

Al-Farabi Kazakh National University (KazNU)

Faculty of Biology and Biotechnology



DISCIPLINE: «Modern Problems of Plant Genetics»

Lecture 8

Genetic transformation of plants with *Agrobacterium tumefaciens*.

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Genetic Engineering of Plants with *Agrobacterium*

Agrobacterium (lat.) is a group of gram-negative bacteria first identified as an independent genus by **H.J. Conn in 1942**.

Representatives of the genus are capable of horizontal gene transfer, with the help of which they cause tumors in plants.

The most studied and well-studied species of this genus is *Agrobacterium tumefaciens*. *Agrobacterium* is widely known for its ability to reciprocally transfer DNA between itself and plants. Due to this property, representatives of this genus have become **an important tool for genetic engineering**.

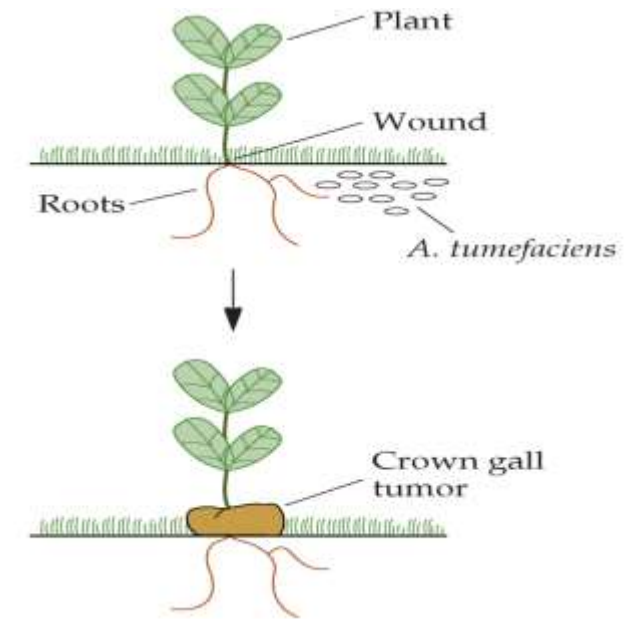
Infection of a plant with *A. tumefaciens* and formation of a **crown gall tumor**.

Genetically modified crops are plants used in agriculture, the DNA of which has been modified using genetic engineering techniques.

In most cases, **the aim is to introduce a new trait to the plant which does not occur naturally in the species**.

Agrobacterium tumefaciens mediated genetic transformation of plants technique.

The *Agrobacterium tumefaciens* is a phytopathogen that, as a normal part of its life cycle, genetically transforms plant cells.

