

Detecting Genetically Modified Foods by PCR



The “Green Revolution”

1950s-1970s



High-yield crop strains
Chemical fertilizers
Mechanized harvesters

Irrigation
Pesticides
Herbicides



Second “Green Revolution”

Genes for...

Herbicide resistance

Insect resistance

Drought tolerance

Frost tolerance



What is a GMO?

Genetically Modified Organism –

Organisms that have had their DNA changed through methods of genetic engineering

(the change would not occur naturally by mating and/or natural recombination)

Top 10 genetically modified foods



Corn



Soy



Cottonseed



Papaya



Rice



Rapeseed
(Canola)



Potatoes



Tomatoes

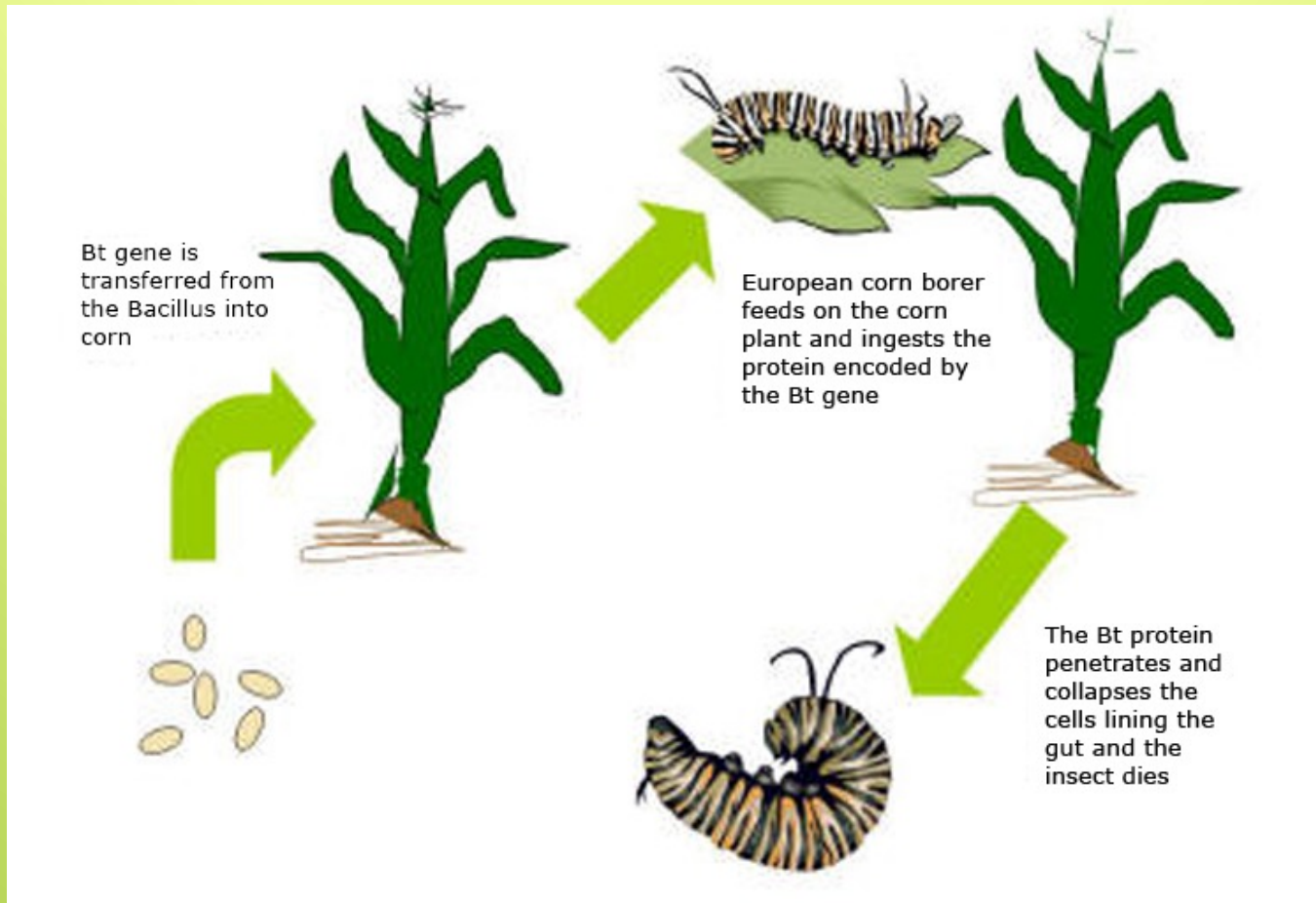


Dairy products



Peas

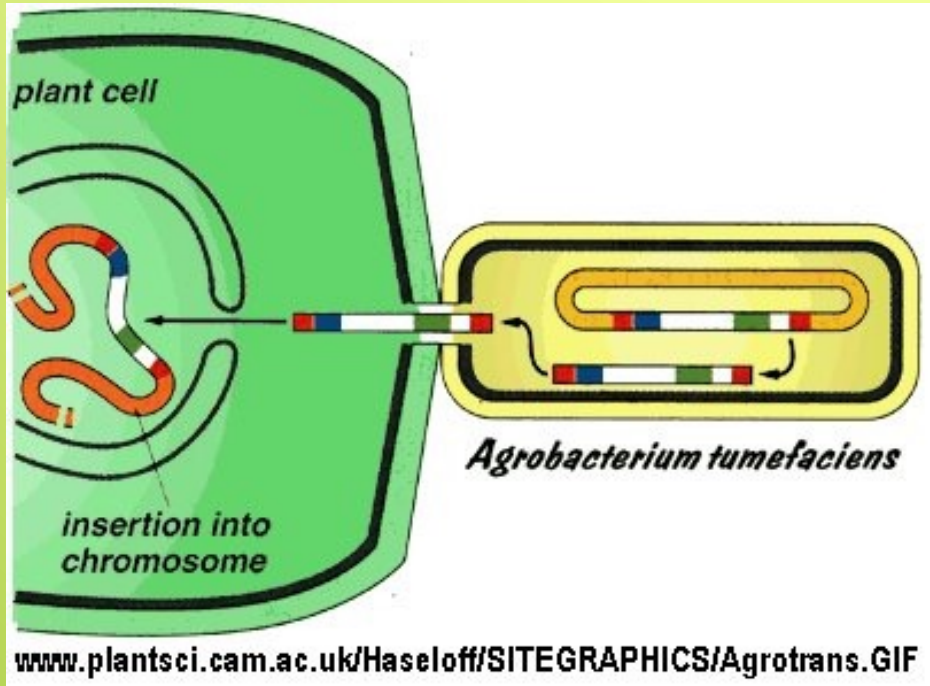
Bt (*Bacillus thuringiensis*) crops



Reduces application of insecticides & increases crop yields

Ht (Herbicide tolerant crops)

Roundup[®] Ready



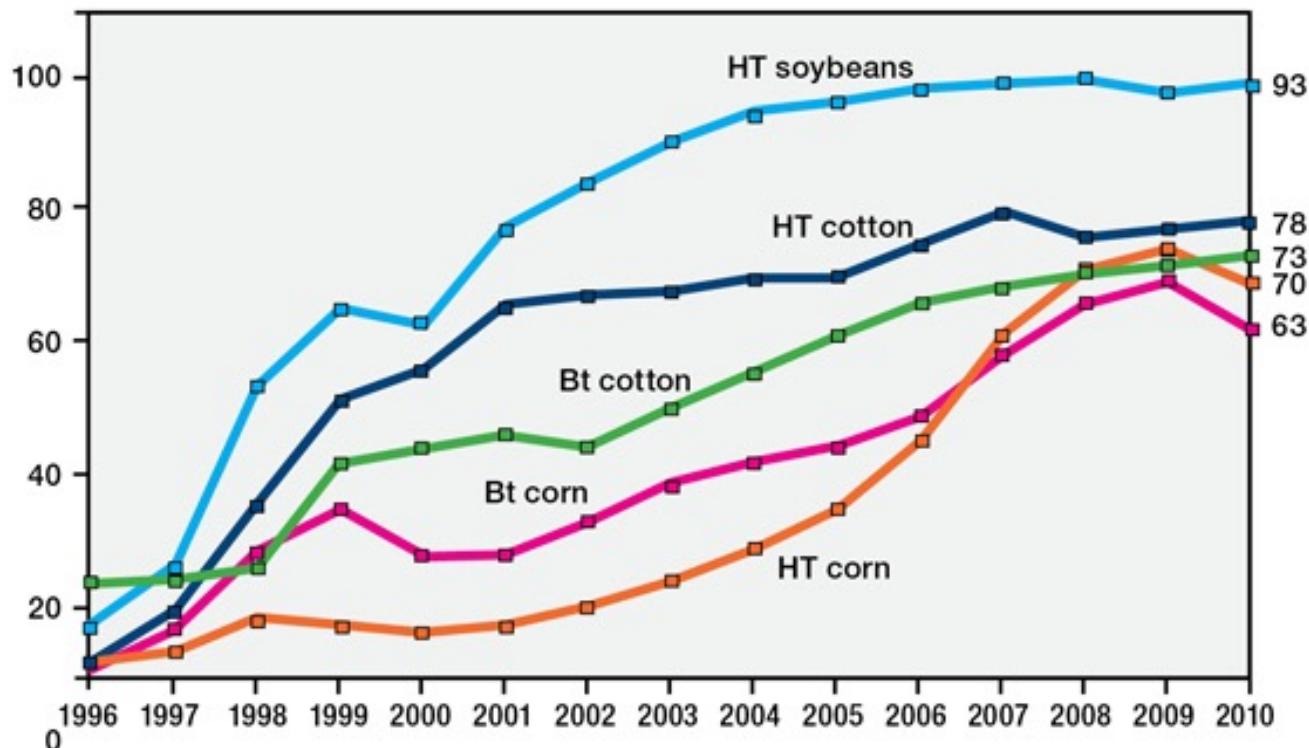
Glyphosate
resistance gene –
protects against the
broad-spectrum
herbicide Roundup[®]

