suitable markers (antibiotic resistant)
- They contain suitable restriction sites that can be used for inserting DNA fragments for cloning



Different types of cloning

1. Recombinant DNA technology or DNA cloning
2. Reproductive cloning and
3. Therapeutic cloning

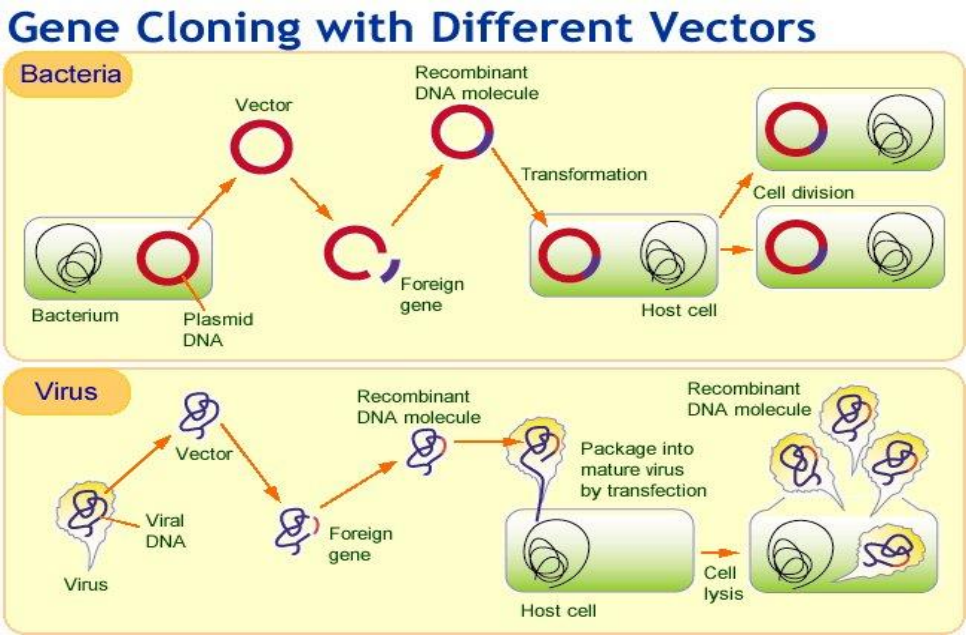
Recombinant Bacterium



Recombinant DNA technology or DNA cloning

The terms "recombinant DNA technology", "DNA cloning", "molecular cloning" or "gene cloning" all refer to the same process: the transfer of a DNA fragment of

interest from one organism to a self-replicating genetic element such as a bacterial plasmid. The DNA of interest can then be propagated in a foreign host cell. This technology has been around since the 1970's, and it has become a common practice in molecular biology labs today.

