



WELCOME!

'GMOs: A Hot Topic in the Media and Classroom: Monsanto Discussion and Presentation'

6/21/17

2:15-3:30pm



MONSANTO 

Quick Highlight- Keep on Radar



The image shows a screenshot of the Facebook page for 'Food Evolution Movie'. The page features a large banner for the movie with the text: 'FROM ACADEMY AWARD® NOMINEE SCOTT HAMILTON KENNEDY FOOD|EVOLUTION NARRATED BY NEIL DEGRASSE TYSON IN THEATERS SUMMER 2017'. The banner background is a collage of various fruits and vegetables. Below the banner, there are interaction buttons for 'Liked', 'Following', 'Share', and 'Send Message'. The left sidebar shows navigation options: Home, Posts, Videos, Photos, About, Likes, Events, Notes, and a 'Create a Page' button. The main content area includes a 'Featured For You' section with a photo of a man and a smaller version of the movie banner, and a 'Community' section with statistics: '4,063 people like this' and '4,198 people follow this'. There are also small profile pictures of users who liked the page.

Food Evolution Movie ✓
@FoodEvoMovie

Home
Posts
Videos
Photos
About
Likes
Events
Notes
Create a Page

Liked Following Share ... Send Message

Featured For You

Movie

Community

- Invite your friends to like this Page
- 4,063 people like this
- 4,198 people follow this
- Billy Brennan and 5 other friends like this

<http://foodevolutionmovie.com/screenings/>

Anticipatory Set

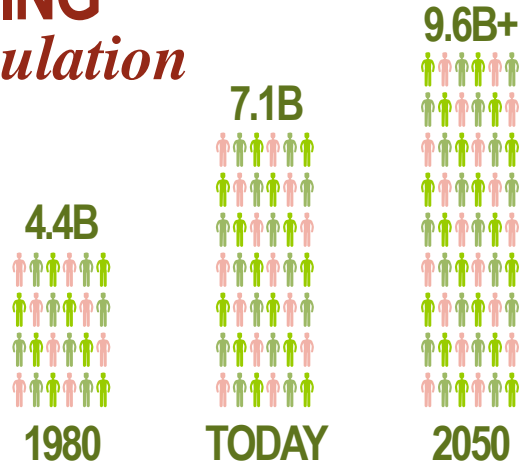




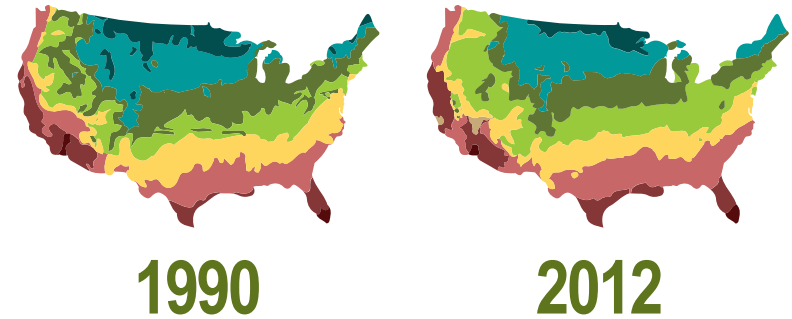
We Will Need to Grow as Much Food in the Next 50 Years, as in the Past 10,000 Years Combined