Roundup[®]-treated fields require less tilling, reducing soil runoff

GM Crops in the US

Rapid growth in adoption of genetically engineered crops continues in the U.S.

Percent of acres



Adoption of herbicide-tolerant (HT) crops, has been particularly rapid since they first became available to U.S. farmers in 1996. HT soybeans expanded to 94 percent of U.S. soybean planted acreage, HT cotton reached 73 percent of cotton acreage, and HT corn expanded to 72 percent of the corn acreage in 2011. Adoption of insect-resistant (Bt) crops containing the gene from a soil bacterium *Bacillus thuringiensis* (Bt), has also expanded. Use of Bt cotton reached 75 percent of planted cotton acreage in 2011 and Bt corn use grew from about 1 percent of corn acreage in 1996 to 65 percent in 2011.

www.ers.usda.gov/Data/BiotechCrops

Identification

- The percentage of a genetically engineered ingredient that must be present in a food before a label is required:

Australia & New Zealand - 1%

European Union – 0.9%

Japan – 5%

United States – no labeling requirements

How can DNA be moved from one organism to another?

Gene gun



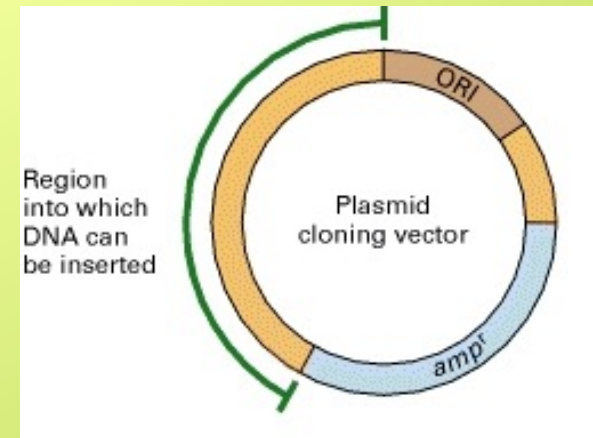
good for plants

DNA microinjection



good for mammals

Plasmid



Bacteriophage/Virus



How will we know if a plant is genetically modified?

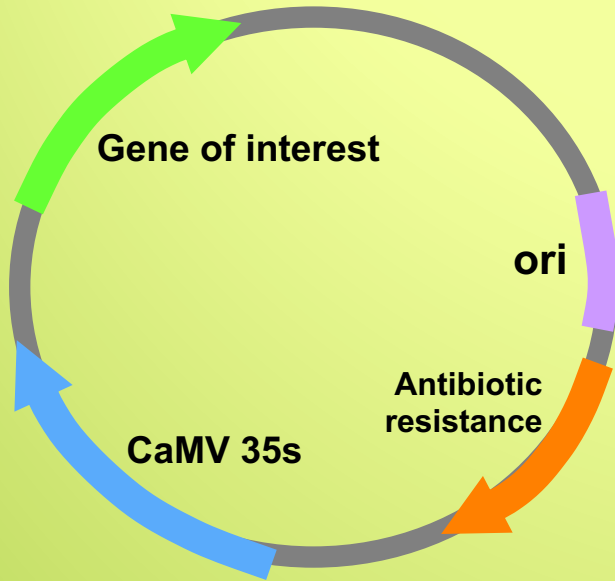
Google “DNALC Kits GMO”

Click on “Protocol”

Click on the “Bioinformatics” tab

Go to “Part 1”

Plasmid



CaMV 35s promoter:

- Very strong promoter causing high levels of gene expression in plants
- Being used in almost all GM crops

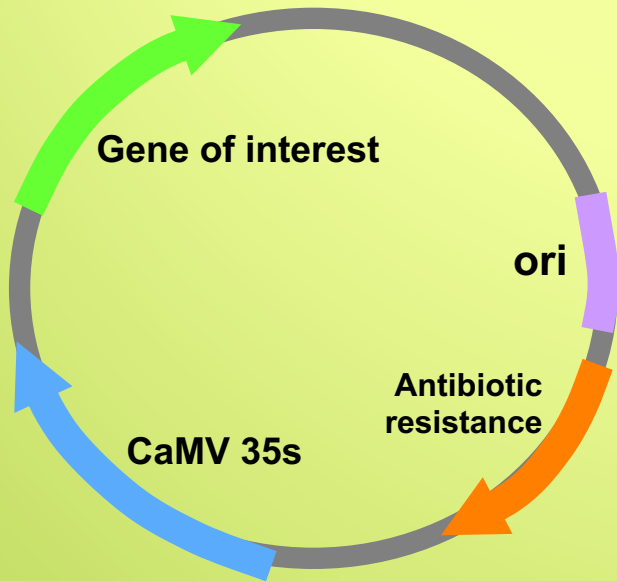
Insect resistance: Bt crops

- *Bacillus thuringiensis* is a soil bacterium that produces toxins which are poisonous to insects