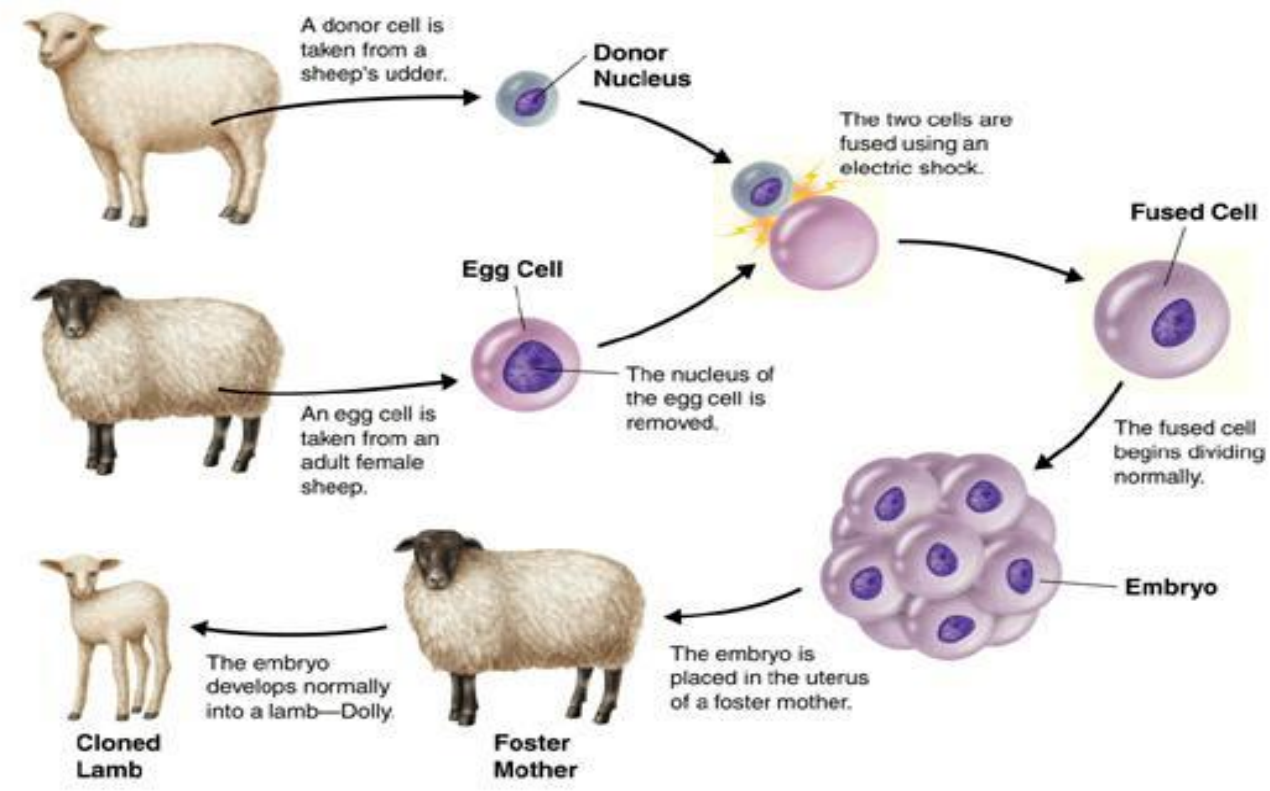


Reproductive cloning

Dolly was created by reproductive cloning technology, in a process called "somatic cell nuclear transfer" (SCNT).

Scientists transfer genetic material from the nucleus of a donor adult cell to an egg whose nucleus, and thus its genetic material, has been removed. The reconstructed egg containing the DNA from of a donor cell must be treated with chemicals or

electric current in order to stimulate cell division. Once the clone embryo reaches a suitable stage, it is transferred to the uterus of a female host where it continues to develop until birth.



How can cloning technologies be used?

- Gene therapy can be used to treat certain genetic conditions by introducing virus vectors that carry corrected copies of faulty genes into the cells of a host organism.
- Genes from different organisms that improve taste and nutritional value or provide resistance to particular types of disease can be used to genetically engineered food crops.
- Reproductive cloning also could be used to repopulate endangered animals or animals that are difficult to breed**.**

What animals have been cloned?

- Scientists have been cloning animals for many years. In 1952, the first animal, a tadpole, was cloned.
- Since Dolly, researchers have cloned a number of large and small animals including sheep, goats, cows, mice, pigs, cats, rabbits and a gaur.

Can organs be cloned for use in transplants?

Scientists hope that one day therapeutic cloning can be used to generate tissues and organs for transplants.

The stem cells would be used to generate an organ or tissue that is a genetic match to the recipient.

In theory, the cloned organ could then be transplanted into the patient without the risk of tissue rejection.

What are the risks of cloning?

- Reproductive cloning is expensive and highly inefficient.
- More than 90% of cloning attempts fail to produce viable offspring.
- More than 100 nuclear transfer procedures could be required to produce one viable clone.
- In addition to low success rates, cloned animals tend to have more compromised immune function and higher rates of infection, tumor growth and other disorders.