



Biopharming and Edible Vaccine Production



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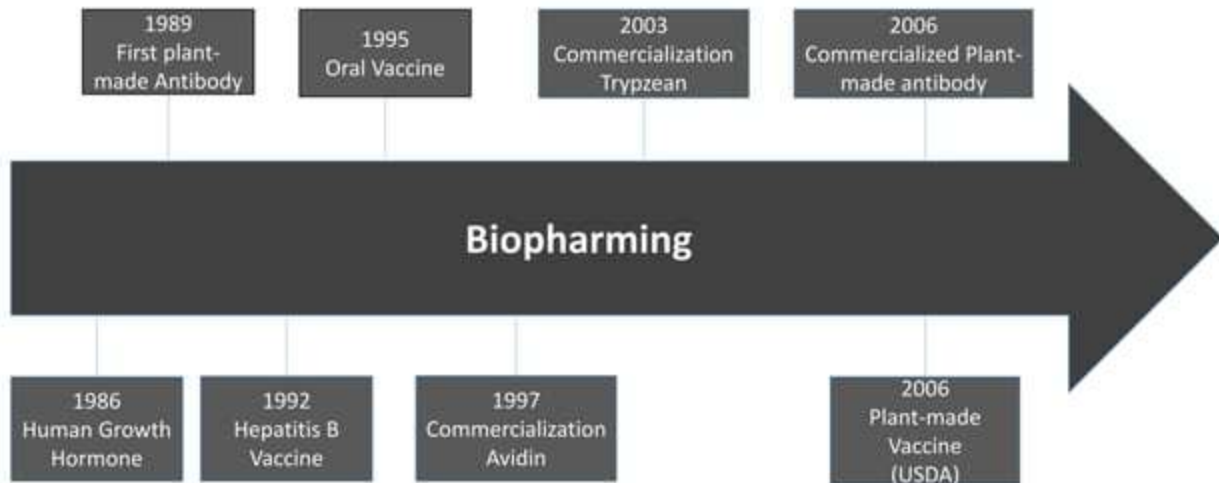
Biopharming

Production of pharmaceuticals in transgenic organisms.

Combination of agriculture and pharmaceutical industries.



Biopharming Milestones



Why to Choose Plants for Biopharming?



Why do we need Biopharming?