1960 – 1 Farmer fed 25 people
Today – 1 Farmer feeds roughly 155 People

RISING *population*



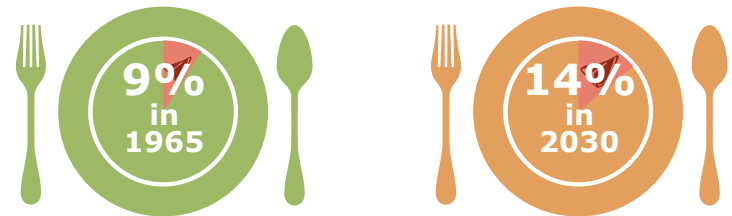
CHANGING *climate*



DECLINING *arable land*

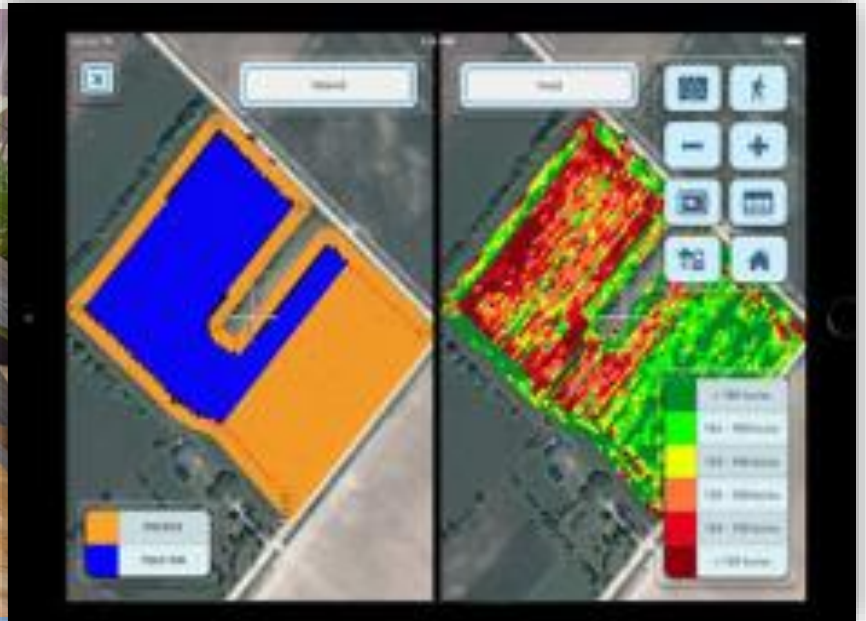


CHANGING *economies & diets*



DIETARY PERCENTAGE OF MEAT





Developing Solutions for Farmers

A grower makes 40+ key decisions that influence how successful their harvest will be each growing season

FARMER NEEDS



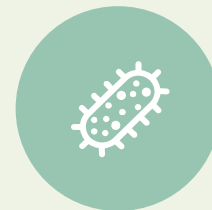
YIELD



INSECT CONTROL



WEED CONTROL



PLANT HEALTH



FERTILITY

CHEMISTRY



BIOTECHNOLOGY



DATA SCIENCE



PLANT BREEDING



BIOLOGICALS



MONSANTO TECHNOLOGIES

Methods of Crop Modification

Cross-Breeding

Polyploidy

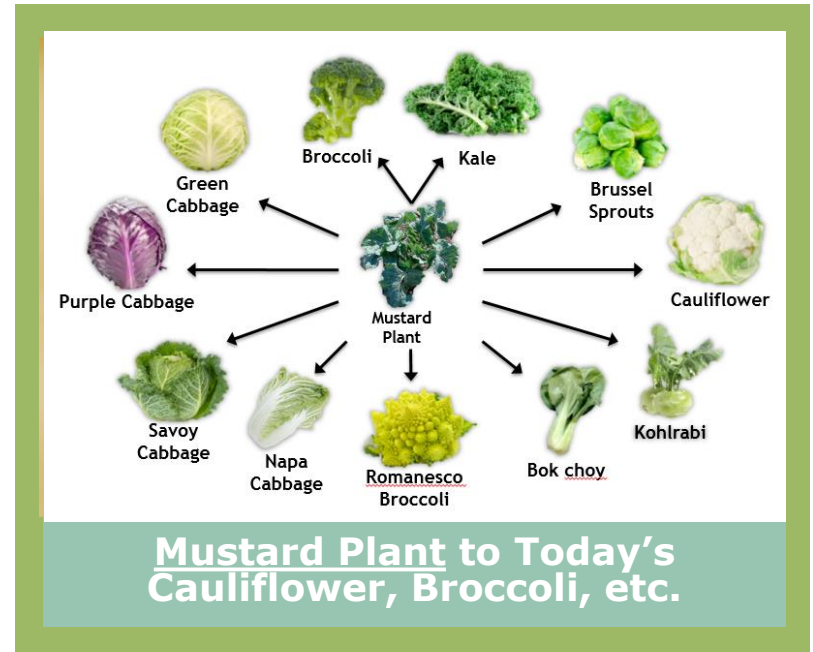
Mutagenesis

Gene Editing

Transgenics (GMO/
Biotech)



Many of the Foods We Eat Today are a Result of Breeding Innovation



Mustard plant → Cauliflower, Broccoli, Cabbage, Kale, Brussels Sprouts and Kohlrabi.

