

GMOs

Genetically Modified Organisms

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GMOs – Areas of Discussion

- 1. GMO Basics
- 2. History
- 3. Benefits
- 4. Regulation
- 5. Importance of Regulation – A Case of “We Ate Animal Feed”
- 6. Health Concerns / Research & Safety
- 7. Is it Fact or Fiction?
- 8. Labeling and Government Initiative
- 9. 4 Things to Remember



GMO Basics^[1,2]

GMOs

Genetically Modified Organisms

GE Foods
Genetically Engineered Foods

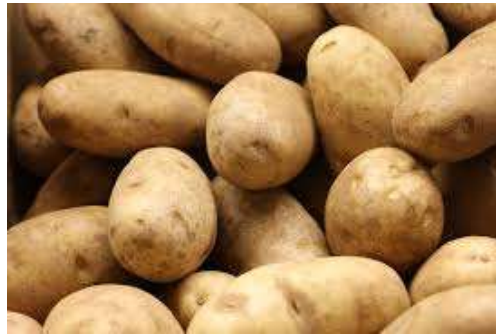
GM Foods
Genetically Modified Foods

Biotech Foods

GMOs

Corn
Cotton
Soybeans
Sugar Beets
Potatoes
Canola
Tomatoes
Wheat
Apples

And Lots More!





History of GE Foods

- ▶ **1982:** 1st GE seeds introduced and grown (tomato)^[3]
- ▶ **1985:** 4 seeds released for field testing
- ▶ **1994:** 1st GE crop approved by USDA's Animal and Plant Health Inspection Service with a FlavrSavr Tomato ^[1,2]
- ▶ **1996:** Commercial use of major GE crops began with Herbicide Tolerant (HT) and Insect Resistant (Bt) seeds
- ▶ **As of September 2013:** **>17000 GE seed varieties, 7800 GE corn,** 2200 GE soybeans, 900 GE potatoes
- ▶ **Today** - U.S. is the world's leading producer of GE crops. ^[4]
 - ▶ Over 90% **corn, cotton, soybeans**, canola, sugar beets are from GE varieties. ^[4,5]
 - ▶ Other major crops: potatoes, squash, apples, papayas ^[1]



Benefits of GMO Seeds

➤ Farmers:

- Higher crop yields – Ex: result from insect resistance and/or tolerance to herbicides [3,5,6,7]
- Lower pesticide costs and/or time & labor savings [3,5,6,7]
- Plants less susceptible to disease caused by viruses [3,5,6,7]

➤ Sustainability & Feeding the Population:

- Lower prices in many cases [7]
- Sustained crops and produce; Environmental and economic benefits to underdeveloped countries [7]
- Alleviating hunger and poverty [7]
- Lower CO2 emissions [7]



Regulation of GMOs

- ▶ FDA in conjunction with USDA and EPA [1,2,3,4]
- ▶ Environmental, health, and safety laws

- ▶ FDA [1,2,3,4]
 - ▶ Enforces U.S. food safety laws, prohibiting unsafe foods.
 - ▶ Regulates all food applications, from GE and non-GE crops, to ensure that the food produced is safe to eat – must meet the same legal and safety requirements
 - ▶ GE plant producers consult FDA before marketing their products
 - ▶ Safety & Scientific Assessments - food is safe to eat, nutrient level comparison to non-GE food, summary report




Regulation of GMOs

- ▶ USDA's Animal and Plant Health Inspection Service (APHIS) ^[1,3,4]
 - ▶ Safeguard the health, welfare, and value of American agriculture and natural resources.
 - ▶ Includes regulating GE foods that may pose a risk
 - ▶ Requires years of field tests prior to application process
 - ▶ Performs extensive review of GE organism.
 - ▶ "Determination of Nonregulated Status" issued if criteria met, or
 - ▶ To EPA: if engineered to "prevent, destroy, repel, or mitigate a pest."

- ▶ EPA ^[1,3,4]
 - ▶ Regulates pesticides, GE Bt food crops to make sure safe for human and animal consumption, and won't harm environment

A Case of “We Ate Animal Feed”^[8]


- ▶ 1998 – 2000. StarLink™ corn, produced by Aventis Crop Science USA LP, containing the protein Cry9c (targets specific insects (incl. corn borers and earworms)
 - ▶ EPA granted license only for animal feed, not for human consumption
 - ▶ Recall resulting from Cry9c protein detected in taco shells (corn)
 - ▶ Reports of hypersensitivity and GI distress led to concern of allergens
 - ▶ Extensive investigation from numerous government agencies, scientist, and physicians. Concern: Risk of allergens.
 - ▶ Conclusion: It was caught very early before many people consumed it. The handful of people experienced some hypersensitivity and nothing more was noted. No long-term health effects.
- ▶ FDA Reaction: Stricter approval and marketing guidelines for biotechnology industry. ^[8]



Health Concerns of Consuming GMOs

► Risk of Allergens.


