

Genetically Modified Foods: Myths and Realities



Source: www.accessexcellence.org

Miracle foods for a hungry world.....



<http://scope.educ.washington.edu/gmfood/>

.....or public menace?



i.cnn.net/.../10/biotech.us.europe/story.gm.jpg



<http://www.newint.org/issue320/Images/tradepic.jpg>

<http://www.foeeurope.org/press/eric01.jpg>



Questions:

What's a GMO?

Are GMOs new?

Are GM foods safe to eat?

Are GM crops safe to grow?

Question: What's a GMO?

- ⇒ A GMO is a "genetically modified organism"
- ⇒ Today this means a crop plant with extra genes

Question: Are GMOs new?

- ⇒ GM means "genetically modified"
- ⇒ All human food crops are genetically modified
- ⇒ To survive in the wild, plants must scatter seeds
- ⇒ For people to harvest seeds, they have to stick

www.kukurydza.org.pl/images/teosinte1.jpg



<http://www.arini.ac.uk/pics/maize%20AltD.jpg>

Corn: a "traditional" GMO



www.kukurydza.org.pl/images/teosinte1.jpg

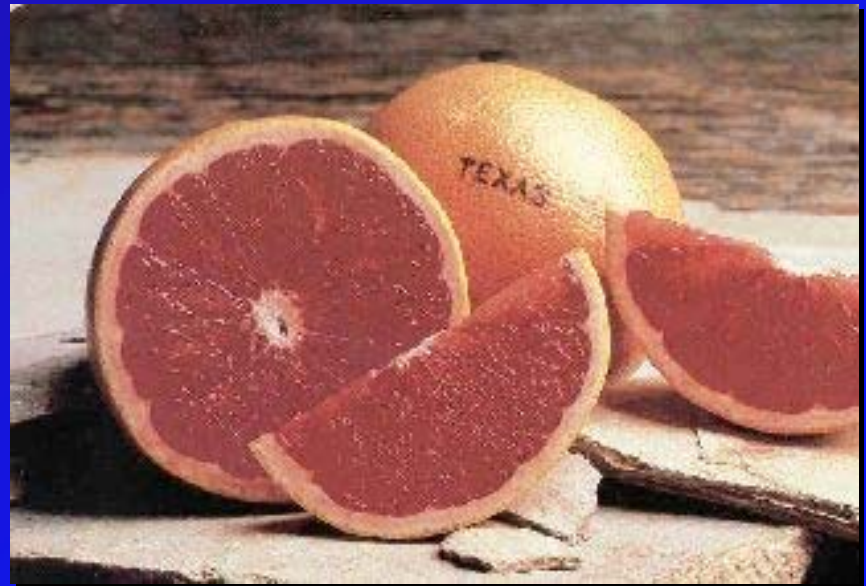


evolution.berkeley.edu/.../images/cornfld.jpg

Familiar genetically modified foods



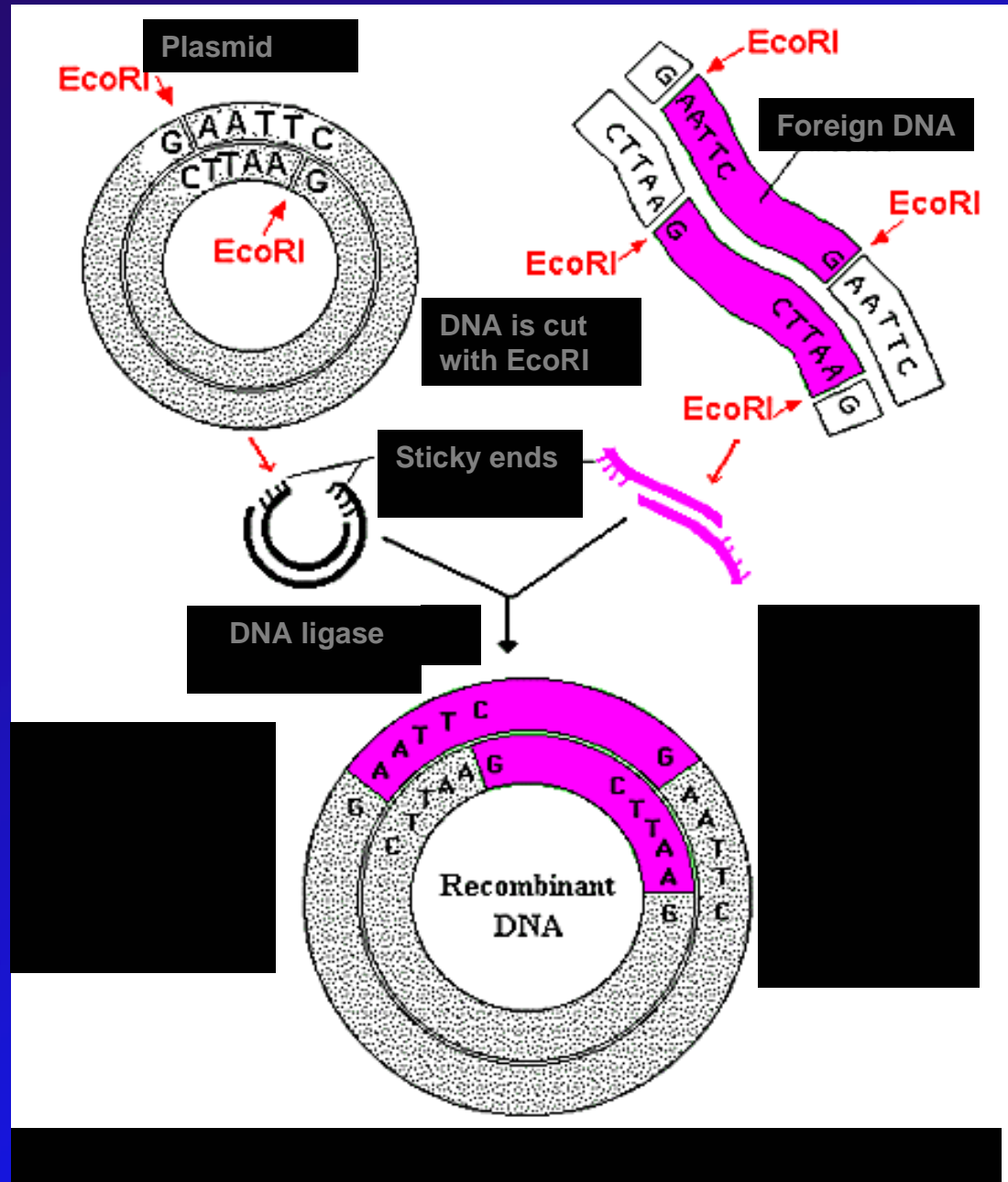
<http://scope.educ.washington.edu/gmfood/>