- Breeders built up mustard plant's ability to store starch in different areas
- Carrots → Black, white, red and purple
 - Were bitter, only bred for orange because of Netherlands in 17th century "house of orange"



Methods of Crop Modification

Cross-Breeding

Polyploidy

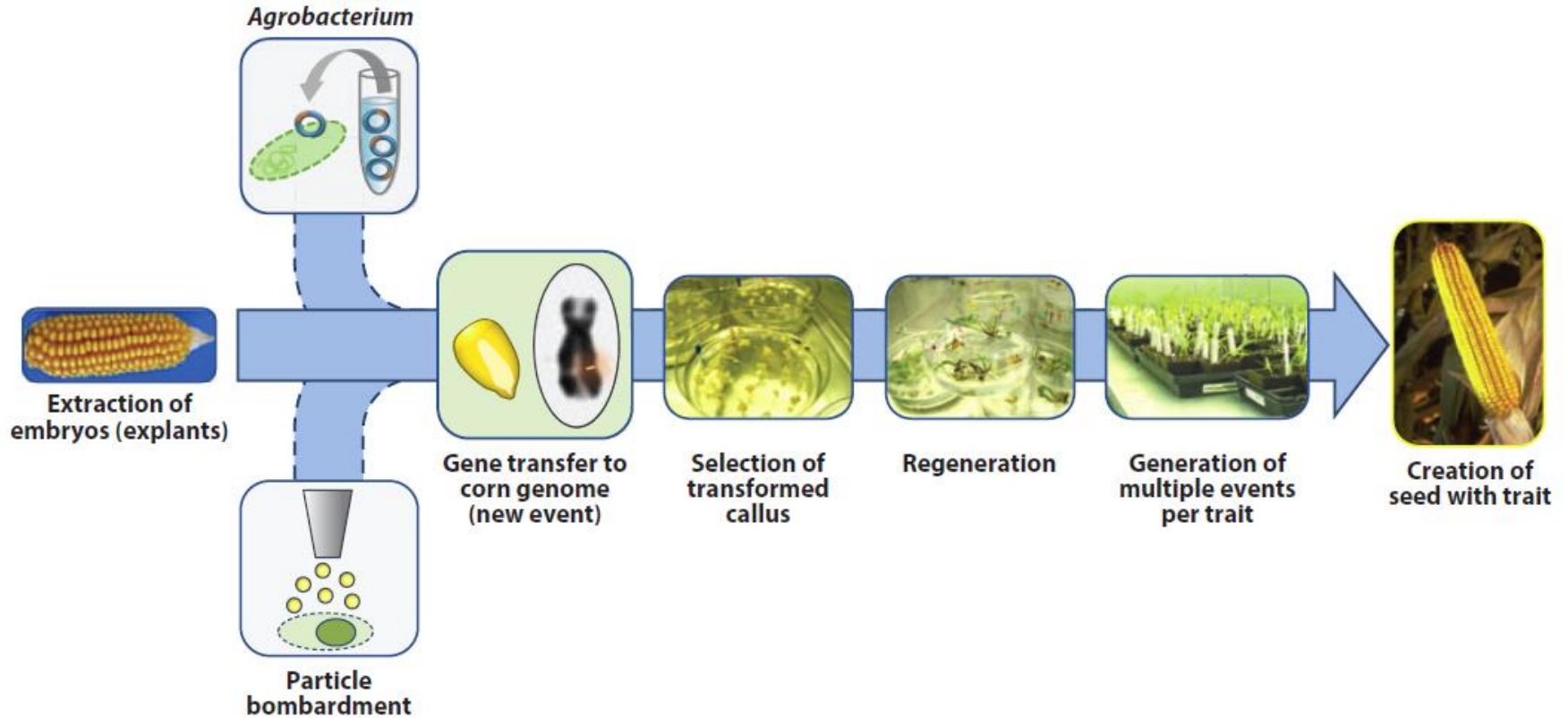
Mutagenesis

Gene Editing

Transgenics (GMO/
Biotech)



Methods for making a new GMO





Horizontal gene transfer: Sweet potato naturally 'genetically modified'

Date: April 21, 2015

Source: Ghent University

Summary: Sweet potatoes from all over the world naturally contain genes from the bacterium *Agrobacterium*, researchers report. Sweet potato is one of the most important food crops for human consumption in the world. Because of the presence of this "foreign" DNA, sweet potato can be seen as a "natural GMO," the researchers say.

