Introduction

- Registered dietitian nutritionists (RDNs) are a reliable, credible source of nutrition and health information for clients, patients, and consumers.
- Given increasing consumer interest in food production, dietitians are frequently asked questions about food biotechnology.
- This CPE provides the science-based information necessary to confidently respond to questions about food biotechnology and advise on healthful, nutritious, and affordable food choices.

**Note:** The slides in the Appendix are included for those interested in additional information. They are optional and not required to receive credit for this course.
Learning Objectives

By the end of this module, the reader will be able to:

- Understand the meaning and history of food biotechnology.
- Recognize the rigorous safety standards and regulatory processes that all foods produced through biotechnology must undergo.
- Identify the current and potential benefits of food biotechnology for improved nutrition and sustainability.
- Confidently answer questions about food biotechnology.
Outline

Click on links below to jump to each section
1. Food Biotechnology Overview
2. Safety of Food Biotechnology
3. Regulation & Labeling of Food Biotechnology
4. Benefits of Food Biotechnology
5. Building Trust Through Effective Communication
FOOD BIOTECHNOLOGY OVERVIEW
The Definition of Food Biotechnology

When you break down the word “biotechnology”, you get:

Blo = “life”
techno = "tools"
ology = "the study of”

Therefore, food biotechnology means using biology (the study of life) and biological processes to enhance attributes of plants, animals, and other organisms or to improve methods and tools for producing foods.

More specifically...

- The concept of food biotechnology involves selecting DNA from a plant, animal, or microbe possessing a specific desirable trait or traits (e.g. high yield), and precisely moving the genetic blueprint (DNA) for that trait to another plant, animal, or microbe in order to pass the desirable trait(s) along to the end product.
- This technique selects and integrates traits in a precise and targeted manner to decrease costs of farming and decrease insecticide use, which can help contribute to improved safety, sustainability, and affordability of the food supply.
A Note About Terminology

The topic of food biotechnology is known by several terms, some scientifically accurate and some not.

- Terms such as "genetically modified," "genetically modified organism," and "GMO" are neither scientific nor accurate. They describe all methods of altering plant genes, including modern and conventional breeding, because breeding, however it is done, modifies the organism’s genes.
- The U.S. Food & Drug Administration (FDA) recommends using the terms “genetic engineering” or “food biotechnology,” which are more specific to modern, scientific plant modification.
- In keeping with this recommendation, this module will refer to biotechnology as either "food biotechnology" or "genetic engineering" or simply "GE," and will use phrases like "GE foods" or "biotech crops" throughout the module.

http://www.fda.gov/food/guidanceregulation/guidancedocumentsregulatoryinformation/labelingnutrition/ucm059098.htm
IFIC Foundation, Your Food, Farm to Table:
https://www.youtube.com/watch?v=K1XbEpNZ5yk&list=UUn2k5w1PhSWv_umuKmQkHrQ
http://www.usmint.gov/mint_programs/medals/?action=medal&ID=25
The Need for Food Biotechnology

By the year 2050, the global population is expected to reach 9 billion people, requiring 70% more food than today.

Food biotechnology is one tool that we can use to help address hunger and prevent future food shortages around the world.

How Do Farmers Decide What to Grow?

- The average American farmer feeds **155 people**.
- Farmers must balance a host of issues, from weather, supply costs, labor, yield, and demand to make decisions about what to produce and how.
- Farmers often use a combination of growing methods in order to produce affordable, safe, and nutritious foods, including conventional growing methods and those using biotechnology.
- Consumer demands, along with environmental challenges, require farmers to combine traditional farming methods with innovative ones to yield the best sustainable results. Farmers must also consider whether to utilize organic growing practices.
### Differences in Plant Breeding:
**The What, Why, & How of Traditional and Biotechnology**