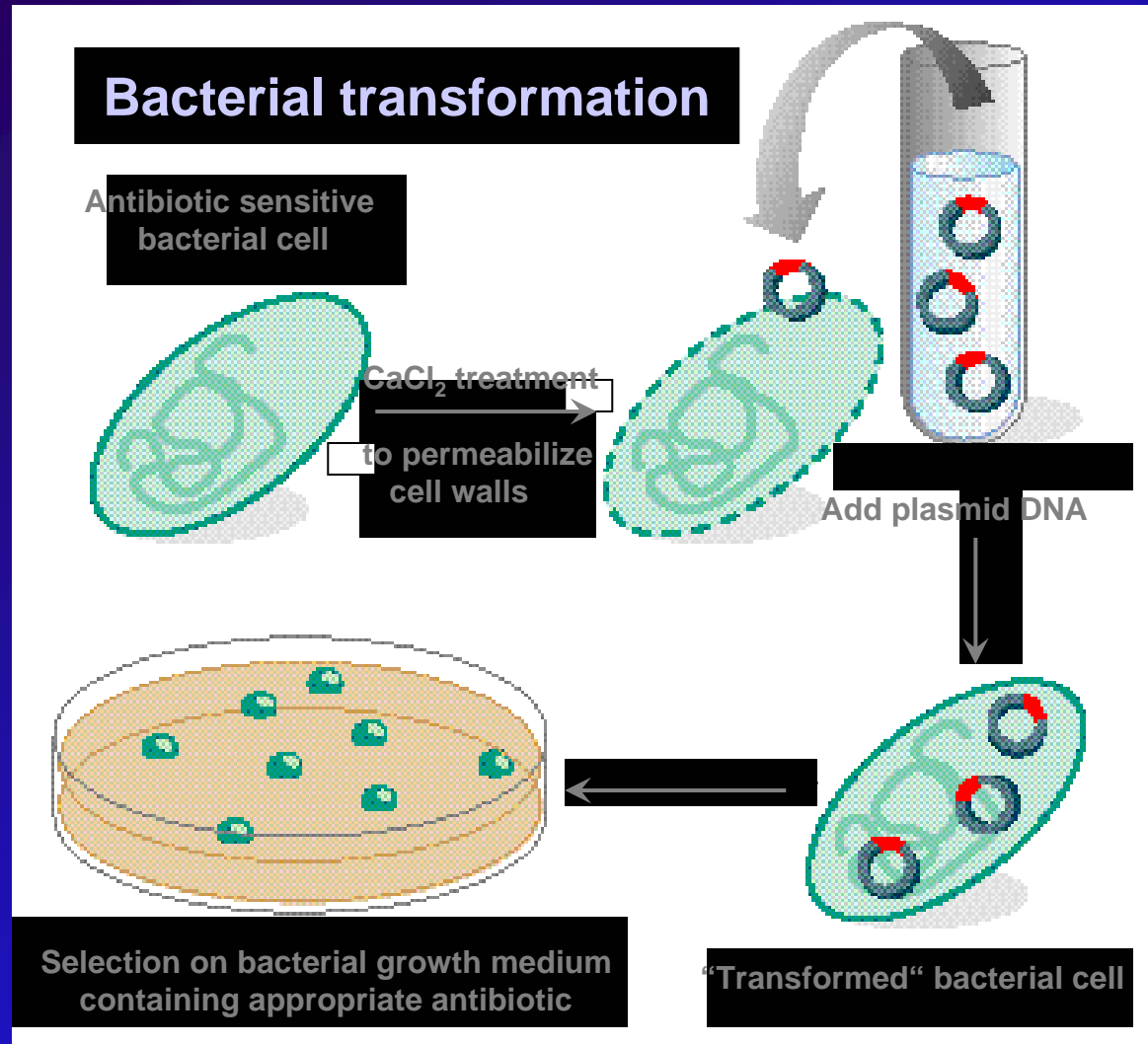


<http://primera.tamu.edu/kcchome/homeowner/riored.htm>

- ⇒ Today's *GMO* a crop plant with extra genes
- ⇒ The extra genes were added using recombinant DNA techniques
- ⇒ Changing plants with recombinant DNA techniques is called "genetic engineering"