Share: [f](#) [t](#) [G+](#) [p](#) [in](#) [✉](#)

RELATED TOPICS

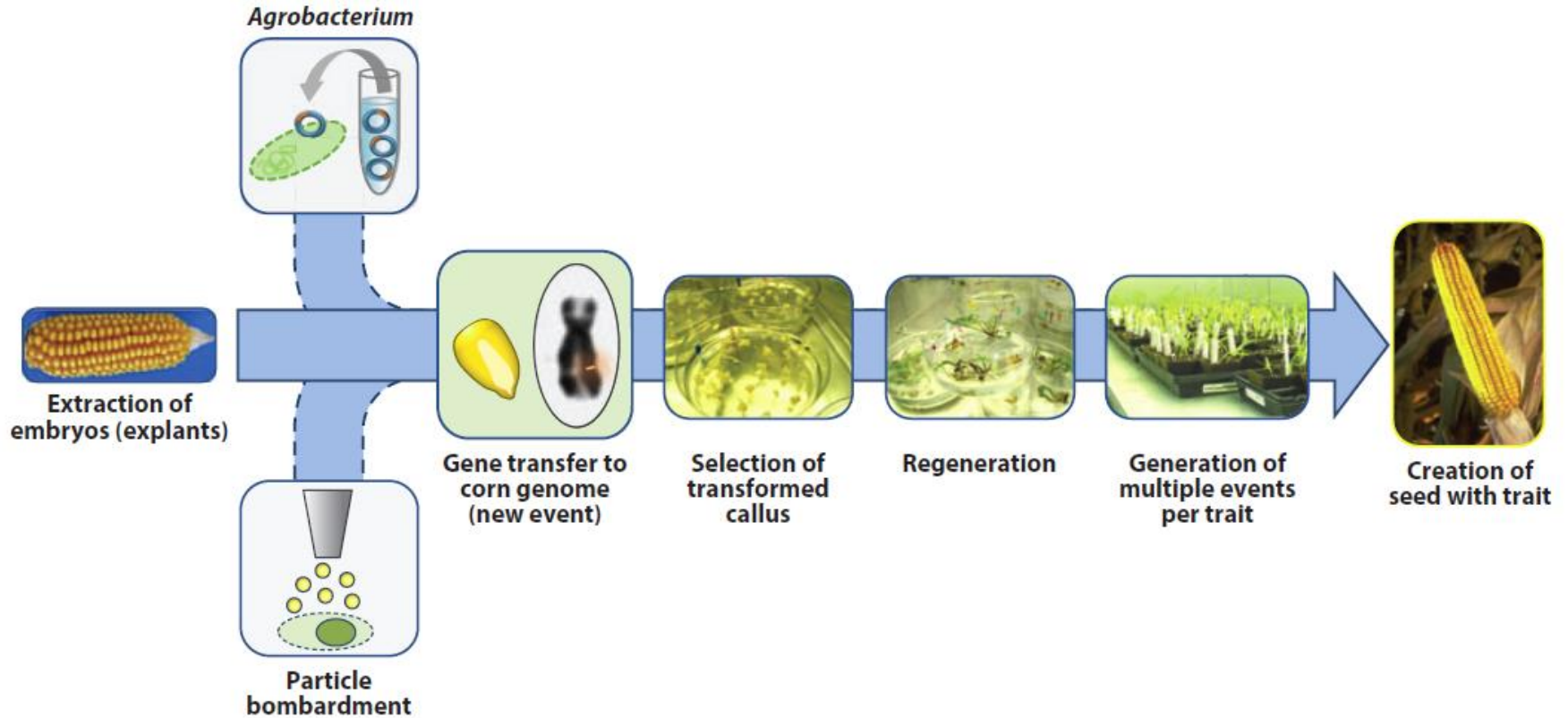
Plants & Animals

- > [Biotechnology and Bioengineering](#)
- > [Biochemistry Research](#)
- > [Biotechnology](#)
- > [Evolutionary Biology](#)

