

- red biotechnology -

Vaccines

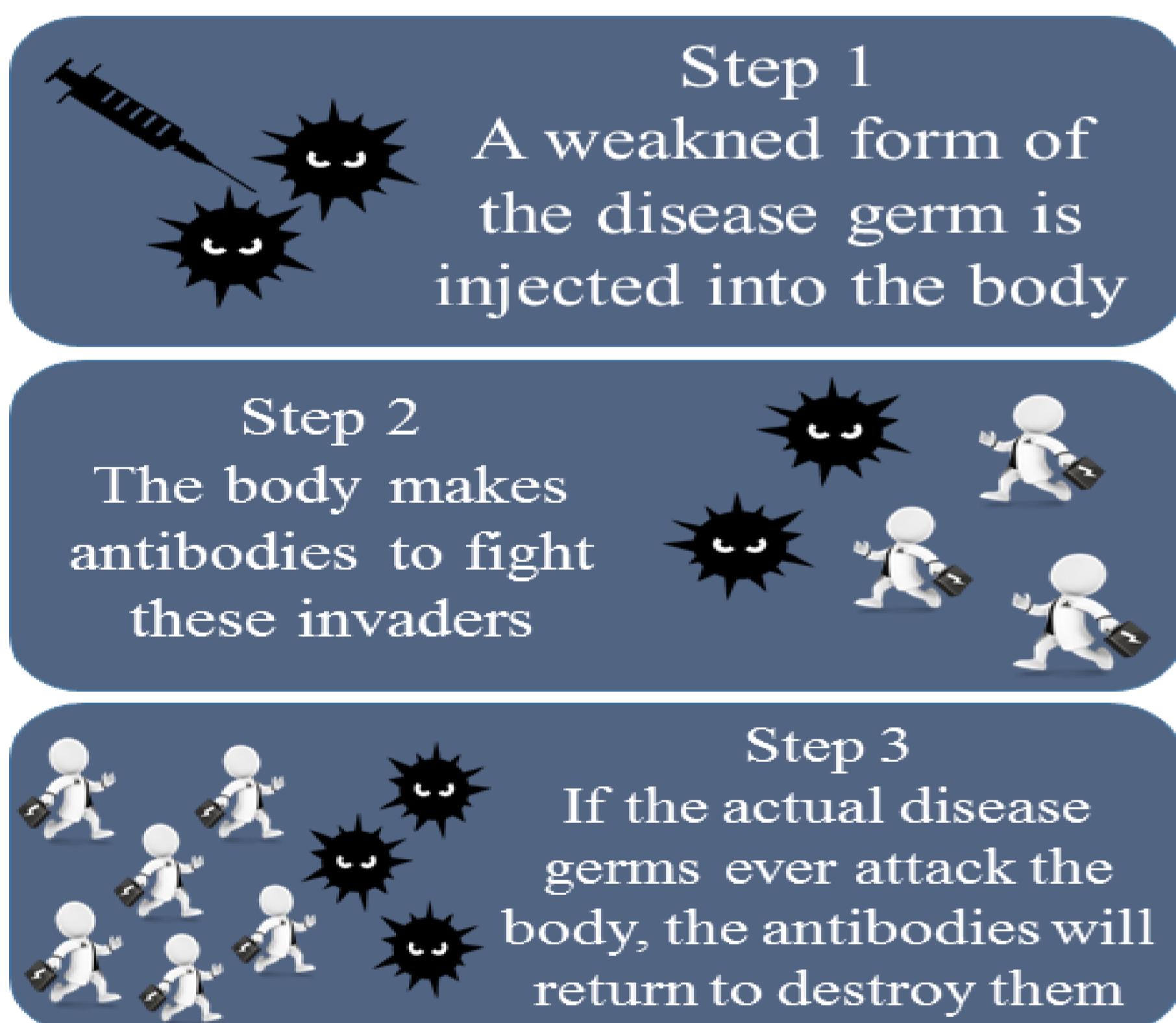
Susanna Gobbi, Oliver Sumberg

What are vaccines?

A vaccine is a biological preparation used to produce or improve immunity against a particular disease. By inoculating killed or weakened disease-causing microorganisms the production of antibodies is stimulated.

How do vaccines work?

