

Recombinant vaccines

- A recombinant vaccine is a vaccine produced through recombinant DNA technology. This involves inserting the DNA encoding an antigen (such as a bacterial surface protein) that stimulates an immune response into bacterial or mammalian cells, expressing the antigen in these cells and then purifying it from them.

The recombinant vaccines may be broadly categorized into three groups:

Subunit recombinant vaccines:

- These are the components of the pathogenic organisms. Subunit vaccines include proteins, peptides and DNA.

Attenuated recombinant vaccines:

- These are the genetically modified pathogenic organisms (bacteria or viruses) that are made non-pathogenic and used as vaccines.

Vector recombinant vaccines:

- These are the genetically modified viral vectors that can be used as vaccines against certain pathogens. Some of the developments made in the production of recombinant vaccines against certain diseases are briefly described.

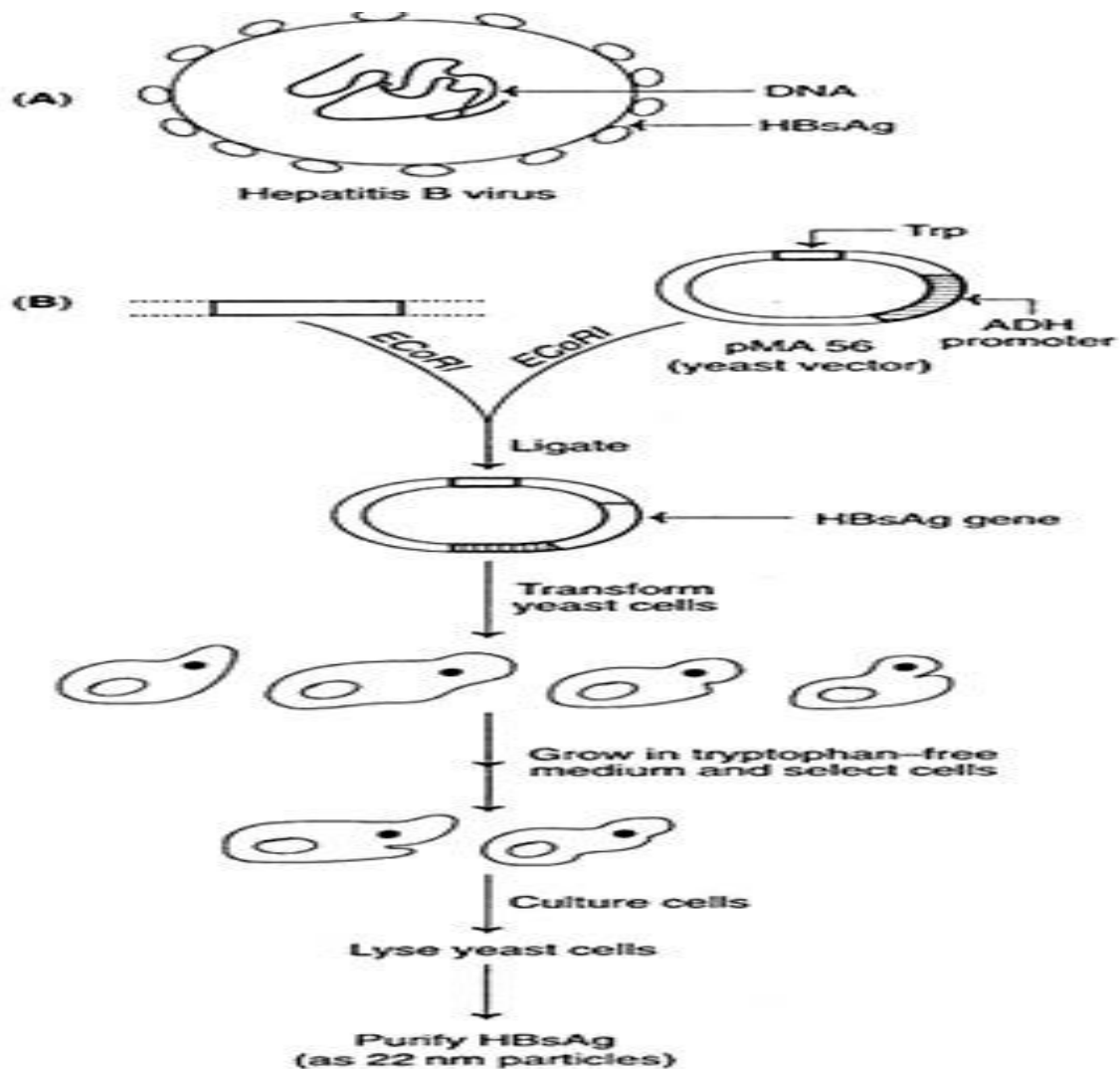


Fig. 16.1 : (A) Hepatitis B virus–Dane particle (42 nm particle); (B) Production of hepatitis B surface antigen (HBsAg) in yeast cells (Trp–Tryptophan, ADH–Alcohol dehydrogenase).

Animal cloning

Animal cloning

- Cloning is a process that produces genetically identical genes, cells, tissues and organisms.
- Some plants and bacteria produce clones through asexual reproduction. Natural human clones are known as identical twins. The twins are produced when an embryo splits, creating two or more embryos that have almost identical DNA.