FULL STORY



Methods for making a new GMO



BIOTECHNOLOGY

results

Currently, there are 8 commercially available GMO crops:



Corn



Soybeans



Cotton



Alfalfa



Sugar Beets



Canola



Papaya



Squash



Corn that is resistant to drought, insects and disease



Papaya that resists a disease that threatened to wipe out the crop



Cotton with reduced pesticide usage that enables us to produce more fiber for clothing and other goods

BIOTECHNOLOGY IN AGRICULTURE HAS BEEN RESEARCHED FOR OVER 30 YEARS AND GROWN COMMERCIALY FOR 18 YEARS



What is not a GMO?



These crops (among many others) are not the result of modern genetic modification:



Honeycrisp
Apple



Seedless
Watermelon



Grape
Tomatoes



Wheat



Broccolini



Baby
Carrots

GMOs Used Outside of Ag/Crops in Many Common Products



Enzymes

Nearly all cheese is made using rennin produced through biotechnology



Yeast

Scientists use biotechnology to create unique yeast strains for use in brewing beer and making bread



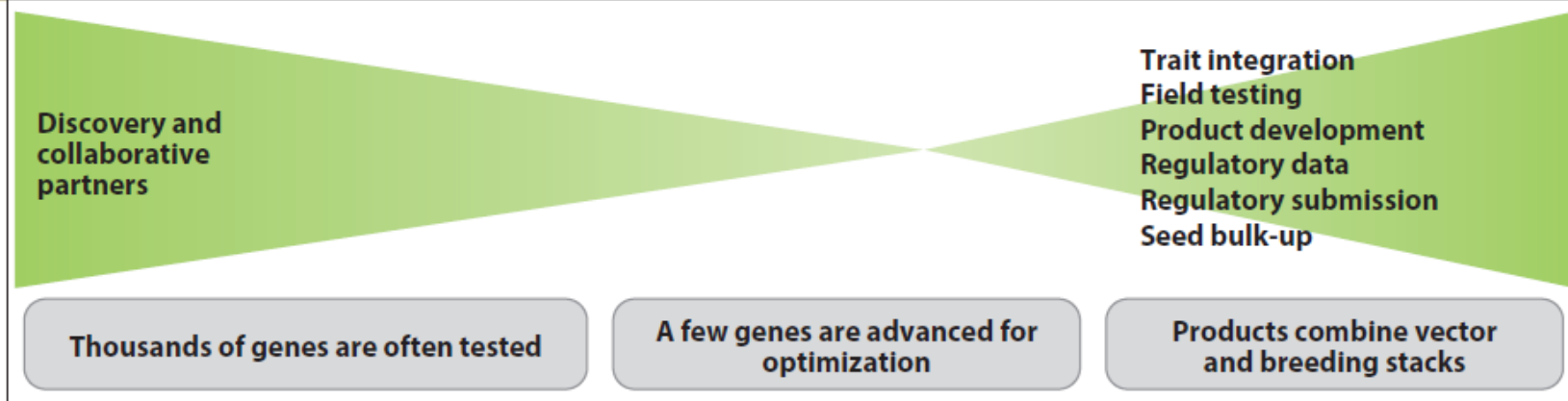
Medicine

Most insulin used by diabetics is produced through biotechnology.