Vaccines help develop immunity by imitating an infection. This type of infection, however, does not cause illness, but it does cause the immune system to produce T-lymphocytes and antibodies.



Picture created by Susanna Gobbi

How are vaccines produced?

Biotechnology is used in three different ways in the development of vaccine:

- 1. Use of monoclonal antibodies for immunopurification of antigens:** Once antigen is purified, it is used for developing a vaccine against a pathogen.
- 2. Use of cloned genes for the synthesis of antigens:** cloned genes have been used for the synthesis of antigens leading to the preparation of vaccines.
- 3. Synthetic peptides as vaccines:** vaccines can also be prepared through short synthetic peptide chains.



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Vaccines in use

- living:** it uses live-attenuated organisms and they contain modified strains of a pathogen (bacteria or viruses) that have been weakened but are able to multiply within the body.
- non-living vaccines:** they are based on whole killed pathogens or components of them. They are very efficacious and allowed the control.

Reverse vaccinology

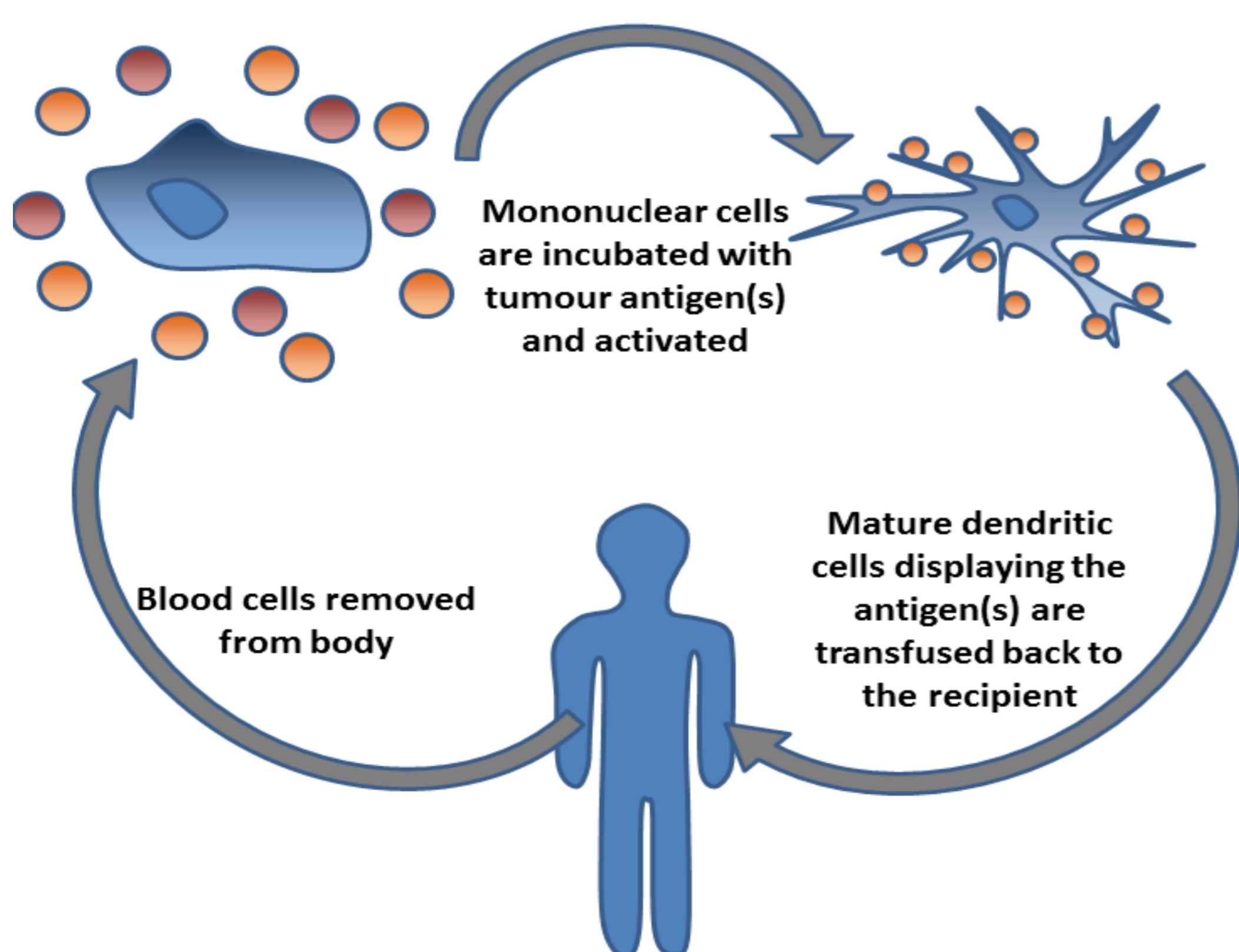
Reverse vaccinology is an innovative technique for the development of new vaccines through the sequencing of the genome of the pathogen.