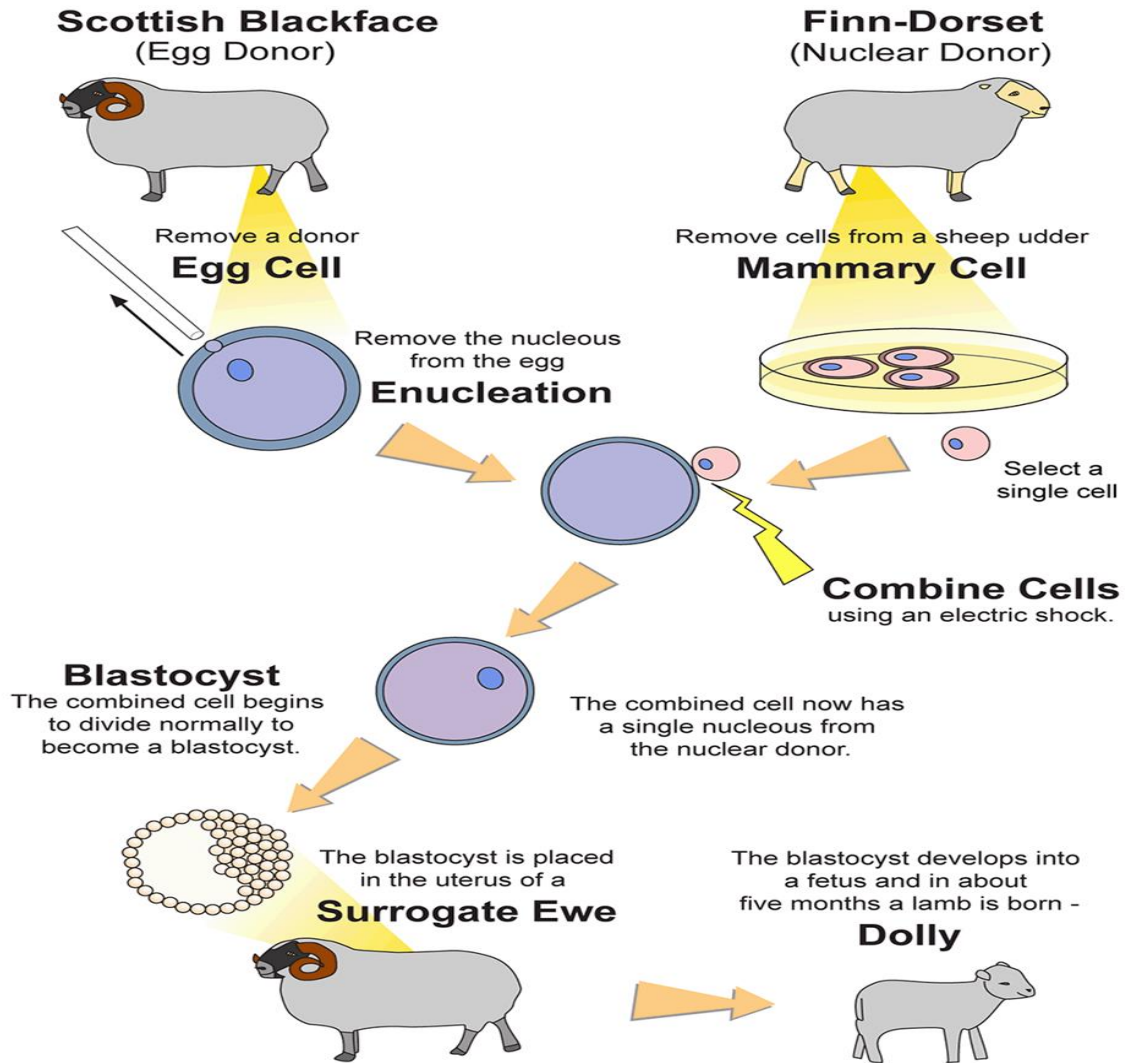
Types of Artificial cloning

- Gene cloning-Produces copies of genes or segments of DNA
- Reproductive cloning produces copies of whole animals
- Therapeutic cloning produces stem cells for experiments aimed at creating new tissues to replace injured or diseased tissues

Procedure

- Scientists remove a cell (like a skin cell) from the animal they want to copy
- They remove the nucleus of an egg cell from the surrogate mother (the female who will grow and birth the clone)
- They put the DNA from the skin cell into the egg cell of the surrogate mother
- A few months later, the clone is born (a baby)