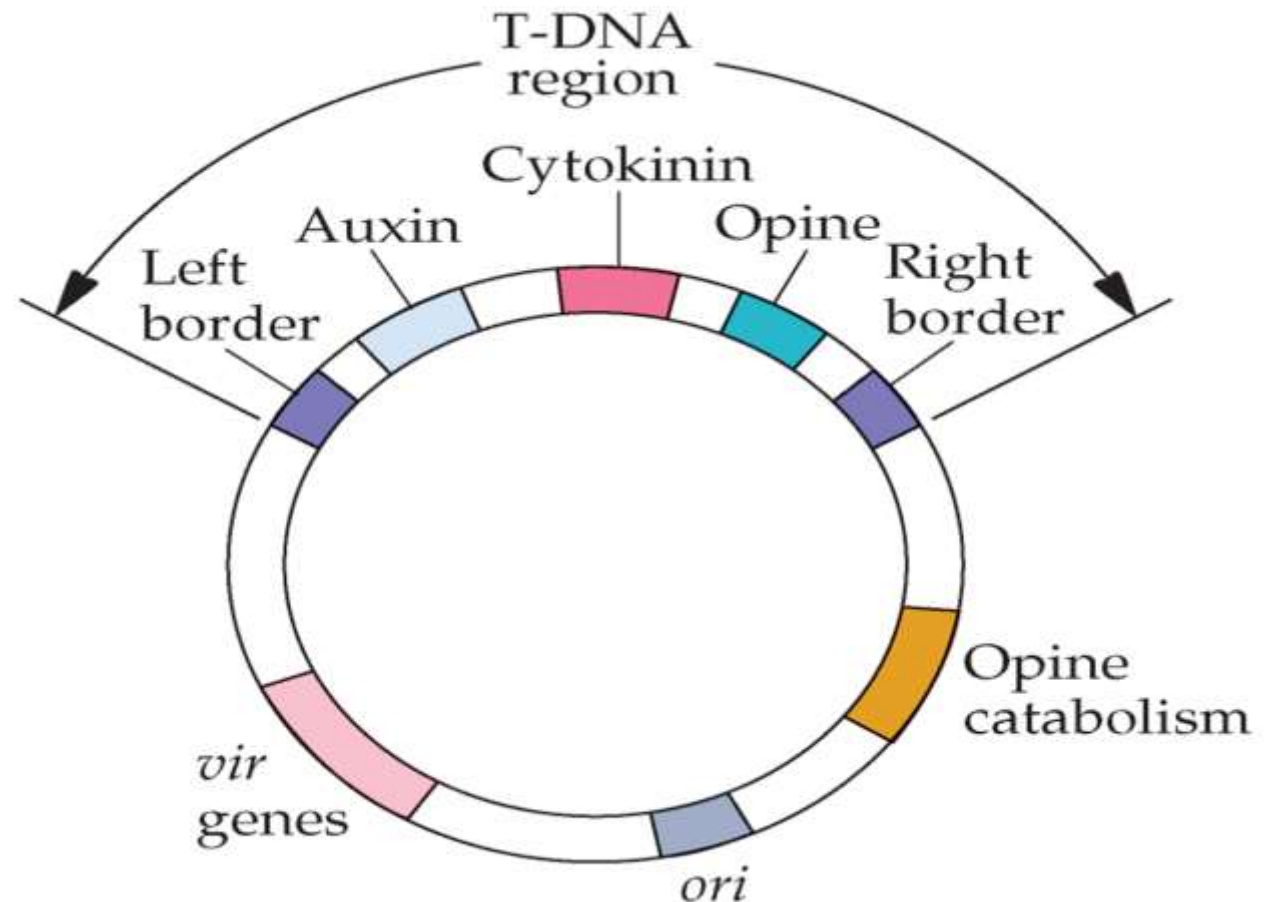


Crown gall (tumor) formation.