- Concern: if person with peanut allergy eats GM food with a peanut's protein, it is possible that the individual would experience an allergic reaction.^[2]
- **FDA:** requires extensive scientific testing and proof that no allergens are incorporated into GM foods. If proof of no allergens cannot be provided, allergen label required to be on product.^[2]
- **Food and Agriculture Organization of the United Nations (FAO) and WHO:** Conventionally grown foods usually not tested for allergens. GM foods have more testing since it is required.^[6]
- **WHO:** "No allergic effects have been found relative to GM foods currently on the market."^[6]



Health Concerns of Consuming GMOs

- ▶ **Gene Transfer of GMO DNA and antibiotic.** [1,2,4,6]
 - ▶ Concern: No reputable evidence exist proving that GM plants have any safety risk and are as safe as non-GM foods
 - ▶ **WHO: the risk of transfer is very low and the risk of it having a negative impact on human health is even lower.** [6]

- ▶ **GM food testing without clinical trials.** [2,6]
 - ▶ **WHO: since 60-70% of processed foods in U.S. contain a GM ingredient and is therefore difficult to achieve comparison of GM-free diet vs GMO-diet. Clinical trials would have to last over a lifetime.**
 - ▶ There are conventionally grown foods that cause unfavorable health effects – saturated fats and simple sugars for example.



Health Concerns of Consuming GMOs

➤ Outcrossing.

- WHO: cases of outcrossing have been detected. Improvements in this area are needed.^[6]

➤ Overall safety of GE foods containing toxins.

- WHO: Safe for human consumption ^[6]
- Risk assessments are performed: evaluate GMO characteristics, effect and stability in environment, ecological impact, possible and real unintended effects.^[6]
- Each GM food is unique and is assessed on a case-by-case basis. Therefore making a general statement on safety of all GM foods is not possible.^[6]
- GM foods available in the market has passed safety assessments and unlikely to present risks for human health.^[6]

Health Concerns of Consuming GMOs

According to a statistics portal site, Statista, the top countries in 2017 for GM Crop Production - (in million hectares; 1 hectare = 2.471 acres)^[9]

#1	United States (75)	#10	Bolivia (1.3)
#2	Brazil (50.2)	#11	Uruguay (1.1)
#3	Argentina (23.6)	#12	Australia (0.9)
#4	Canada (13.1)	#13	Philippines (0.6)
#5	India (11.4)	#14	Myanmar (0.3)
#6	Paraguay (3)	#15	Sudan (0.2)
#7	Pakistan (3)	#16	Spain (0.1)
#8	China (2.8)	#17	Mexico (0.1)
#9	South Africa (2.7)	#18	Columbia (0.1)

Health Concerns of Consuming GMOs

World Cancer Research Fund & American Institute for Cancer Research provides list of the top 50 countries with the highest cancer rates based on the age-standardized rate. [9,10]

- ▶ Countries that are major GM producers and are also named in the top 50 countries for cancer – (#GM/CA) **only 5 out of 18**

#1 /5	United States (75)	#10	Bolivia (1.3)
#2	Brazil (50.2)	#11/31	Uruguay (1.1)
#3	Argentina (23.6)	#12 / 1	Australia (0.9)
#4 /11	Canada (13.1)	#13	Philippines (0.6)
#5	India (11.4)	#14	Myanmar (0.3)
#6	Paraguay (3)	#15	Sudan (0.2)
#7	Pakistan (3)	#16 /29	Spain (0.1)
#8	China (2.8)	#17	Mexico (0.1)
#9	South Africa (2.7)	#18	Columbia (0.1)

Health Concerns of Consuming GMOs

What about all the other countries with high GM production and those with high cancer rates? [9,10]

Remaining Top GE Crops		Remaining Top 50 Countries w/ CA	
Brazil	Sudan	New Zealand	Luxembourg
Argentina	Mexico	Ireland	Serbia
India	Columbia	Hungary	Slovenia
Paraguay		Belgium	Latvia
Pakistan		France	Slovakia
China		Denmark	Czech Republic
South Africa		Norway	Sweden
Bolivia		Netherlands	Italy
Philippines		UK	Croatia
Myanmar		South Korea	Lithuania
		Germany	Estonia
		Switzerland	+ 21 more



Are GMOs Safe to Eat?

- ▶ According to –
 - ▶ National Cancer Institute [11]
 - ▶ Merck Manual [12]
 - ▶ **Cancer Risk Factors do NOT include GMOs or GMO-related agents**

- ▶ According to – [1,2,3,4,6]
 - ▶ FDA
 - ▶ USDA
 - ▶ WHO
 - ▶ **GMO foods are SAFE to eat**



Is it Fact or Fiction?

- From research that is current, valid, reliable, accurate, objective
- Credentials of writer or researcher
- Research from peer reviewed journals
- Scientific based research
- Source of influence – affiliations, funding
- Research limitations noted or observed
- Research not retracted or noted with errors
- Read all of the article

- ***Don't believe everything you hear or read from media or interest groups!***

Labeling & Government Initiative

- ▶ **“Non-GMO”** - Nonprofit Non-GMO Project ^[2]
- ▶ **“USDA Certified Organic”** - USDA federally regulated ^[2]
 - ▶ ensures the absence of GMOs in food product
 - ▶ GMOs are prohibited in organic products
- ▶ Effective January 1, 2020, any bioengineered foods with a “detectable genetic material that has been modified” through genetic engineering must have logo on its label ^[13]





4 things to remember

- ▶ 1. GMOs through cross-breeding have been in use for 1000s of years.
- ▶ 2. New GMO labeling starts January 1, 2020.
- ▶ 3. We have government agencies that –
 - ▶ require strict processes,
 - ▶ impose restrictions,
 - ▶ require extensive testing, and
 - ▶ set regulations on usage and marketing of GMO seeds.
- ▶ 4. GMO foods have been found safe to eat.



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