<table>
<thead>
<tr>
<th></th>
<th>Traditional Plant Breeding</th>
<th>Plants produced through Biotechnology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What?</strong></td>
<td>&quot;Cross-breeding&quot; or combining the genes of plants.</td>
<td>Crop improvement by the precise addition of a gene encoding a trait</td>
</tr>
<tr>
<td><strong>Why?</strong></td>
<td>Bred for various reasons, e.g.:</td>
<td>Same reasons as traditional, e.g.:</td>
</tr>
<tr>
<td></td>
<td>• Improve quality &amp; yield</td>
<td>• Improve quality &amp; yield</td>
</tr>
<tr>
<td></td>
<td>• Improve taste or nutrition</td>
<td>• Improve taste or nutrition</td>
</tr>
<tr>
<td></td>
<td>• Protection from pests or diseases</td>
<td>• Protection from pests or diseases</td>
</tr>
<tr>
<td><strong>How?</strong></td>
<td>By combining desirable traits (e.g. disease protection) from both parent plants—may result in positive and negative traits being passed on.</td>
<td>By inserting a specific gene associated with a desirable trait directly into the new plant variety, with more predictable results. (e.g. recombinant DNA technology)</td>
</tr>
</tbody>
</table>

## Food Production Methods: Traditional vs. Organic

<table>
<thead>
<tr>
<th>May Use These Technologies &amp; Inputs:</th>
<th>Traditional</th>
<th>Organic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Plant Breeding</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Plants/animals produced with biotechnology</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Permitted non-synthetic fertilizers and pesticides</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Approved synthetic fertilizers and pesticides</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>
What is a Pesticide?

Pesticides include a broad class of crop protection products, including four major types:
1. Insecticides used to control insects
2. Herbicides used to control weeds
3. Rodenticides used to control rodents
4. Fungicides used to control mold, mildew and fungi

<table>
<thead>
<tr>
<th>Synthetic Pesticide (&quot;traditional&quot;)</th>
<th>“Natural” Pesticide</th>
</tr>
</thead>
<tbody>
<tr>
<td>The active ingredient has been comprised of substances made in a laboratory by humans</td>
<td>The active ingredient is a naturally-occurring substance. (See Practice Note, right)</td>
</tr>
</tbody>
</table>

http://www.epa.gov/pesticides/about/types.htm
http://www.tandfonline.com/doi/pdf/10.1080/10408690490911846
http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0011250
http://www.colostate.edu/Dept/CoopExt/4DMG/PHC/psticid2.htm

http://www.epa.gov/pesticides/about/types.htm
http://www.tandfonline.com/doi/pdf/10.1080/10408690490911846
http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0011250
http://www.colostate.edu/Dept/CoopExt/4DMG/PHC/psticid2.htm
GE Crops Are Used Mostly for Animal Feed

- Farmers depend on GE crops as critical components in their animals’ feed supply.
- Livestock in the US have been fed GE crops since they were first introduced in 1996.
- **Percent of total GE crops used for livestock feed:**
  - 72% of all GE Soybeans
  - 60% of all GE Corn

There has been no documented presence of GE DNA or proteins in the milk, meat, or eggs from animals that have eaten feed derived from biotech crops.

The nutrients in meat, milk, and eggs from livestock fed feed derived from biotech crops are the same as those from livestock fed conventional feeds.

What about Animal Biotechnology?

• In addition to plants, biotechnology can also be applied to food animals. Because there are currently no commercially-available genetically engineered animal products, this module focuses primarily on plant biotechnology.

• However, biotechnology is used in some aspects of food animal production, including in animal feed, as described on the last slide, and in milk production, through the use of the protein hormone, rbST (see next slide). While the first cloned animal was born in 1996, no meat from cloned animals is currently in the marketplace.

• A genetically engineered salmon, bred to grow to market size faster than traditional salmon, is currently being evaluated. If approved, it would be the first genetically engineered food animal product in the marketplace and would provide an alternative to wild and farmed salmon, and an additional source of heart-healthy omega-3 fatty acids. While FDA and EPA have completed safety and environmental assessments and found no concerns, the application is currently still pending.
A Closer Look at Animal Biotechnology

Animal biotechnology is the spectrum of advanced breeding practices currently being used in animals, such as genetic engineering, cloning, and the use of the protein hormone recombinant bovine somatotropin (rBST) given to dairy cows to improve milk production.