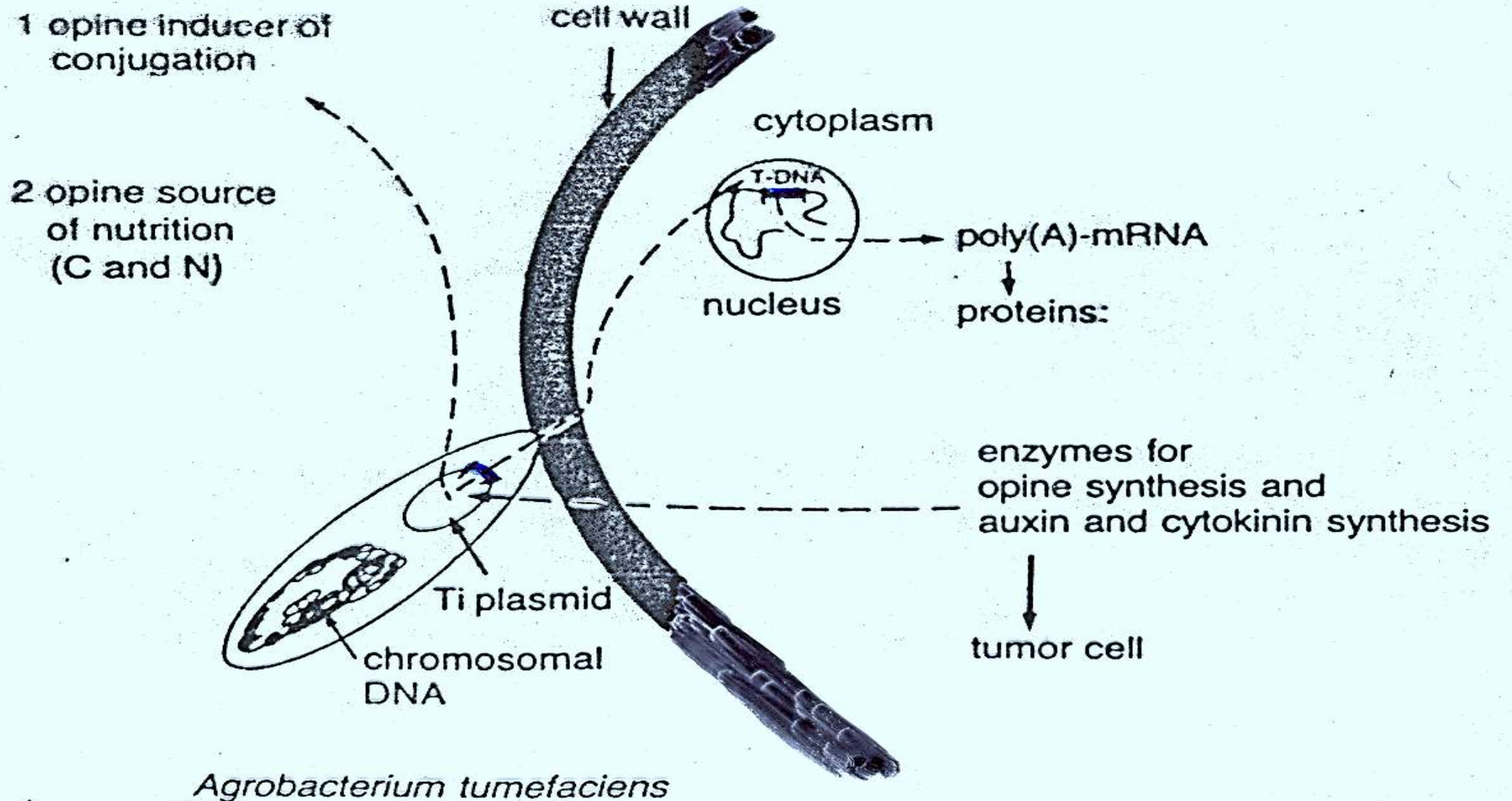


- The **vir genes** are located on a 35-kb region of the Ti plasmid that lies outside of the T-DNA region.
- The products of the **vir genes** are essential for the transfer and integration of the T-DNA region into the genome of a plant cell.
- The T-DNA region includes the genes **AUX** and **CYT**. This pair of genes encodes enzymes that synthesize the plant hormone auxin (indoleacetic acid) and cytokinin.

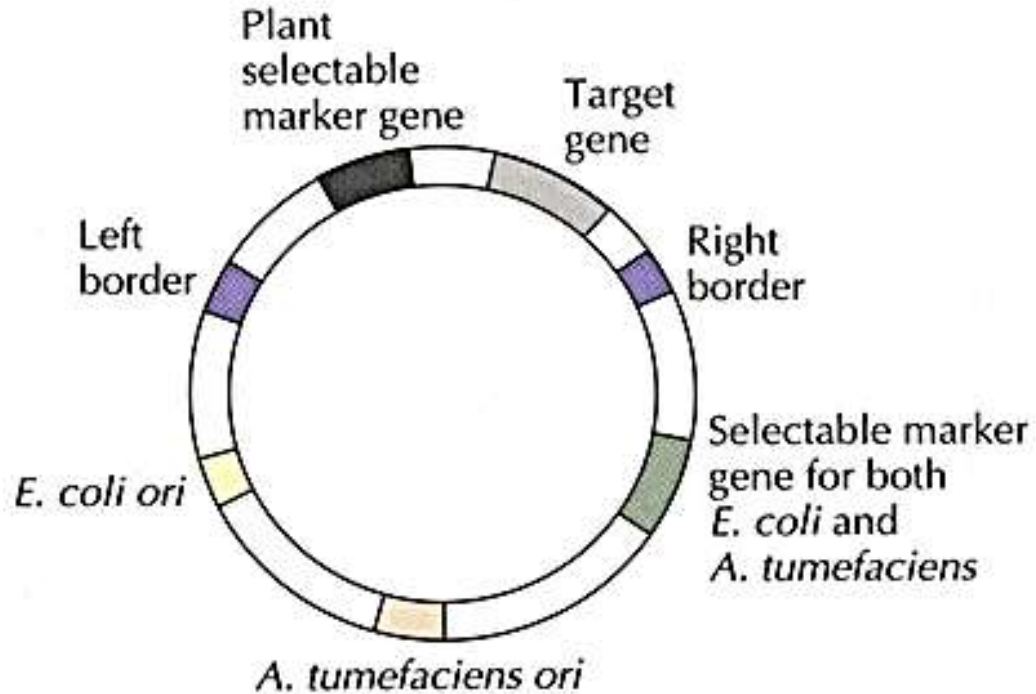
Ti plasmid structure



The Ti plasmid of *Agrobacterium tumefaciens* and the transfer of its T-DNA to the plant nuclear genome



Clone YFG (your favorite gene) or the target gene in the small T-DNA plasmid in *E. coli*, isolate the plasmid and use it to transform the disarmed *A. tumefaciens* as shown.



**Disarmed
Ti plasmid**

Plant genetic engineering with the binary Ti plasmid system

