



Genetic Engineering:

Genetically Modified Foods
and You!

GMOs: What's the difference?

- iGEM works almost exclusively with microorganisms:
 - single-celled, short lifespans, easy to manipulate with standardized parts and protocols
 - many projects are “proof-of-concept”
 - incredibly useful applications in many areas of research and development



GMOs: What's the difference?

- Applications in higher level organisms (plants)
- Often compared to traditional plant breeding
 - "Substantial equivalence"
 - Traditional plant breeding will pretty much never incorporate genetic materials from such vastly different species as plants and bacteria

GMOs in the US

- GM foods first put on the market in 1996
 - Examples: soybeans, maize (corn), canola, rice, cotton
- No directly modified animals currently
 - Animal feed can consist of GMOs
 - First approved genetically modified compound in the US: rGBH (recombinant bovine growth hormone) used to increase milk production

GMOs in the US

- Other food additives not legally considered food
- Compounds derived from genetically modified bacteria:
 - additives, enzymes, vitamins, amino acids, flavors (aspartame, vitamins B2 and C, xanthan, citric acid, numerous enzymes in fermentative products)
- Microbial DNA not detectable in final products; must be chemically pure



Examples of Genetic Modifications:

- Pesticide/herbicide/virus resistance ("Round-up Ready")
- Production of insecticidal proteins (Bt toxin)
- Nutritional enhancement (increased beta carotene, laurates, sucrose)
- Delayed ripening (Flavr Savr tomatoes)
- Drought/bad weather tolerance
- Disease resistance

Possible Complications



- Promoters and repressors from original cell may not function in recombinant organism, altering gene expression
- Products from metabolism of proteins may be toxic to humans or endosymbionts (evolutionarily unfamiliar)
- Indirect complications from corporate control (intellectual property, monoculture, unequal distribution of resources in developing regions)
- Ethical concerns already mentioned (gene transfer of antibiotic resistance, novel toxins)

Biotech Companies

- Goals of biotech companies: increase food stocks, reduce losses, corporate responsibility to shareholders to be profitable
- Monsanto provides the technology in 90% of the genetically engineered seeds used in the US market (mostly Round-up tolerant strains)

Big Biotech: pros and cons

- + Financial benefits to the producers, may have indirect environmental benefits and marginal cost benefits to consumers
- + More beneficial traits in food crops
- + Reducing soil erosion
- + Conservation of water
- + Reducing groundwater contamination
- + Profitable for developing countries (subsidies)
- + Increased crop yields
- ✗ Legal and academic bullying of scientists who study adverse effects of GMOs
- ✗ Harassing whistle-blowers
- ✗ Exploiting bureaucratic loopholes
- ✗ Manipulating experimental data and poor experimental design
- ✗ Decreased food sovereignty for small rural subsistence farmers
- ✗ Potential allergenicity

Politics

- Monsanto's "revolving door" in US political positions (FDA, EPA, USDA)
- Deregulation is the ultimate goal
- US: no labeling required (voluntary)
 - Legislators work with industry officials to come up with policies
 - Increased lobbying in the US during 1970's paralleled growth of Non-Governmental Organizations in Europe
 - Companies not required to consult the FDA, nor are they required to follow the FDA's recommendations after the consultation
- Political expediency vs. health concerns

Right to Know

Serving Size 172 g

Amount Per Serving

Calories 200 Calories from Fat 8

% Daily Value*

Total Fat 1g 1%

Total Cholesterol 1g 1%

Total Sodium 7mg 0%

Total Carbohydrate 36g 12%

Dietary Fiber 11g 45%

Sugars 0g

Protein 13g

Vitamin A 1% • Vitamin C

Calcium 4% • Iron

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

NutritionData.com



GMO's

What do you think?

- “[R]isks of genetically engineered organisms must be assessed case by case and ... these risks can differ greatly from one gene-organism combination to another.” (Union of Concerned Scientists)
- Does labeling matter?
- Is it best to err on the side of caution?
- Who needs to make these types of decisions?