This technique consists in:

- extracting entire bacteria genomes
- Identifying the antigens
- study on the biological role of each protein
- genes are rapidly cloned in order to produce the proteins they encode
- proteins are evaluated for their ability to cause an immune response
- isolate a dozen of antigens to be subjected to further analysis

Experimental: These are a number of innovative vaccines in development.

Dendritic cell vaccines



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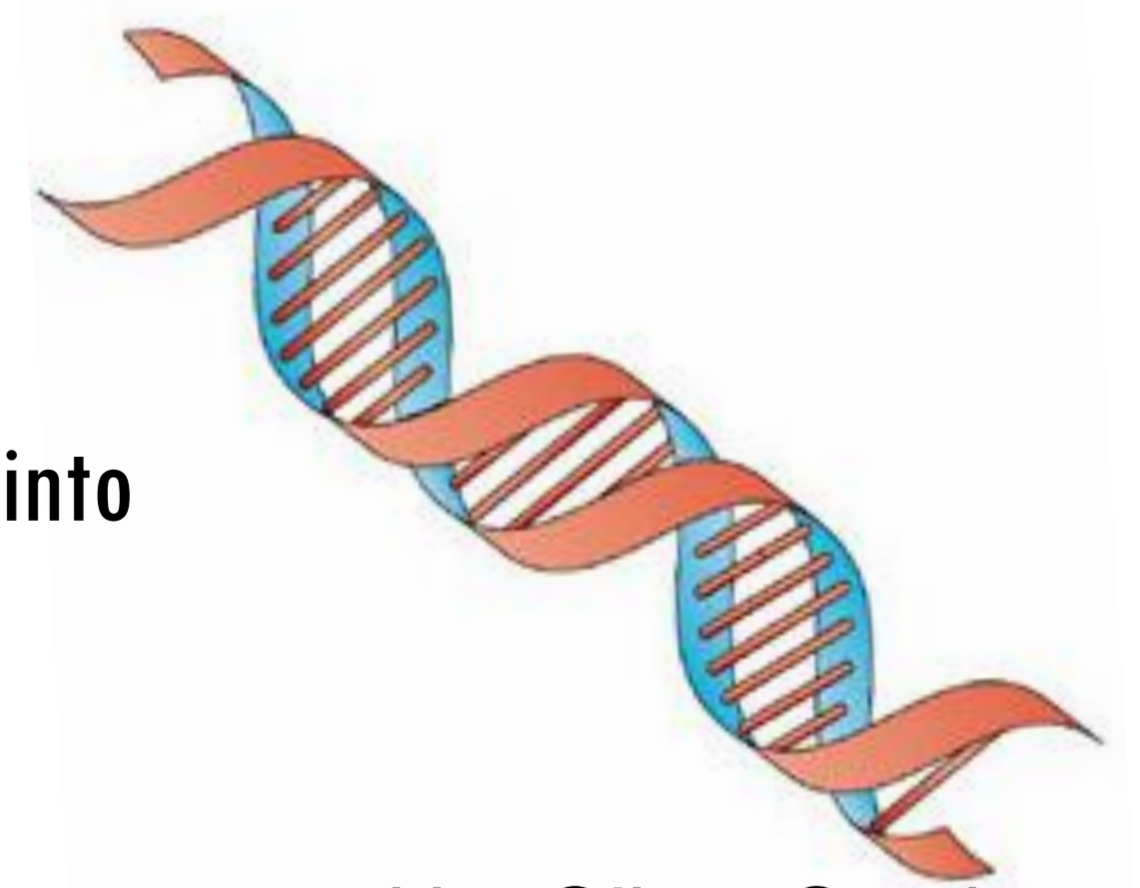
Plants as bioreactors for vaccine production

Transgenic plants have been identified as promising expression systems for vaccine production.