Replacement of very expensive
Bioreactor

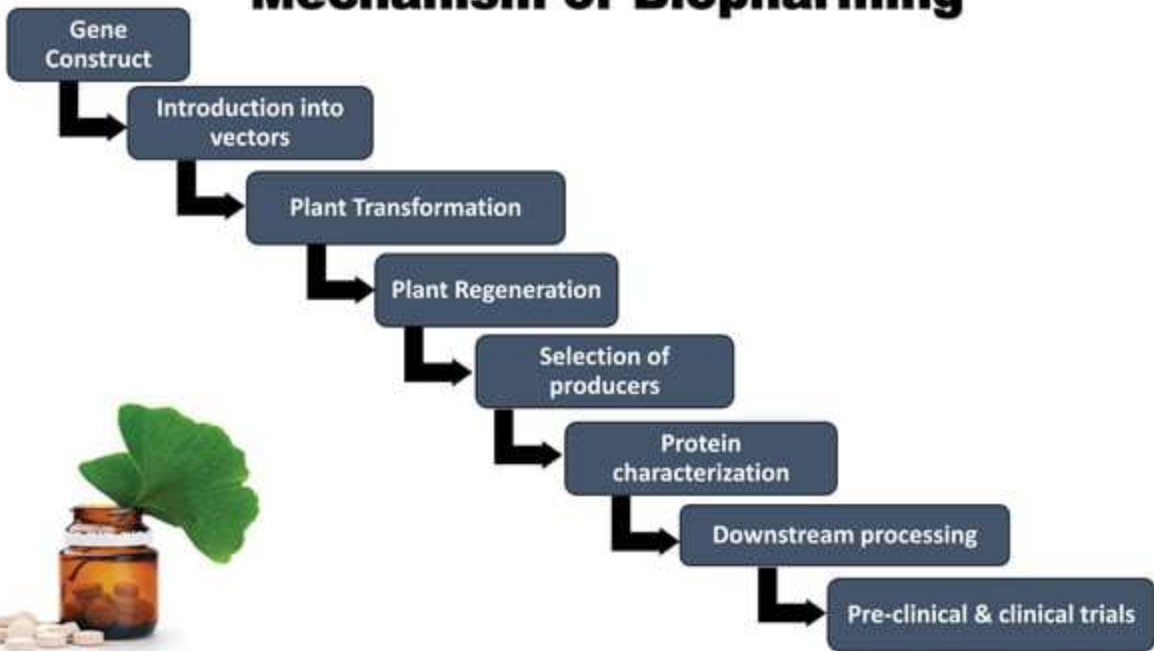


Expression of expensive molecules
in plants



Ease of extracting the desired
product

Mechanism of Biopharming



Applications of Biopharming



Parental therapeutics
and pharmaceutical
intermediates



Industrial proteins and
enzymes



Monoclonal antibodies



Biopolymers



Antigens for edible
vaccines



Plantibodies

Edible Vaccine- A Biopharming Dream

Antigenic gene expressed in edible portion

Ingestion helps release the antigenic protein

Stimulate both humoral & mucosal immunity

Agrobacterium tumefaciens + Antigenic gene

Exposure of plant explant to bacterial suspension carrying antigenic gene

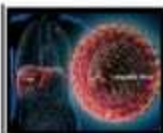
Selection of transformants

Callus formation

Plant regeneration

Edible plant tissue as Vaccine

History of Edible vaccines



Hepatitis

Hepatitis B
surface antigen
(HBsAg)

Tobacco/leaf

Mason et al 1992



E. Coli

Diarrhea

Heat labile
toxin B subunit
(LTB)

Potato/tuber,
tobacco/
leaf

Haq et al 1995



Rabies virus

Rabies

Rabies virus
glycoprotein
(RVG)

Tomato/leaf,
fruit

McGarvey et al 1995



Norwalk virus
(NV)

Gastroenteritis

Norwalk virus
capsid protein
(NVCP)

Potato/tuber
tobacco/leaf

Mason et al 1996



V. Cholerae

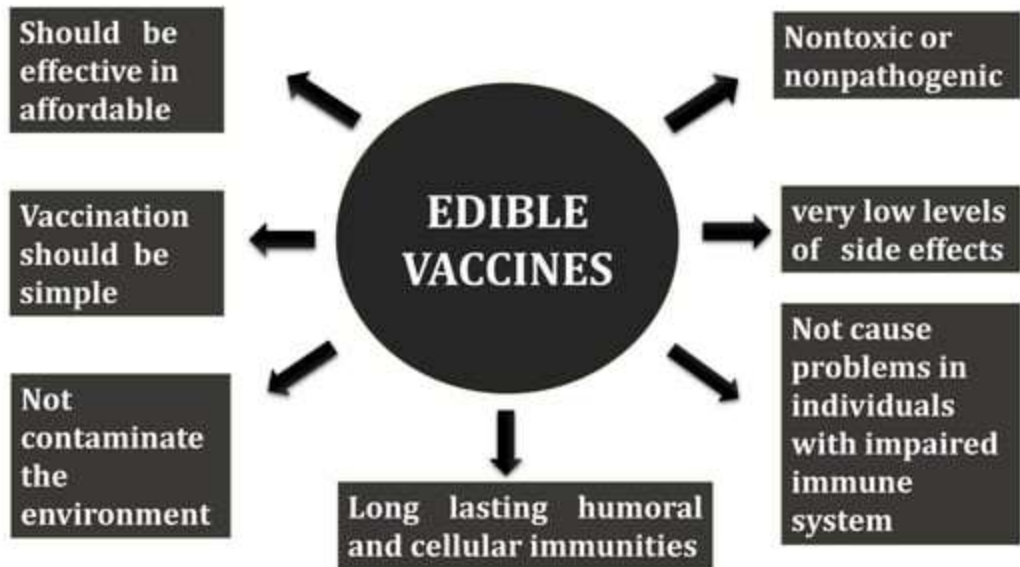
Cholera

Cholera toxin
B subunit
(CTB)

Tobacco/leaf

Hein et al 1996

Ideal Properties of Edible Vaccine



Candidates for Edible Vaccine



Plant Species Selection Criteria

Potato :

Advantage

Easily transformed.
Easily propagated.
Stored for long periods without refrigeration.

Disadvantage

Need cooking which denature antigen.



Banana

Advantages

Do not need cooking.
Protein not destroyed even after cooking.
Inexpensive .
Grown widely in developing countries.

Disadvantages

Trees take 2-3 to mature years.
Spoils rapidly after ripening.



Paddy :

Advantages

Commonly used in baby food
High expression of antigen.

Disadvantages

Grows slowly.
Requires glasshouse condition.