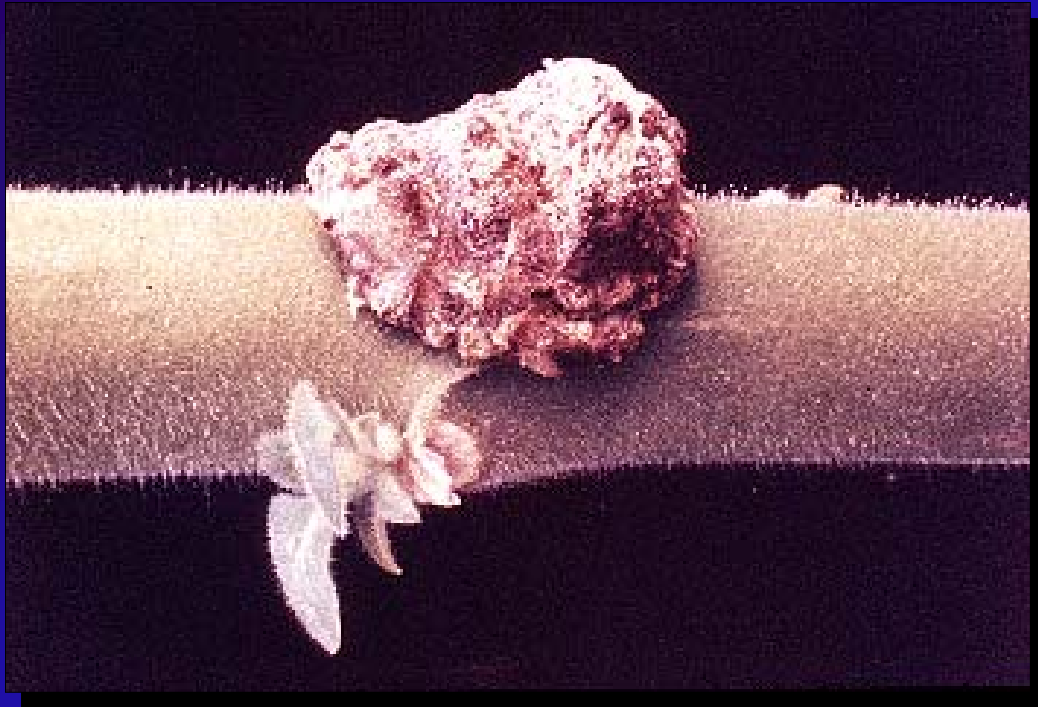
Making recombinant DNA





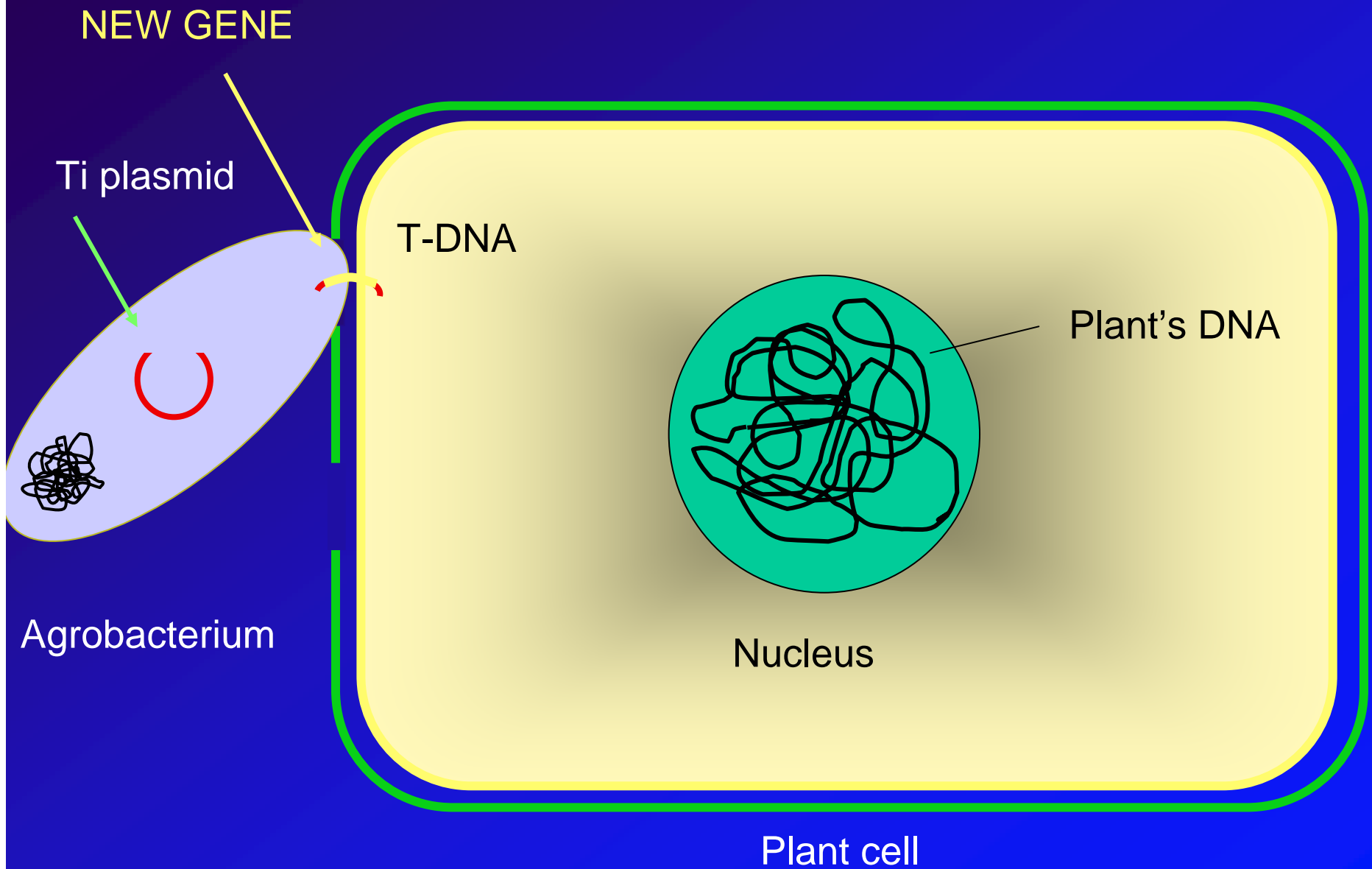
Making many copies of the recombinant DNA