Why Animal Biotechnology?

- Reduced diseases in animals
- Increased yields of animals and animal products in the food supply
- Development of products that can be used as drugs, biologics, medical devices, food additives, or other high value products

MEAT

- Meat from animals bred through genetic engineering is currently not in the marketplace in the US, though the FDA has a mandatory process in place to evaluate safety on a case by case basis if and when new products from animals bred using genetic engineering are proposed.

MILK

- Because natural bST is present in milk, no milk is “bST-free,” therefore the term “rbST free” is potentially misleading
- To help clarify, FDA suggests use of phrases like “No significant difference has been shown between milk derived from rBST-supplemented and non-rBST supplemented cows” on product packaging.


FDA. Regulation of genetically engineered animals. 2012; http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm048106.htm
SAFETY OF FOOD BIOTECHNOLOGY
Decades of Research Support Safety of Biotechnology

- Numerous studies conducted over the past three decades have supported the safety of current foods produced through biotechnology.

- There has not been a single confirmed instance of harm to human health since people began consuming foods produced with biotechnology in 1996.
  - Extensive research is conducted before new varieties can be marketed.
  - Regulations are in place for these foods.
  - No difference in safety for children and pregnant/nursing women.
  - No increased risk for allergies (more on this later).

Recognition of Safety: Organizations in the United States

These health, science, and regulatory authorities have reviewed and deemed foods currently produced through biotechnology to be safe and not to cause harm to health:

**United States Government Agencies**
- Environmental Protection Agency (EPA)
- Food and Drug Administration (FDA)
- United States Department of Agriculture (USDA)

**Other US Organizations**
- American Medical Association
- American Association for the Advancement of Science
- Institute of Food Technologists
- Society of Toxicology
- American Society for Microbiology
- Council for Agricultural Science and Technology
- Federation of Animal Science Societies
- National Academies of Science
- Organization for Economic Cooperation and Development

*Note: The Academy of Nutrition and Dietetics currently does not have a position regarding food biotechnology.*

PRACTICE NOTE
Help your clients recognize that these separate US government agencies oversee foods produced through biotechnology to ensure safety to the highest and most comprehensive level.

Recognition of Safety:

### Global Organizations

- Australian Government/Australian Academy of Sciences
- Health Canada
- Brazilian Academy of Sciences
- British Medical Association
- Chinese Academy of Sciences
- Food and Agriculture Organization of the United Nations
- European Commission
- European Food Safety Authority (EFSA)
- The French Academy of Science
- Indian National Science Academy
- Irish Council for Science Technology & Innovation
- International Council for Science
- International Union of Food Science and Technology
- Italian National Academy of Science
- New Zealand Royal Commission on Genetic Modification
- National Research Council, National Academy of Sciences
- Royal Society of the United Kingdom
- World Health Organization (WHO)

---

One common area of question among consumers relates to the impact of GE foods on the risk of food allergy.

- Researchers have found no differences in allergic patients’ reactions to GE foods compared with non-GE foods.
- For those with food allergies, the use of biotechnology itself will not increase the potential for a food to cause an allergic reaction or a new food allergy, or increase the potential for a new food allergy to develop.


REGULATION & LABELING OF FOOD BIOTECHNOLOGY
Government Agencies that Oversee Biotech Safety

FDA conducts voluntary review of GE crops before they enter the marketplace:
- Using the 1992 Statement of Policy: Foods Derived from New Plant Varieties, the FDA regulates foods and ingredients made from GE crops to ensure they are safe to eat.
- Food and food ingredients derived from GE plants must adhere to the same safety requirements under the Federal Food, Drug, and Cosmetic (FD&C) Act that apply to food and food ingredients derived from traditionally bred plants.
- To date, FDA has completed 156 evaluations on GE foods

USDA’s Animal and Plant Health Inspection Service (APHIS) is responsible for protecting agriculture from pests and disease, including making sure that all new GE plant varieties pose no pest risk to other plants:
- The USDA has a permit process to approve field trials with GE crops before they can be planted in open fields.
- GE crops are then field-tested and evaluated for safety to plant in open fields.