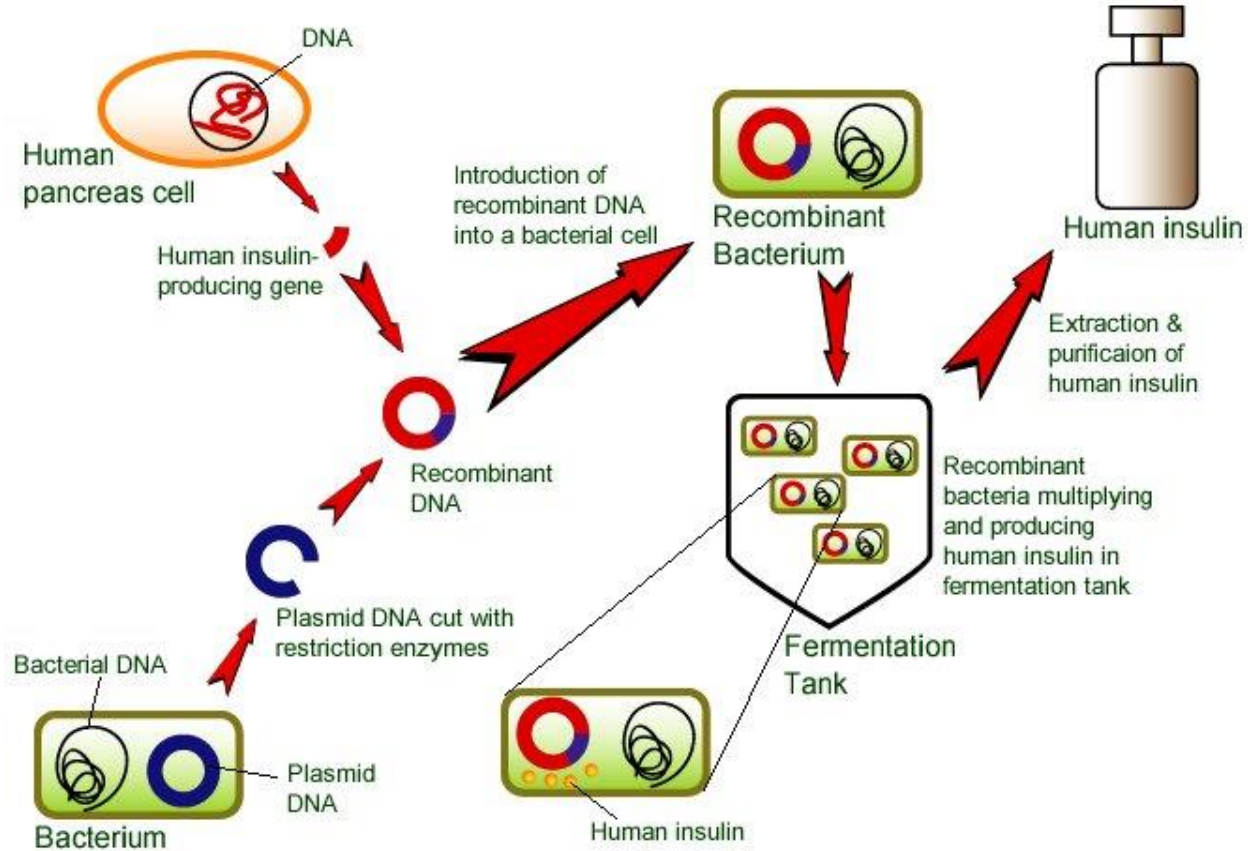
The Story of Dolly



Transgenic microbes

The microorganisms which carry foreign genes are called transgenic microbes. A number of microbes (e.g., Lactobucillus, Leuconostoc, Bacillus, Streptomyces, Yeast, Rhizopus, Penicillium, Aspergillus) are employed commercially in preparation of Yoghurt, cheese, alcoholic drinks, vinegar, lactic acid, enzymes, vitamins and antibiotics.