Agrobacterium: nature's genetic engineer

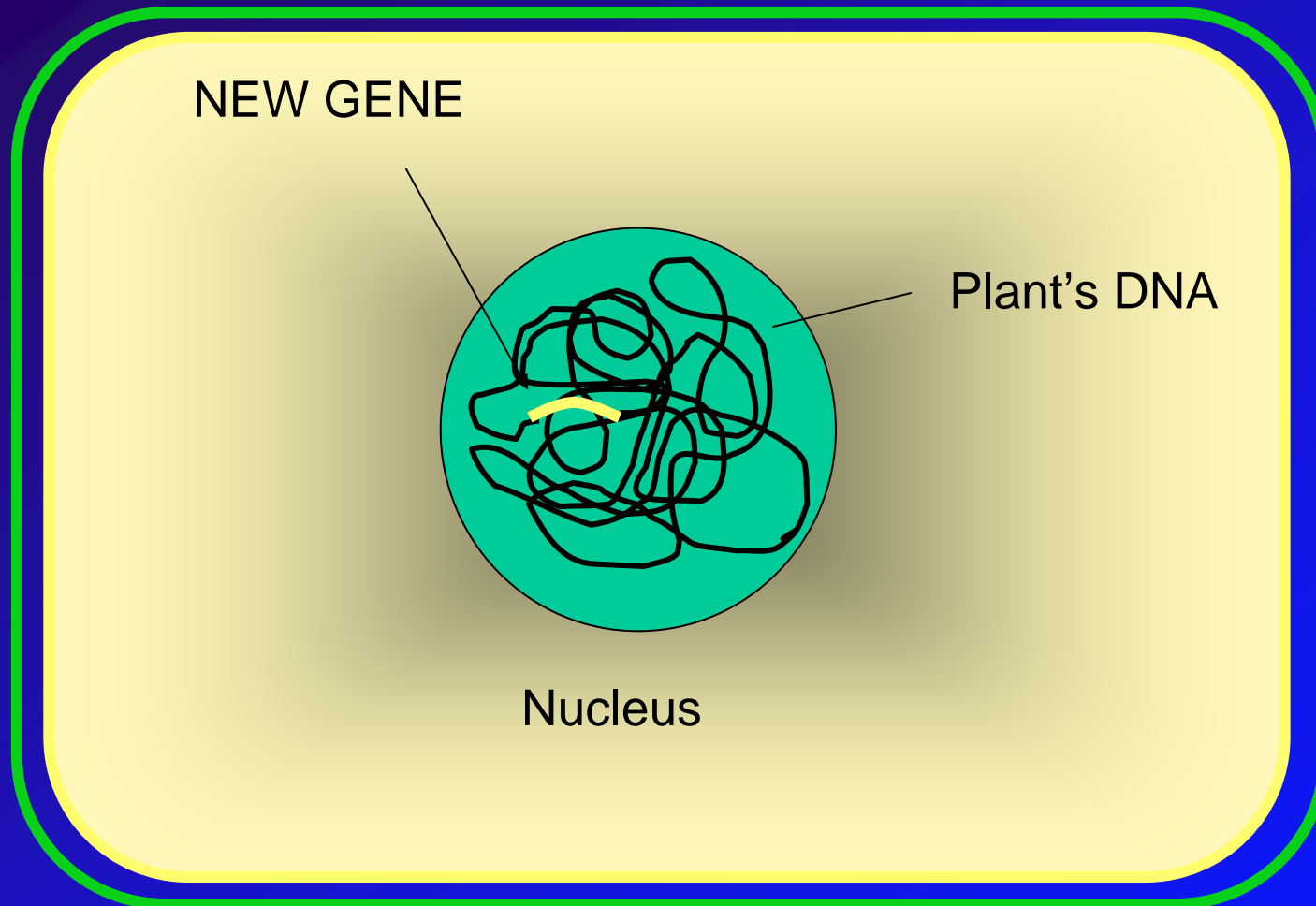


Agrobacterium is the causative agent of galls

Introducing genes using the Ti plasmid

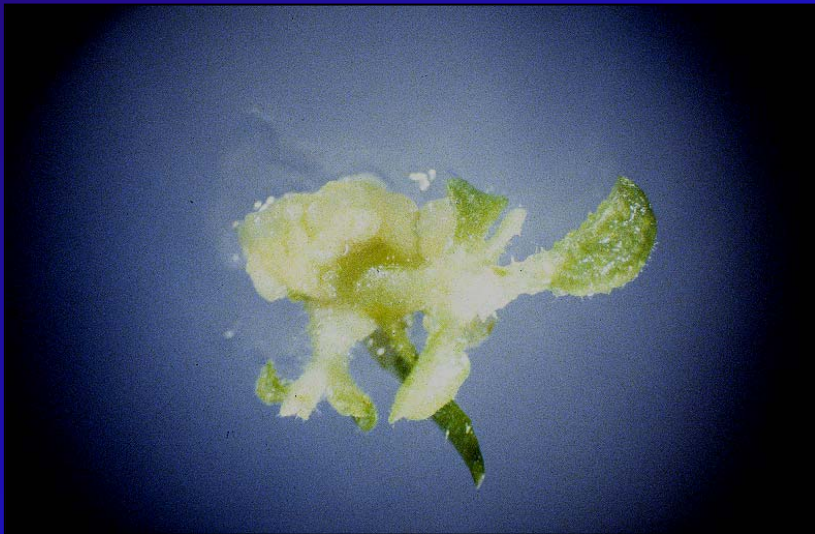


The new gene is integrated into the plant's DNA



Plant cell

Here's how it looks in the laboratory





A plant with a new gene added

Molecular methods in plant improvement

Today:

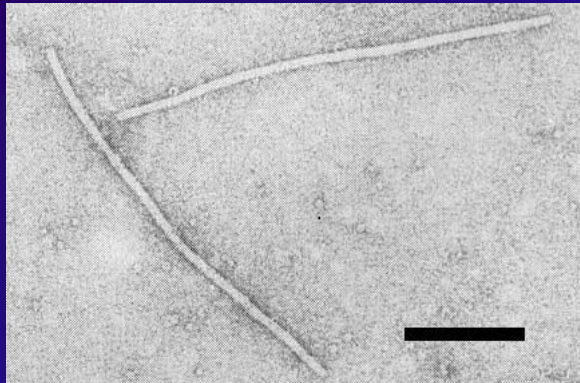
- ⇒ Insect resistant plants
- ⇒ Herbicide-tolerant plants
- ⇒ Virus resistant plants
- ⇒ Vitamin A- and iron-enriched rice