Tomato

Advantage

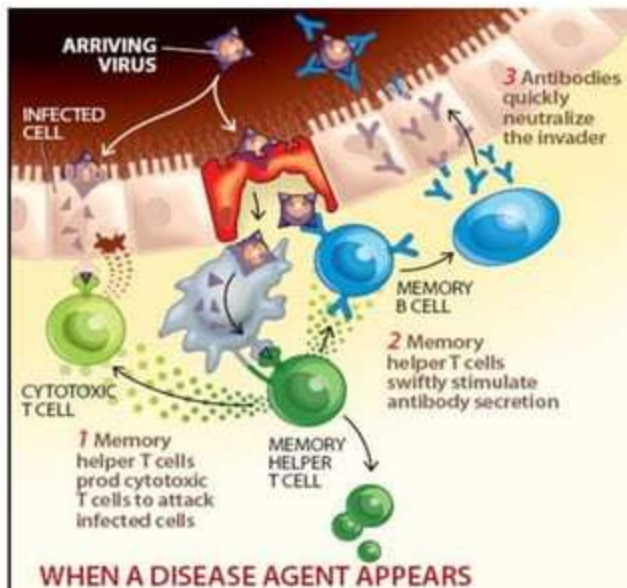
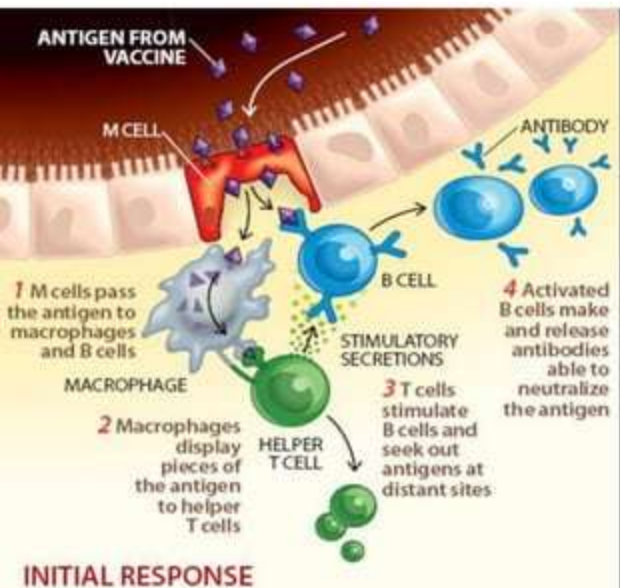
Grow quickly.
Cultivate broadly.
High content Vitamin-A may boost immune response.

Disadvantages

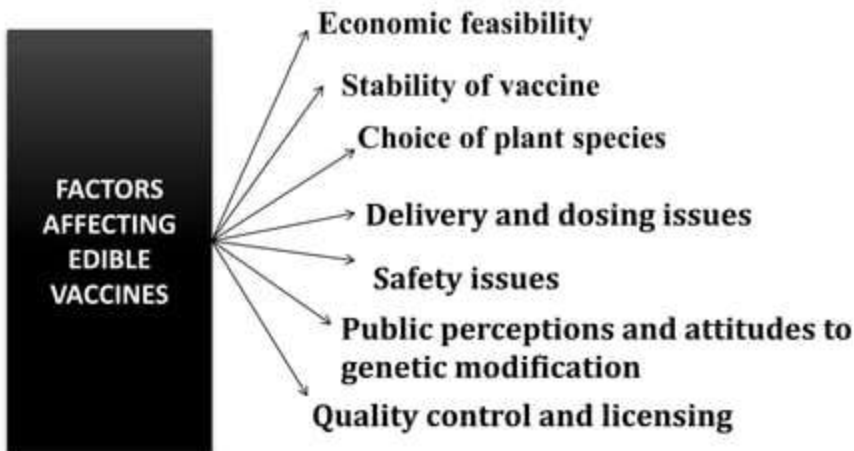
Spoils readily.



Mechanism of Protection by Edible Vaccine



Factors affecting Efficacy of Edible Vaccine



Disadvantages and Advantages

- Inconsistency of dosage.
- Food supply contamination.
- Uncertain stability of vaccine.
- Environment contamination.
- Health safety concerns.



- Mass production of vaccines with low cost.
- Ease of separation & purification.
- Ease of administration.
- Low chances of infection.
- Eliminate trained medical Personnel.
- No adjuvant is required.
- Extensive storage.

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Thank you !! ☺

