

MOLECULAR PHARMING FOR THE PRODUCTION OF VACCINES IN FOOD

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OBJECTIVES

- To know how molecular pharming works and what it is for.
- Investigate how can be applied so that food can be used as drugs or vaccines.
- To know how Covid-19 could be combated through this method.

MOLECULAR PHARMING

It is a technology used for the production of large amounts of protein with therapeutic value. Genetic engineering is used to introduce genes of interest into the plant genome so that they can express them and produce drugs.

- ✓ **Low production cost.**
- ✓ **Easy plant cultivation.**
- ✓ Access to vaccines in **underdeveloped countries.**
- ✓ **Local production** (planting seeds).
- ✓ A demanding cold chain is not needed = **easy transport.**
- ✓ **More effective** in the oral vaccine.
- ✓ **Friendly** oral administration, without having to puncture.

PLATFORMS PRODUCTION

The incorporation of exogenous DNA can be carried out through transformation methods based on the Ti plasmid of *Agrobacterium tumefaciens*.

There are two systems of expression:

- **STABLE TRANSFORMATION** (integrative): plants transformed in a stable way at the nuclear or chloroplast level. **Heritable** transformation.
- **TRANSIENT TRANSFORMATION** (non-integrative): faster method but **not heritable**. It can be through agroinfiltration or virus infection.

PMF with *Agrobacterium tumefaciens*

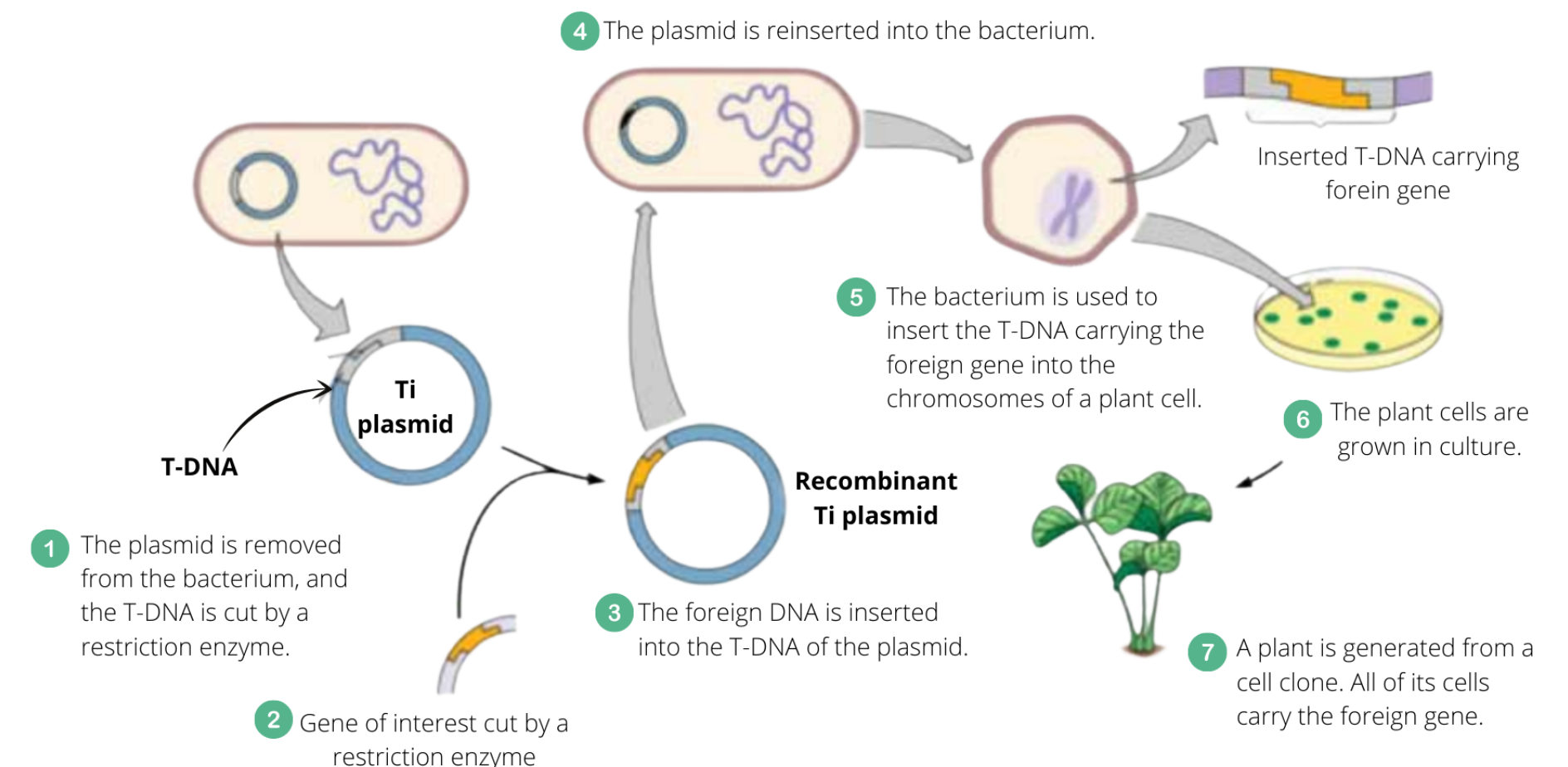


Figure 1: Plant molecular farming (PMF) with *A. tumefaciens*.

Source: Original version in english (Benjamin Cummins 2004).

APPLICATION TO COVID-19

- Plants can meet unforeseen and large-scale demand to reach the entire world population.
- There are three important elements for the virus to enter the cell and they are key to the development of treatments or vaccines: the S protein, the ACE-2 receptor, and the TMPRSS2 cell protease.

CONCLUSIONS

Plants have the ability to rapidly produce pharmaceutical proteins on a large scale and at a relatively low cost. The different production platforms allow to address high quantities of production in a short time and can facilitate the access of the products obtained in all the sectors of the world population. This could also help find a solution to combat Covid-19. The right genes, a strong commercial need and a good production system, will help the commercialization of plant molecular crops.