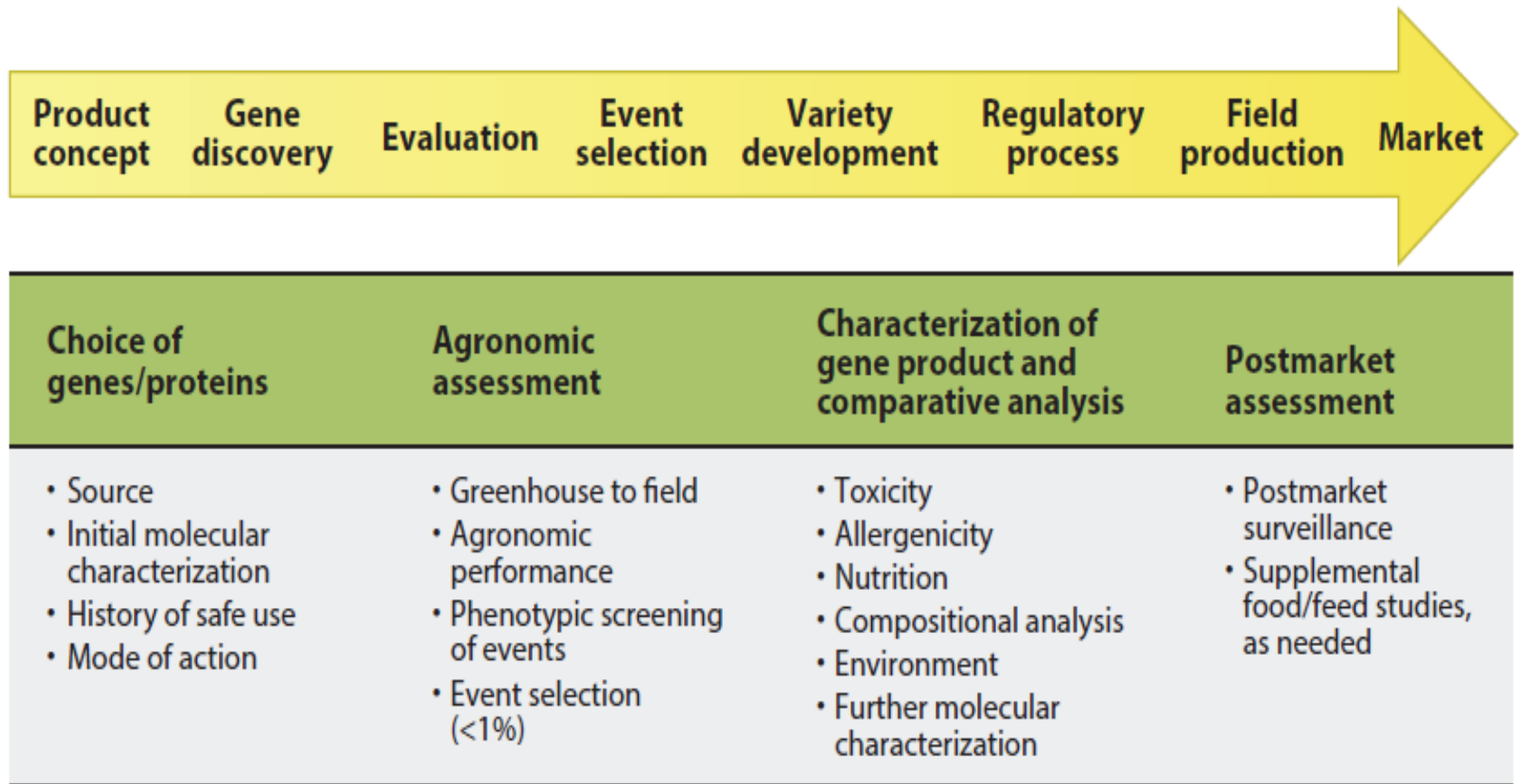


GMO testing and regulation is similar to clinical trials for medicine.

	Discovery Gene/trait identification	Phase 1 Proof of concept	Phase 2 Early development	Phase 3 Advanced development	Phase 4 Prelaunch
Average duration	54 months	27 months	30 months	37 months	49 months
Average cost	USD 31 million	USD 28.3 million	USD 13.6 million	USD 45.9 million	USD 17.2 million
Key activity	<ul style="list-style-type: none"> • High-throughput screening • Model crop testing 	<ul style="list-style-type: none"> • Gene optimization • Crop transformation 	<ul style="list-style-type: none"> • Trait development • Preregulatory data • Large-scale transformation 	<ul style="list-style-type: none"> • Trait integration • Field testing • Regulatory data generation • Product development 	<ul style="list-style-type: none"> • Regulatory submission • Seed bulk-up • Premarketing • Product development