EPA is responsible for the human health, animal health, and environmental safety issues that could be related to any pesticide substance produced in GE organisms:
- The EPA performs a risk assessment for pesticides in GE crops, evaluating:
  - Any risk to human health.
  - Any risk to non-target organisms and the environment.
  - The potential for cross-pollination of pesticidal traits
  - The need for an insect resistance management plan.
- The EPA then establishes any conditions needed to minimize or eliminate any potential harm to the environment, humans, and/or animals.

For more information on the FDA’s 1992 Statement of Policy: Foods Derived from New Plant Varieties, visit:
http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm352

For more information on APHIS, including official documents, guidance for GE developers, application status, news, and upcoming events, visit:
www.aphis.usda.gov/biotechnology/brs_main.shtml

http://www.allgov.com/departments/department-of-agriculture?detailsDepartmentID=568
http://www2.epa.gov/aboutepa/our-mission-and-what-we-do
http://www.fda.gov/
http://www.usda.gov/wps/portal/usda/usdahome
http://www.epa.gov/
067.htm
http://www.accessdata.fda.gov/scripts/fdcc/?set=Biocon
http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/2009/ucm109066.htm
Material Fact: A fact that would be important to a person in deciding whether to engage or not to engage in a particular transaction, i.e. purchasing an item; an important fact as opposed to an unimportant detail.
http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/ucm059098.htm
Allergenicity:
The FDA Review

The FDA requires special labeling of any food, whether produced through biotechnology or conventional breeding, if a protein from one or more of the major food allergens is present.

- If a new food product developed using biotechnology introduces a protein from one or more of the 8 major food allergens, then testing for the potential to cause allergic reactions is required by the FDA.
- Further, it is important to remember that only protein components of foods can be allergens (not the fat or carbohydrate component of the food), so any fat or carbohydrate-based ingredients arising from biotechnology would not be the source of any allergen concerns.

Whether consuming GE or traditional foods, allergic individuals can be guided by the ingredient list on the food label.

PRACTICE NOTE

For clients with food allergy concerns, be sure they know no unexpected allergic effects attributable to any GE food or GE ingredient in the marketplace has ever been documented or found. In helping them uncover possible allergen sources in their diet, be sure to point out the 8 “major” allergens:

- Eggs
- Fish
- Milk
- Peanuts
- Shellfish
- Soy
- Tree nuts
- Wheat

http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Biotechnology/ucm096095.htm
Voluntary Biotech Labeling

The FDA issued draft guidance to industry on the voluntary labeling of foods that indicates whether foods have or have not been developed using bioengineering, and the FDA supports voluntary labeling.

Many food manufacturers currently utilize voluntary labeling options such as the “Non-GMO Project,” but it is important to realize such labeling systems are not created, backed or endorsed by any government or standards-setting agency.

In contrast, the organic seal is administered by the USDA:
- USDA Organic seal verifies that a farm or handling facility complies with the USDA organic regulations and contains 95% organic ingredients.
- USDA uses methods such as inspections and residue testing to ensure the integrity of organic products from farm to market.
- There are no tolerance levels in organic regulations for GE cross-contamination; thus, even certified organic products may contain trace amounts of GE ingredients.

For the full DRAFT Guidance for Industry: Voluntary Labeling Indicating Whether Foods Have or Have Not Been Developed Using Bioengineering, visit:
http://www.fda.gov/food/guidanceregulation/guidancedocumentsregulatoryinformation/labelingnutrition/ucm059098.htm
BENEFITS OF FOOD BIOTECHNOLOGY
Benefits of Food Biotechnology: Protecting Nutritious Produce

The natural defenses of plants can be enhanced by biotechnology, resulting in hardier plants and increased yields.

In the 1990's, the Hawaiian papaya crop was nearly devastated by papaya ring spot virus, which would have eliminated the only U.S. supply of the fruit.