Human Insulin Production



Transgenic Animals

A female animal is superovulated and eggs are collected.



The eggs are fertilized invitro.



The transgene containing solution is injected into the male pronucleus using a micro pipette to as it is larger than female nucleus and closer to the oocyte surface.

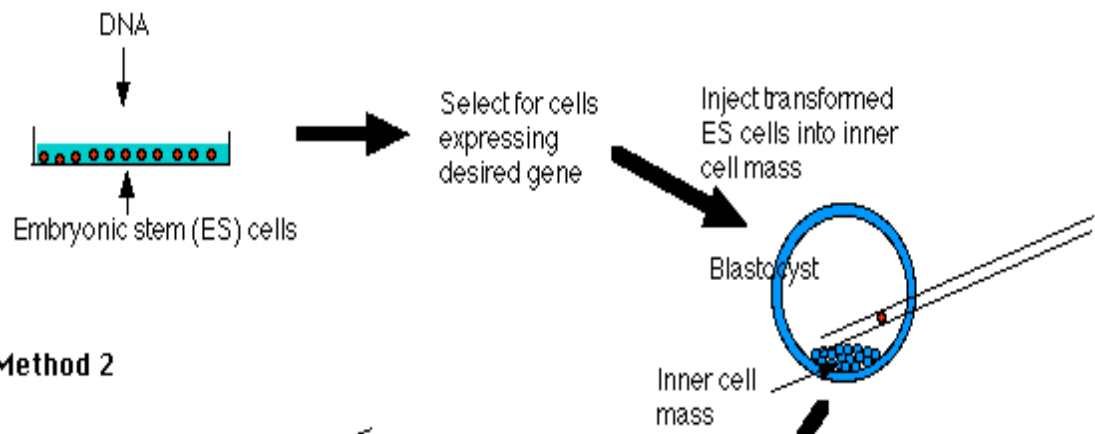


Eggs with the transgenes are kept overnight in an incubator to develop to a 2 cell stage.