The story of papaya ringspot virus

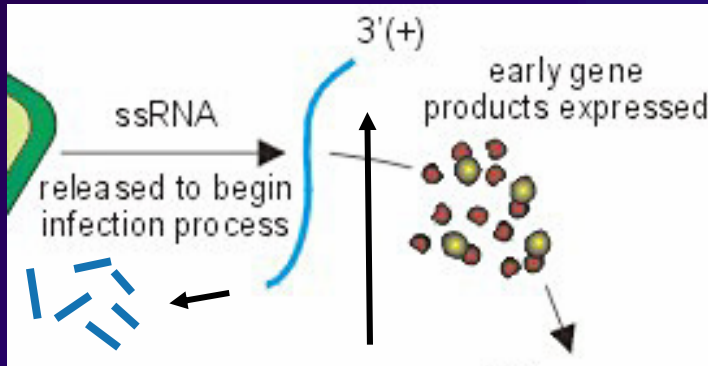


<http://www.apsnet.org/education/feature/papaya/Top.htm>

The story of papaya ringspot virus



The story of papaya ringspot virus



1980s: PRSV-resistance project starts under direction of Dennis Gonsalves

1991: First transgenic PRSV-resistant papaya plant

1992: PRSV discovered in Puna district

1992: First field trials PRSV-resistant papaya plants

1994: USDA grants permission for large scale field trials

1995-97: Approvals for release from USDA, EPA, FDA

1992-1997: PRSV takes its toll; many farmers go out of business

1998: Seeds released, free of charge, to growers

2000: Papaya industry bounces back; crop back to pre 1995 levels

The story of papaya ringspot virus



<http://www.apsnet.org/education/feature/papaya/Top.htm>

Bt corn



<http://dragon.zoo.utoronto.ca/~jlm-gmf/T0201A/corn1.jpg>



Fusarium ear rot produces fumonisins



Kernel rot produces aflatoxin



<http://www.apsnet.org/online/feature/BtCorn/Images/healthy%20ear.JPG>

Bt corn



<http://dragon.zoo.utoronto.ca/~jlm-gmf/T0201A/corn1.jpg>



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Molecular methods in plant improvement

Tomorrow:

- ⇒ Nutritionally enhanced crops
- ⇒ Anti-cancer substances
- ⇒ Edible vaccines
- ⇒ Antibodies from plants
- ⇒ Biodegradable plastics
- ⇒ New biomaterials
- ⇒ Disease-resistant plants
- ⇒ Spoilage-resistant seeds and tubers
- ⇒ Stress-resistant crops
- ⇒ High-yielding pseudo C_4 rice

Golden rice



Rice with vitamin A and iron

Are GM foods safe to eat?

⇒ Is DNA safe to eat?

⇒ Could antibiotic genes get into people?

⇒ Could GM foods contain new toxins?

⇒ Could GM foods cause allergies?

Are GM foods safe to eat?

⇒ Is DNA safe to eat?

All foods contains DNA -- about a teaspoon of DNA in a pound of food

Adding one gene adds roughly 1 part in a million or ~0.0001%

DNA is digested starting in your mouth

Tiny fragments gets through the digestive process

This is always happening when we eat food

It doesn't change our genes

Are GM foods safe to eat?

⇒ Could antibiotic resistance genes get into people?

No, DNA is broken down into tiny pieces in our digestive tracts

⇒ Could they get into other bacteria in the gut?

Bacteria take up DNA very rarely

Transfers to gut bacteria have been looked for, but not found

Are GM foods safe to eat?

⇒ Could GM foods contain new toxins?

Plants contain chemicals that are toxic -- in large amounts

The FDA requires chemical analyses and toxicity studies

GM foods are better analyzed than any in human history

Are GM foods safe to eat?

⇒ Could GM foods cause allergies?

⇒ Allergy facts

Most food allergies are caused by about half a dozen proteins

Foods contain more than 100,000 different proteins

The FDA requires developers to identify allergenicity potential

What's the bottom line?

*A GM food is less likely to cause a problem
than any new food you've ever tried*

Are GM crops safe to grow?

⇒ Could genes escape from crops to cause problems?

⇒ Will GM crops reduce biodiversity?

⇒ Could genes escape from crops to cause problems?

Gene transfer from crops to other plants is now called "gene flow"

Gene flow occurs between members of the same species

Gene flow is not a new problem in agriculture

⇒ What kinds of problems does gene flow cause?

It depends on the crop

⇒ Will GM crops reduce biodiversity?

The monarch butterfly incident



<http://www.scu.edu/cas/research/images/smecology.jpg>

Bt genes in Mexican land races



http://www.newsroom.ucr.edu/images/releases/997_0.jpg

⇒ Will GM crops reduce biodiversity?

"Nothing has driven more species to extinction or caused more instability in the world's ecological systems than the development of an agriculture sufficient to feed 6.3 billion people."

"To assert that GM techniques are a threat to biodiversity is to state the exact opposite of the truth."

"The less focused and productive this agriculture is, the more destructive its effects will be."

Peter Raven, Director of the Missouri Botanical Garden

Why are attitudes toward GM foods so negative?



Does it matter whether we accept GM crops?



"You people in the developed world are certainly free to debate the merits of genetically modified foods, but can we please eat first?"

-- Florence Wambugu, 2003