While other approaches to controlling the virus failed, biotechnology saved Hawaii's papaya industry with the development of virus-resistant papaya.

Citrus trees, including oranges and lemons, are currently facing threats from a crippling bacterium, causing a phenomenon known as "citrus greening." The bacterium spreads quickly and can devastate entire groves. Citrus farmers are in a rush to find a solution, and researchers are encouraged by the possibilities using biotechnology. (USDA ARS)


Citrus greening information: USDA ARS http://www.ars.usda.gov/citrusgreening/
Benefits of Food Biotechnology:
Developing More “Heart Healthy” Oils

- Soybean and canola oils are being developed using biotechnology to provide improved fatty acid composition profiles that are better for heart health:
  - Increase omega 3 levels
  - Decrease omega 6 levels
  - No trans fats

According to IFIC’s Consumer Perceptions of Food Technology Survey, 72% of consumers are “somewhat” or “very likely” to buy oils modified by biotechnology to contain healthful fats like Omega-3s.

Background Point: Tilling the soil, done in preparation for planting and for weed control, can cause top soil to blow away or harden. Hard soil does not absorb water well, which causes sediment, fertilizer, and chemicals to run into ground water. Excessive tillage is also less suitable for growing healthy crops and reduces the ability of the land to support beneficial insects and microorganisms living in the soil.

- Conservation tillage, which reduces the amount of soil disturbance, has been widely adopted, with 63% of all U.S. farmland being treated with this technique. As of 2009, two-thirds (65%) of soybeans were being grown using conservation tillage, resulting in a 93% decline in soil erosion, and preserving an estimated 1 billion tons of top soil.
- A practice known as “no-till farming”, which eliminates soil tillage, has increased 35% since the introduction of biotechnology. It is more easily adopted with herbicide-tolerant crops (See below) because they eliminate or greatly reduce the need to till for weed control.

Herbicide-Tolerant Crops: Crops that have been developed to survive (tolerate) exposure to particular herbicides by the incorporation of certain gene(s), either through genetic engineering or traditional breeding methods. The herbicide can therefore be applied to the
field for weed control without damaging the crop.
Pesticide reduction -
http://www.foodinsight.org/Background_on_Food_Biotechnology
Carbon footprint -

Future Benefits of Food Biotechnology:
Improve Foods for Safety, Nutrition & Acceptability

Foods in Development or Under Review (not yet in marketplace):

- **Golden Rice**
  - Addresses the issue of blindness and death from Vitamin A deficiency, a serious public health problem in developing countries.
  - Golden rice has higher levels of beta-carotene → vitamin A.

- **Biofortified Sorghum**
  - Contains increased levels of Vitamin A, Iron, and Zinc; and improved nutrient bioavailability to the body.

- **Tomatoes, Melons, and Papaya**
  - Ripen at the point of optimal freshness.

- **Reduced Allergenicity (under development)**
  - In the future, scientists may be able to remove proteins that cause allergic reactions to foods such as soy and peanuts, making the food supply safer for allergic individuals.

---


When Questions Arise: Taking a Balanced Approach

- Despite decades of safe consumption of genetically engineered foods, media continue to display conflicting headlines questioning their safety and impact on the environment.
- While the IFIC Food Technology Survey (2014) indicates the average US consumer is not concerned about foods produced through biotechnology, some consumers may have questions or concerns. As a trusted source for information on food biotechnology, it is important that health professionals, such as RDs, have the tools and resources to be able to talk confidently with their clients about food biotechnology.
BUILDING TRUST THROUGH EFFECTIVE COMMUNICATION
Who Do Consumers Trust?
IFIC’s Consumer Perceptions of Food Technology Survey

Consumers name **health professionals** among their most trusted sources for information on food biotechnology

**Question:** Which of the following sources, if any, do you or would you trust for information on biotechnology? Rank your top three.