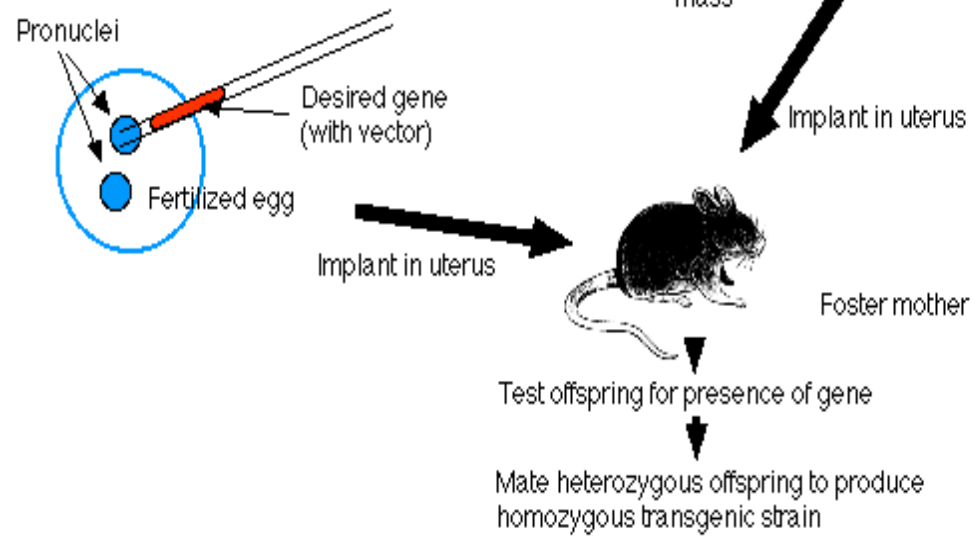


The eggs are then implanted into the uterus of a pregnant female (female which has been mated with a vasectimized male the previous night).

Method 1



Method 2



Transgenic fish:

- ⦿ Tilapia
- ⦿ Salmon/trout
- ⦿ Catfish
- ⦿ Can grow up to 6 times faster than wildtype fish
- ⦿ Most have extra copies of **growth hormone (GH)** gene



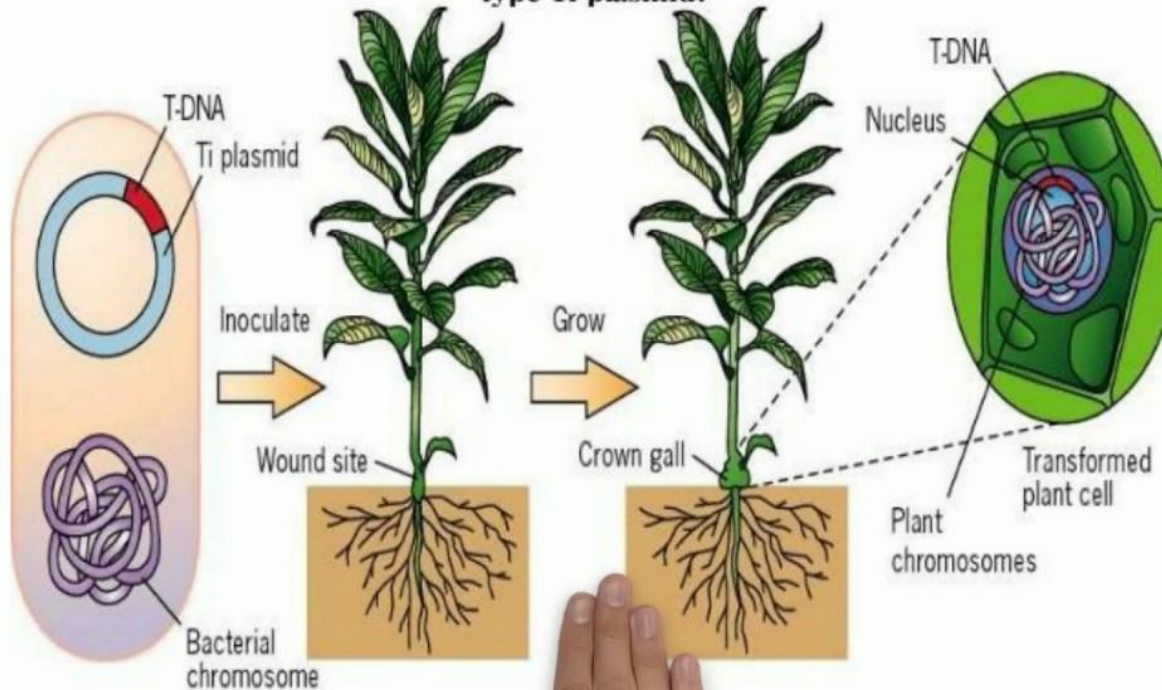
Transgenic Cow:

- ⦿ Transgenic cows carrying extra copies of two types of **casein** genes produce 13% more milk protein.
- ⦿ Currently the milk from these animals is under FDA review.