Herbicide tolerance: Ht crops

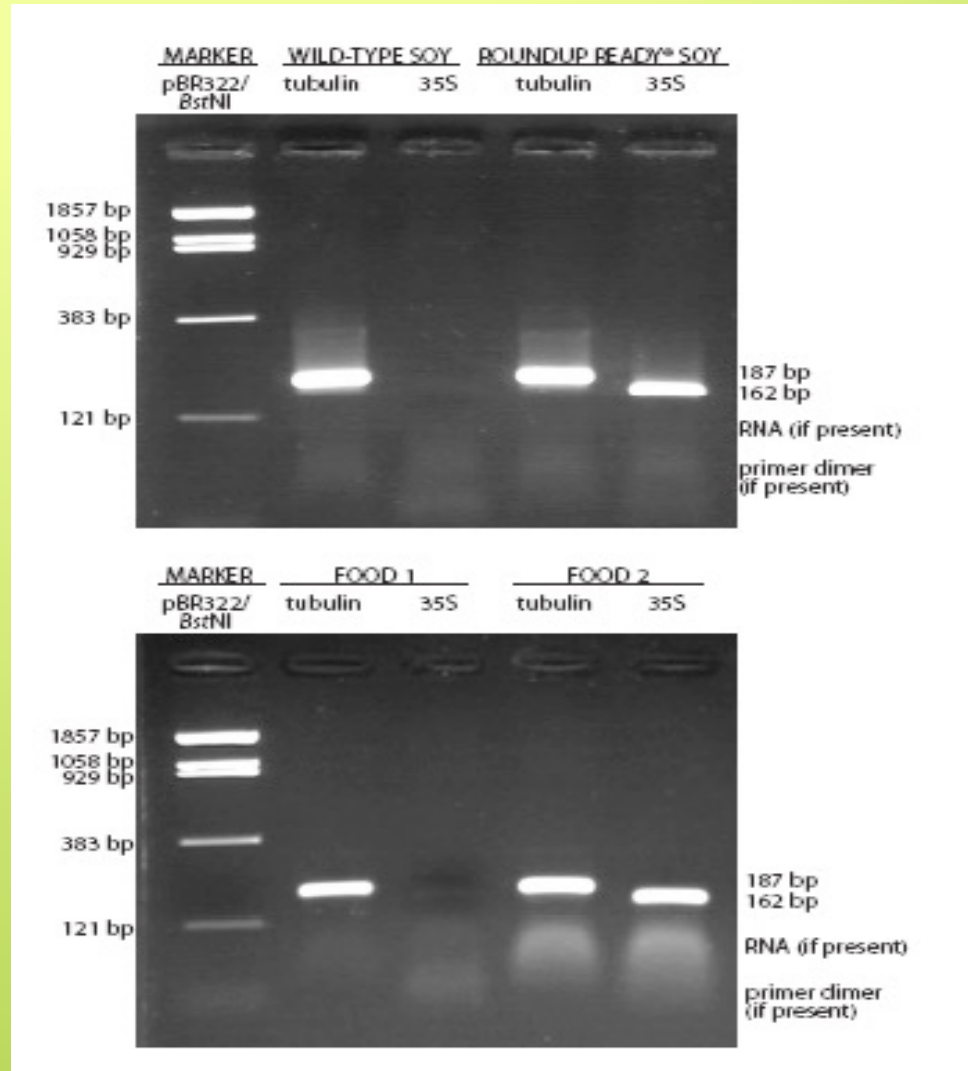
- *Agrobacterium sp.* produce proteins that provide resistance to glyphosate herbicides (Roundup® Ready)

Results



GM foods will contain the 35s promoter

All foods will contain tubulin:
proteins that make up microtubules
(components of the cytoskeleton)



What can it provide?

- Pest resistance
- Herbicide tolerance
- Viral resistance
- Drought resistance
- Increased nutritional value
- Improved fruit
- Altered ripening
- Enriched nutrient content

Issues?

- Creation of super pests
- Creation of super weeds
- Loss of biodiversity
- Biotechnology companies control agriculture
- Health concerns
- Loss of farmable land

Adoption of genetically engineered crops in the United States, 2013