<table>
<thead>
<tr>
<th>Source</th>
<th>% Ranked 1st – 3rd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health organization</td>
<td>50%</td>
</tr>
<tr>
<td>Government agency</td>
<td>45%</td>
</tr>
<tr>
<td>Health professional</td>
<td>45%</td>
</tr>
</tbody>
</table>

As an RDN, a conversation about food biotechnology offers a perfect opportunity to provide expert advice to clarify misconceptions and build trust.
Becoming a Trusted Source of Information

The Critical Role of the RDN

Ways to become a trusted source of food biotechnology information include:

1) Identify credible sources, and then teach your clients how to identify credible sources of information about food biotechnology that are evidence-based.

2) Critically evaluate the science on food biotechnology and related topics.

3) Answer any questions, including “tough questions”, accurately, directly and in a non-emotional manner. If you don’t know how to answer a question, refer them to an expert or ask permission to get back to them with an answer.

4) Even with your own knowledge about food biotechnology, know when to seek further input from trusted advisors.

5) Continue to be an ongoing resource for your clients in helping them become informed consumers.
Becoming A Trusted Source of Information

Credibility

✅ Who is credible?

- Government/ regulatory agencies and officials
- Scientists, scientific societies
- Health Professionals
- Members of academia

⚠️ Proceed with caution:

Documentaries and videos posted online are often designed to play purely on emotion rather than science-based facts and evidence.

IFIC Foundation, Evaluating Evidence:
Evaluating Scientific Evidence

Questions to Help Evaluate the Quality of Scientific Paper

- Do the title and abstract reflect the study?
- Is the study useful, novel, and/or relevant to humans?
- Is the hypothesis clearly stated?
- Was the study methodology described in detail?
- Are the methods valid, accurate, and reliable?
- Does the analysis of the results make sense?
- Are the conclusions supported by the data?
- Are there conflicts of interest (personal, academic, financial, conflicts of commitment)?
- How does the study fit into the totality of evidence?

Source: IFIC Foundation, Evaluating Evidence (2013)
**USDA’s Biotechnology Information:**
- Learn more about USDA’s position on Agricultural Biotechnology, how the U.S. Government regulates biotech plants, answers to biotechnology FAQs, and a Glossary of important biotech terms.

**FDA’s Biotechnology Information:**
http://www.fda.gov/food/foodscienceresearch/biotechnology/
- Get more information about FDA’s policy on biotechnology, the FDA’s role in regulating GE foods, and FAQs on food from GE crops.

Answering Tough Questions
Food Allergies and Food Biotechnology

Your clients with a food allergy, or who have children with a food allergy, may have heightened awareness of foods produced with biotechnology.

There is a lot of conflicting information in the media and online about the role of these foods in causing or exacerbating food allergy. When discussing their concerns, it is important to show empathy, while offering reassurance in the safety, as well as labeling of foods containing major allergens, to aid them in selecting foods that are safe for them.

Q: I read that consuming genetically modified foods could cause my child to develop allergies. Why would FDA allow these foods into the food supply?

A: The FDA has specifically focused on allergy issues and requires manufacturers to analyze the proteins they are using in the biotechnology process to determine if they are allergenic for humans, including infants, toddlers, pregnant women, and other special populations.

No product of biotechnology on the market today has introduced any major allergen to any food. During FDA’s extensive review of a new food product developed using biotechnology, if one or more of the eight major food allergens is introduced, testing for the potential to cause allergic reactions is required. If one or more of the major food allergens is found to be present, the food must be labeled, per FDA’s Food Allergen Labeling & Consumer Protection Act (FALCPA).

Q: Where can I look to find out if a food contains an allergen?

A: Read food labels, including the ingredients list and special allergen labeling required by law, to determine if a major allergen is present.

FDA FALCPA:
http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Allergens/ucm106890.htm
Answering Tough Questions
Children and Food Biotechnology

Your clients with children may have specific concerns about the impact of foods produced with biotechnology on their children’s health.

Q: I’ve heard that the reason more kids have allergies is because of GMOs.
A: There is no published scientific evidence that infants/children have had allergic reactions, nutritional problems, or toxic effects due to consuming food produced using biotechnology.