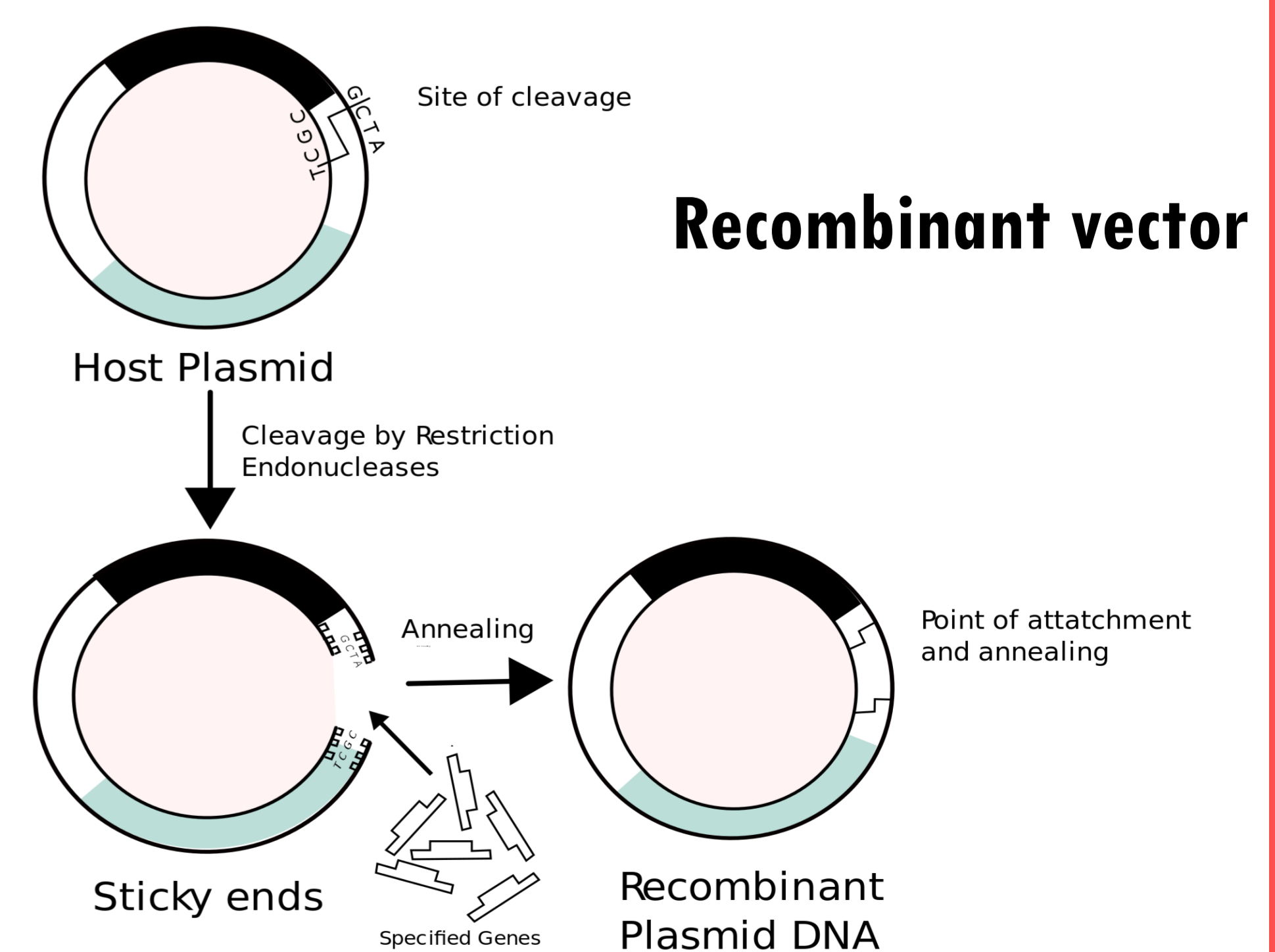
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DNA vaccination

The proposed mechanism is the insertion of viral or bacterial DNA into human or animal cells.



Picture created by Oliver Sumberg



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