Biotechnology, from an idea to the field



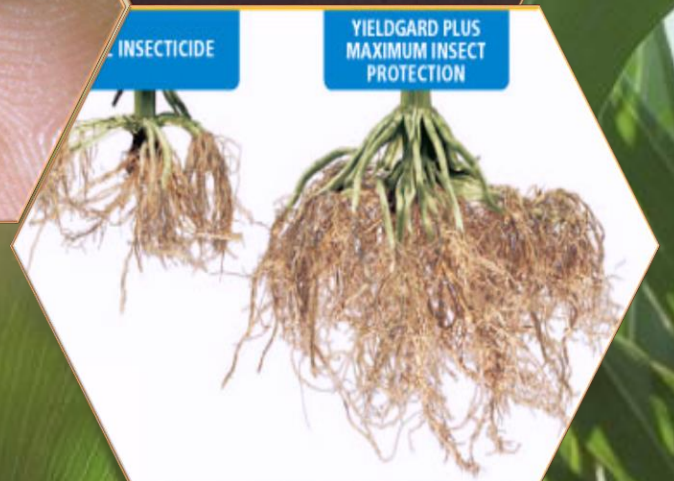
Monsanto GMO Traits

1. Bt Products
2. Roundup Ready Crops
3. Disease resistant Squash
4. Drought Tolerant Corn
5. Soybeans – reducing Trans/Saturated fats
 - **SDA Omega-3** soybeans
 - **Vistive® Gold** soybeans
Industrial/non toxic benefits of replacing petroleum-based products and synthetic oils
<http://www.monsanto.com/products/pages/vistive-gold-soybeans.aspx>

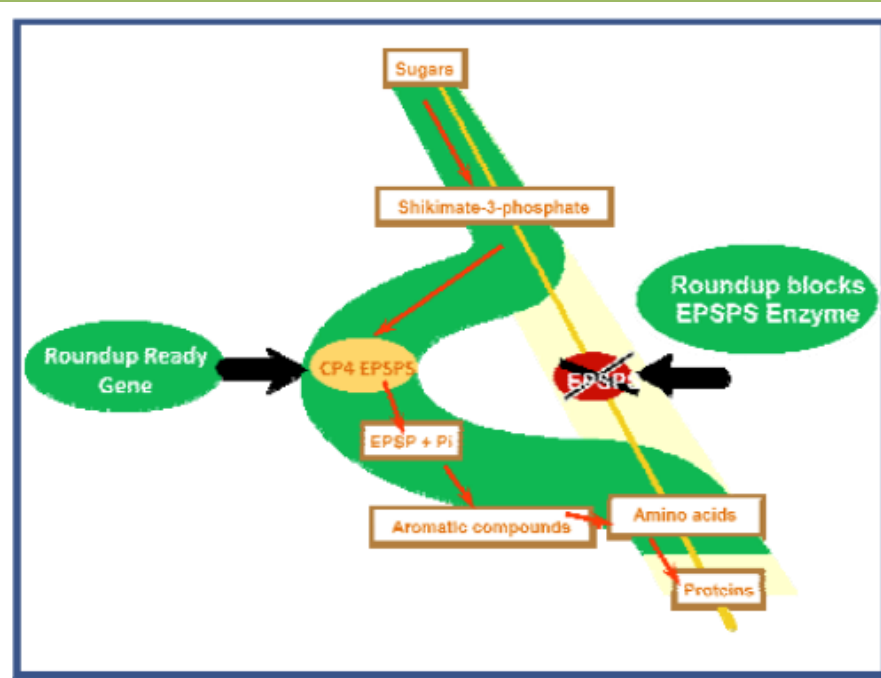


Insect Protected (*Bt* crops)

- The bacterium, *Bacillus thuringiensis*, makes several proteins that are toxic to specific insects (*Coleoptera* and *Lepidoptera*). These protein toxins are activated in the insect gut and bind to specific receptors in the insect.
- Humans and other animals have acidic stomachs and thus the protein is digested.
- Mammals lack the receptor to bind the protein making it completely non-toxic to humans and other animals.