Q: I have kids – have the health effects of biotech foods on children been thoroughly vetted?
A: There is no published scientific evidence suggesting that adults/children/infants are affected by biotech ingredients at all or that children/infants are affected differently than adults.
Helping Your Clients Become Informed Consumers

- Beyond your counsel, be sure to **provide credible sources of information** about food biotechnology that are science-based, consumer-friendly and easily accessible.

- **Point out sources of sound information** they can watch or read online.

- Remind them to **consider the broader benefits** of food biotechnology, including nutrition, food cost, and sustainability, which may align with issues they care about.

- Encourage them to **make their own informed decisions about which foods to purchase** and support them fully in their choices which may change over time.
IFIC & IFIC Foundation Resources on Food Biotechnology

Food Biotechnology: A Communicator’s Guide to Improving Understanding
3rd edition, © 2013

Physicians Offer Expert Advice on Food Biotechnology (Videos)

Your Food, Farm to Table (Infographic video)

Consumer Insights Regarding Food Biotechnology (Surveys)

Fact Sheet: Common Food Production Practices and their Unique Contributions to the Food Supply

Understanding Our Food Communications Tool Kit

And More!
Contact Information

International Food Information Council Foundation
www.foodinsight.org
info@foodinsight.org
202-296-6540

Based on IFIC Foundation's
Food Biotechnology: A Communicator’s Guide
to Improving Understanding
3rd edition, © 2013
Contributors

- Content compiled and written by Rachel Cheatham, PhD
- Reviewed by:
  - Connie Diekman, M. Ed, RD, CSSD, FADA, FAND
  - Dee Sandquist, MS, RDN, LD, CDE
References


References (cont.)


FDA. Genetically engineered animals, 2012b. http://www.fda.gov/AnimalVeterinary/AnimalHousingAndCare/GeneticallyEngineered/GeneticallyEngineeredAnimals/ucm102184.htm

FDA. Genetically engineered plants. 2012c. http://www.fda.gov/AnimalVeterinary/AnimalHousingAndCare/GeneticallyEngineered/GeneticallyEngineeredPlants/ucm106266.htm


FDA. Regulations of genetically engineered animals. 2012d. http://www.fda.gov/AnimalVeterinary/AnimalHousingAndCare/GeneticallyEngineered/GeneticallyEngineeredAnimals/ucm102184.htm


International Institute of Tropical Agriculture (IITA). 2012; http://www.iita.org/


http://www.ncbi.nlm.nih.gov/pmc/articles/PMC297481/3/


References (cont.)


Thank You!

Additional information can be found in the Appendix on the Following Slides (Optional, not required for credit)

Take Quiz [insert link]
Return to beginning of module
Return to CPE home page [insert link]
Regulation of Foods Produced Through Biotechnology
The Role of the FDA

1) **FDA**: conducts a pre-market voluntary review of GE crops and a mandatory review of GE animals to verify their safety.

- Food and food ingredients derived from GE plants must adhere to the same safety requirements under the *Federal Food, Drug, and Cosmetic (FD&C) Act* that apply to food and food ingredients derived from traditionally bred plants.

- Using the 1992 *Statement of Policy: Foods Derived from New Plant Varieties* (the FDA’s science-based regulatory guidelines), the FDA regulates foods and ingredients made from GE crops to ensure they are safe to eat.

- The FDA also reviews genetic engineering of animals by determining whether any new DNA is safe for the health of the animal and that the food from the GE animal is safe for humans and/or other animals to eat.


http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm352067.htm
http://www.accessdata.fda.gov/scripts/fdcc/?set=Biocon
Regulation of Foods Produced Through Biotechnology
The Role of the USDA

2) USDA: USDA's Animal and Plant Health Inspection Service (APHIS) is responsible for protecting agriculture from pests and disease, including making sure that all new GE plant varieties cannot become invasive or problematic to other plants.

- The USDA has a permit process to approve field trials with GE crops before they can be planted in open fields.
- GE crop developers can speed up the permit process by way of the notification process by providing proof of 6 criteria (See Sidebar).
- GE crops are then field-tested and evaluated for safety to plant in open fields.