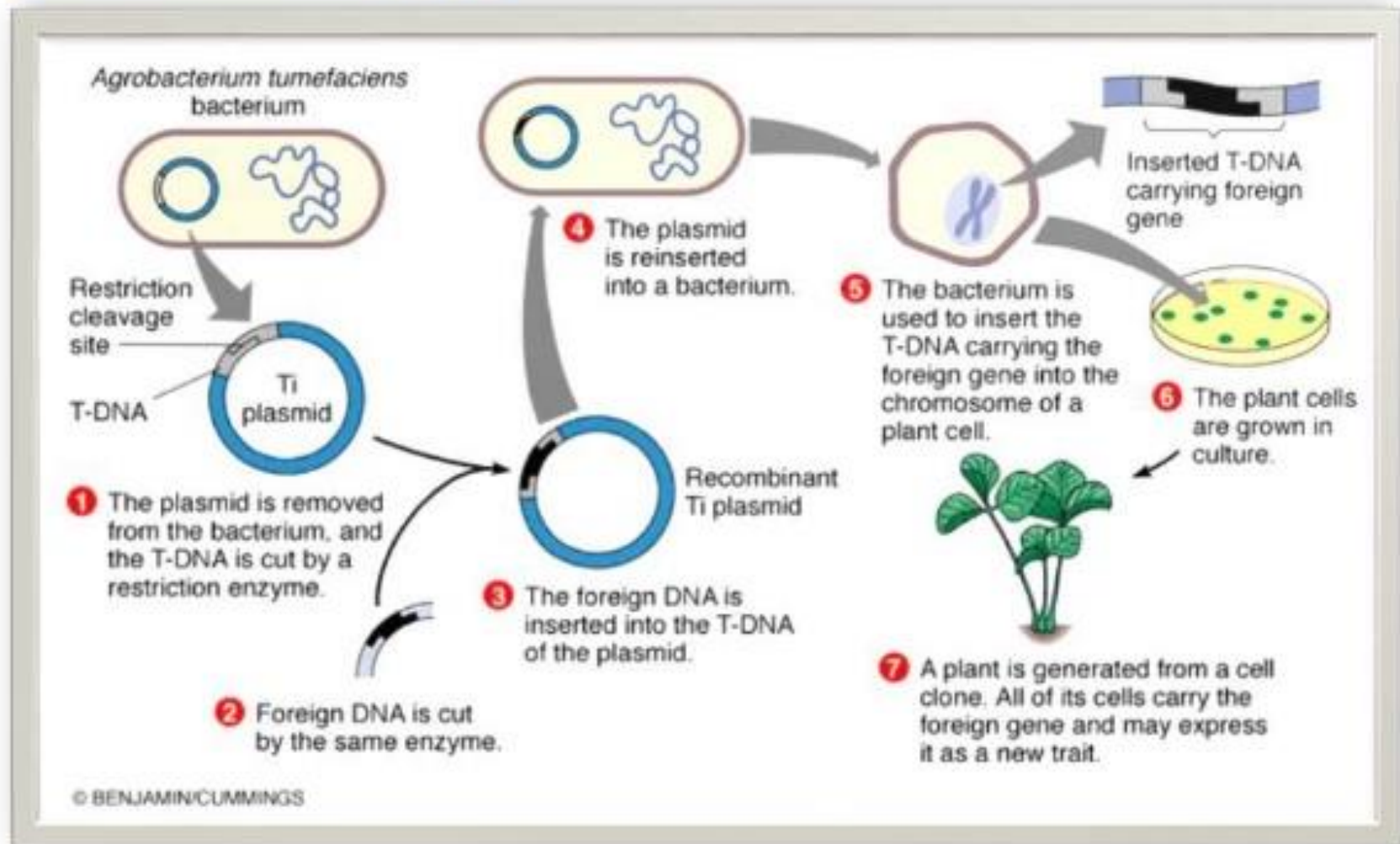
Transgenic plants

Transformation of plant cells by *Agrobacterium tumefaciens* harboring a wild-type Ti plasmid:



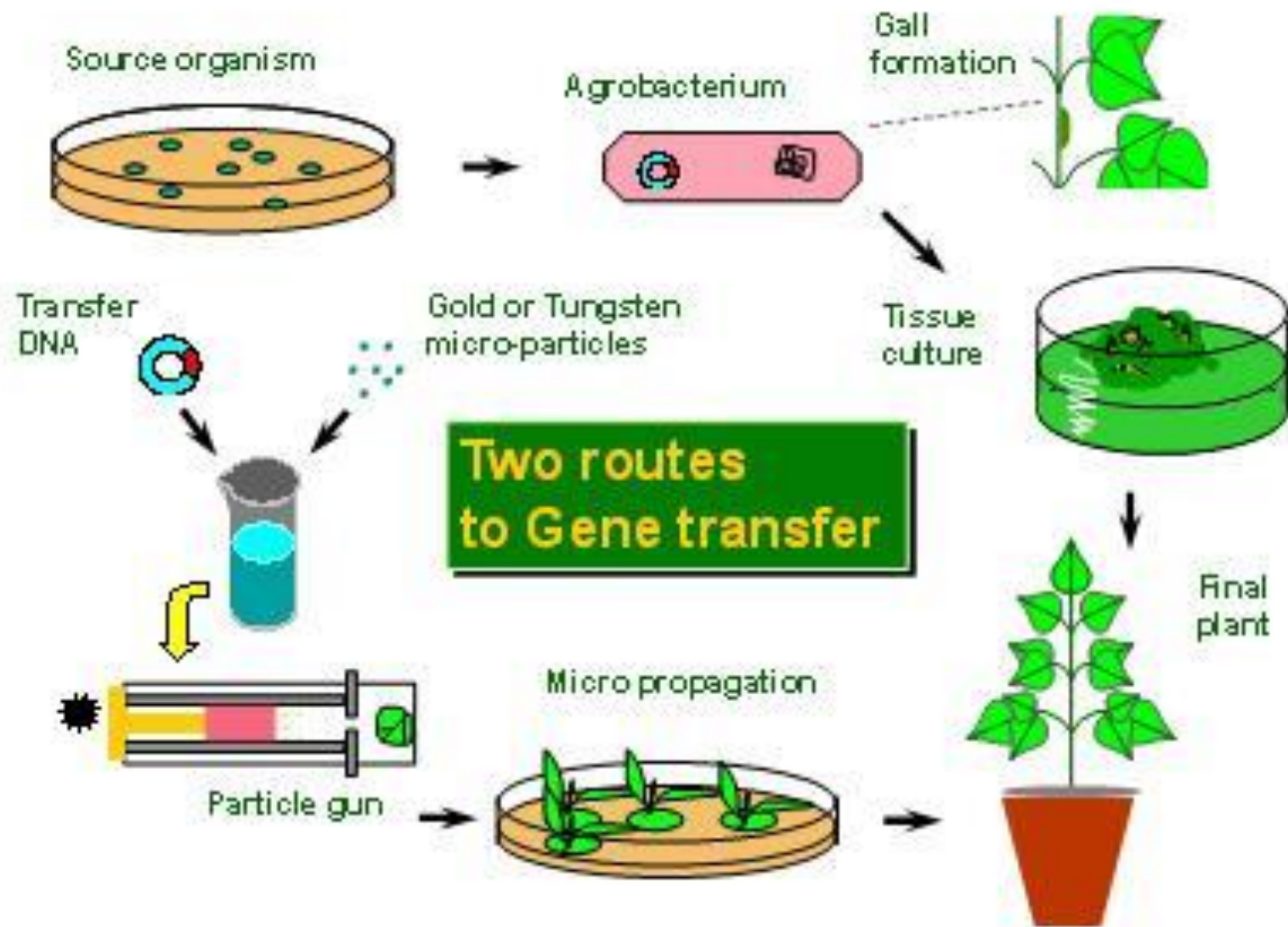
When the bacteria recognizes a wounded cell, a piece of its Ti plasmid is transferred into the cell and integrated into plant chromosome

Technology:



Examples

- Golden rice
- Flavr savr tomato
- Bt cotton



GENETICALLY MODIFIED TOMATO

- A **genetically modified tomato**, or transgenic **tomato** is a **tomato** that has had its genes **modified**, using **genetic engineering**. The first commercially available **genetically modified** food was a **tomato engineered** to have a longer shelf life (**FLAVR SAVR**).



GOLDEN RICE

To make golden rice, beta-carotene-producing genes are obtained from other species and introduced into the white rice genome.