Roundup Ready Crops (tolerant to the herbicide Roundup)



5-EnolPyruvylShikimate-3-Phosphate Synthase

- Glyphosate binds to EPSPS and disrupts amino acid synthesis pathway
- Monsanto discovered an *epsps* gene from a bacterium that was not sensitive to glyphosate but still performed the same function.



Glyphosate Safety

- Comprehensive toxicological studies in animals have demonstrated that glyphosate does not cause cancer, birth defects, DNA damage, nervous system effects, immune system effects, endocrine disruption or reproductive problems.
- Registered in more than **160 countries** with a **40 year history** (1974), average half-life is **32 days** (13 studies, 5 countries, 47 different sites)



Lesson Plans & Kit


Activity 1 – Anticipatory Set: Weeds and Planted Crop Competition Simulation

Activity 2 – Growing Roundup Ready Soybeans and Conventional Soybeans

Activity 3 – Quickstrip Test using Whole Seed- Protein detection

Activity 4 – Quikstrip Test using Leaf Tissue- Protein detection

Activity 5 – PCR Test using Soybean Tissue



Date: _____

Teacher _____
School _____
School _____
Teacher _____

Re: Mat Soybean _____

Dear _____

Subject to you the f Roundup _____

- A Roundup Ready soybean variety (MON 04032-2)
- Approximately 10 seed of conventional soybean, variety A3525
- Approximately 10 seed of conventional soybean variety Williams 82

Additionally, a lesson plan titled Monsanto Crop Biotechnology: Growing and Testing Roundup Ready Soybean Kit will be included (send to email after NSTA conference).

This gift is subject to the following conditions:

1. Children (anyone under 18 years old) may only use the material subject to strict adult supervision.
2. The Material may only be used for the purposes listed in the guidebook and consistent with those instructions. Any additional products used in conjunction with the referenced material, including but not limited to glyphosate, may only be used consistent with those product's label instructions.
2. The Material and/or individual genes in the Material may be covered by one or more patents, and no license under those patents is granted beyond the specific sample supplied. If the Material contains enhanced traits subject to patents or trade secrets, no grant, permission, or license to use the enhanced traits extends beyond the use of the Material for the purposes described in the request form.
3. You must dispose of the Material Monsanto has given to you (including test Material and unused Material) in a safe and secure manner, as permitted by applicable laws and regulations.



Example: Activity 2



Continued. Activity 2

Treated Conventional Soybeans



Continued. Activity 2

Treated Herbicide-Tolerant Soybeans



Environmental Benefits

The reduction in pesticides from 1996 to 2014 was estimated at **1.3 billion lbs.** or **8.2% reduction**

In 2014 alone, biotech helped prevent an estimated **49.4 billion lbs. of CO₂ emissions**, equivalent to removing **10 million cars** from the road for a year.

Without biotech, it would take an additional **44.7 million acres** (1 acre roughly size of football field) to produce the same amount of food produced during 1996 to 2014.

Source:
ISAAA 2013 Report





Other Industry Products

Golden Rice/Super Banana – Vitamin A (2020)

- to cure Vitamin A deficiency in developing countries which kills 670,000 children each year.

Citrus Greening Resistant Oranges

- gene from spinach for resistance to the bacterium, Liberibacter.

Aphid Resistant Wheat

- Natural defense to Aphids which require repeat pesticide usage to combat pests.

Potato – resist bruising (gene taken from wild variety)

- Lowers Acrylamide in high temperature cooking
- Lowers bruises

Mosquitoes (Eliminates transmission of Malaria)

- GMO mosquito blocks malaria parasite infection
- Could be used for Zika virus?

Arctic Apples (Apples that don't brown)

- Reduction in production of one protein- Polyphenol oxidase (PPO)



Check it out!

BioBuilder- Teacher PD

Talking Biotech- Podcast

Science Vs- Podcast

Journey of a Gene – University of NE

“Ag Education Discussion Lab”- FB group

League of Nerds- Interview with Fred Perlak Bt Cotton Launch

Skeptics in the Pub- Idea to Market GMO Crops - Larry Gilbertson

monsanto.com/STEM

Questions?

[Monsanto.com/STEM](https://www.monsanto.com/STEM)