For more information on APHIS, including official documents, guidance for GE developers, application status, news, and upcoming events, visit: [www.aphis.usda.gov/biotechnology/brrs_main.shtml](http://www.aphis.usda.gov/biotechnology/brrs_main.shtml)

Regulation of Foods Produced Through Biotechnology
The Role EPA

2) **EPA**: Under the *Federal Insecticide, Fungicide, and Rodenticide Act* (FIFRA) and the *Federal Food, Drug, and Cosmetics* (FD&C) *Act*, the EPA is responsible for the human health, animal health, and environmental safety issues that could be related to any pesticide substance produced in GE organisms, such as Bt corn and Bt cotton *(See Sidebar)*.

- The EPA performs a risk assessment for pesticides in GE crops, evaluating:
  - Any risk to human health.
  - Any risk to non-target organisms and the environment.
  - The potential for gene flow (cross-pollination of pesticidal traits to wild crops or weeds).
  - The need for an insect resistance management plan.
- The EPA then establishes any conditions needed to minimize or eliminate any potential harm to the environment, humans, and/or animals.

**What is Bt?:**
Most GE crops grown in the U.S. contain genes that provide resistance to pests and/or tolerance to herbicides. For example, GE corn and cotton contain genes from the soil bacterium, *Bacillus thuringiensis* (Bt). The proteins produced from these genes kill lepidopteran insect pests when they are ingested (and are harmless to plants, animals, humans), eliminating the need to use chemical pesticides. The EPA has tested and approved Bt for safe use.

---

APPENDIX B:
ROLE OF BIOTECHNOLOGY
IN SUSTAINABLE FOOD PRODUCTION
What is Sustainability?

According to USDA, **sustainable agriculture** is an integrated system of plant and animal production practices that will, over long term:

- Satisfy human food needs.
- Enhance environmental quality and the natural resource base upon which the agricultural economy depends.
- Make the most efficient use of nonrenewable resources and integrate natural biological cycles and controls.
- Sustain the economic viability of farm operations.
- Enhance the quality of life for farmers and society as a whole.

Benefits of Food Biotechnology:
Sustainable Food Production

Biotechnology supports the *social, economic, and environmental sustainability* of agriculture.

Regarding sustainability, changes in farming practices made possible with the use of *food biotechnology* include:
- Reduction in insecticide use.
- Reduction in carbon footprint.
- Soil protection through no-till farming.
- Improved harvest per acre.

Biotechnology Helps Produce More Food Per Acre

Insect-protected crops allow farmers to harvest

more crops per acre

+

Herbicide-tolerant crops lead to

Improved harvests

= 

Less land, insecticides, fertilizers, fuel, animals, and feed
needed to produce the same amount of food

Biotechnology and More Judicious Use of Pesticides

From 1996-2011, biotech crops have collectively reduced global pesticide applications by 1.04 billion pounds of the active ingredient.

Bt crops:
- Farmers can spray insecticide less often with Bt (insect-protected) crops.
  - This also means that farmers are protected from accidental poisoning.
- Bt crops target only the pests that eat those crops, rather than honey bees or natural predators of the crop pests, which is good for the ecosystem.

379 million pounds
The reduction in pesticide applications in the U.S. from 1996-2009 as a result of biotech crops.
**Carbon Footprint**: Amount of greenhouse gases, specifically carbon dioxide or other carbon compounds, emitted by individuals, companies, or countries (i.e., a person’s activities or a product’s manufacture and transport) during a given period of time. Indicator of air quality often used to measure an entity’s environmental impact.
Video: Bill Gates on the Importance of Biotechnology


“We support research to develop more productive and nutritious varieties of the staple crops grown and consumed by farming families. These include varieties adapted to local conditions that deliver specific benefits farmers seek, such as increased yields, better nutrition, and tolerance to drought, flood, and pests.”

— Bill & Melinda Gates Foundation, 2014
Thank You!

Take Quiz [insert link]
Return to beginning of module
Return to CPE home page [insert link]