Mr. Chairman and Members of the Committee, I am Robert Brackett, Director, Center for Food Safety and Applied Nutrition at the Food and Drug Administration (FDA or the Agency). Thank you for the opportunity to testify today on FDA's regulatory program for foods derived from bioengineered plants, also known as genetically engineered, or bioengineered, foods.

Background

Within FDA, the Center for Food Safety and Applied Nutrition (CFSAN) oversees bioengineered plant-derived food and ingredients intended for human consumption. Our Center for Veterinary Medicine (CVM) oversees bioengineered plant-derived products used as animal feed or as ingredients in animal feed, as well as bioengineered products used to improve the health or productivity of animals. My testimony this morning focuses on bioengineered plant-derived foods. Let me also clarify that in the Federal Food, Drug, and Cosmetic (FD&C) Act, food is defined as food for man or other animals. So, when I talk about food, it also encompasses animal feed unless stated otherwise.

We believe it is very important for the public to understand how FDA is regulating the bioengineered foods being introduced into the marketplace and to have confidence in that process. Therefore, I appreciate this opportunity to describe our policies and procedures.

First, let me state that FDA is confident that the bioengineered foods on the United States market today are as safe as their conventional counterparts. This conclusion has been echoed in recent reports by the National Academy of Sciences (NAS) and the Government Accountability Office, and most recently in a 2004 report from NAS's National Research Council and Institute of Medicine entitled, "Safety of Genetically Engineered Foods: Approaches to Assessing Unintended Health Effects." Over the last ten years, FDA has reviewed the data on more than 60 bioengineered food products, ranging from herbicide resistant soybeans to a modified canola oil. To date, the evidence shows that these foods are as safe as their conventional counterparts.

In a 1992 policy statement on bioengineered foods, FDA announced that the Agency was "not aware of any information showing that foods derived by these new methods differ from other foods in any meaningful or material way, or that, as a class, foods developed by the new techniques present any different or greater safety concern than foods developed by traditional plant breeding." This 1992 statement and its scientific underpinnings still reflect FDA's thinking about bioengineered foods.

Crossbreeding, Hybridization, and Bioengineering

The selection and genetic improvement of plants for agricultural use has been going on for thousands of years, although plant breeding as a science only began in the late 1800s. Typically, plant breeding has involved crossbreeding and hybridization, in which two related plants are cross-fertilized, and the resulting offspring have characteristics of both parent plants.

In the breeding process, however, many undesirable traits often can appear in addition to the desirable ones. Some of those undesirable traits can be eliminated through additional breeding, which is time-consuming. Breeders can then further select and reproduce the offspring that have the desired traits. Many of the foods that are already common in our diet are obtained from plant varieties that were developed using conventional genetic techniques of breeding and selection. Hybrid corn, nectarines (which could be considered genetically altered peaches), and tangelos (which are a genetic hybrid of a tangerine and grapefruit) are all examples of such breeding and selection.

Today, by inserting one or more genes into a plant, scientists are able to produce a plant with new, advantageous characteristics. The new gene splicing techniques are being used to achieve many of the same goals and improvements that plant breeders historically have sought through conventional methods. Today's techniques can be used with greater precision and allow for more complete characterization and, therefore, greater predictability, of the qualities of the new variety. They give scientists the ability to isolate genes and introduce new traits into foods without simultaneously introducing undesirable traits. This is an important improvement over traditional breeding. Any genetic modification technique, including both traditional methods and bioengineering, could change the composition of a food in a manner relevant to food safety. But because of the increased precision offered by the bioengineered methods, the risk of inadvertently introducing detrimental traits is actually likely to be lessened. Bioengineering does expand the range of new proteins and other substances that can be introduced into plants. However, the agencies have well-established procedures for determining the safety of such new substances.

FDA has found no evidence to indicate that deoxyribonucleic acid (DNA) inserted into plants using bioengineering presents food safety problems. The small amounts of the newly expressed proteins are generally unlikely to change the safety profile of the plant. If safety concerns should arise, however, they would most likely fall into one of three broad categories: allergens, toxins, or anti-nutrients. FDA has extensive experience in evaluating the safety of such substances in food.

As to potential allergens, foods normally contain many thousands of different proteins. While the majority of proteins do not cause allergic reactions, virtually all known human allergens are proteins. Since genetic engineering can introduce a new protein into a food plant, it is possible that this technique could introduce a previously unknown allergen into the food supply or could introduce a known allergen into a "new" food. FDA's guidelines help developers to identify this issue and address any concern prior to marketing.

A second possible problem is the introduction of toxins into the food crop. It is possible that a new protein could cause toxicity. A third possible issue is the introduction of anti-nutrients, such as molecules like phytic acid that binds essential dietary minerals such as phosphorus.

Breeding, whether bioengineering or otherwise, can cause unintended changes in the composition of the food. For example, it might result in a reduction of Vitamin C or an increase in the concentration of a naturally occurring toxin in the food. Developers of bioengineered foods analyze the composition of the foods from their new crop varieties to ensure that they do

not market foods whose composition differs from conventionally-derived counterparts.

It is important to note that the kinds of food safety testing typically conducted by developers of a bioengineered food crop to ensure that their foods meet all applicable requirements of the FD&C Act address these potential concerns. In the event that something unexpected does occur, this testing provides a way to detect such changes at the developmental stage and defer marketing until any concern is resolved.

Legal and Regulatory Background

The overall Federal regulatory structure for biotechnology products, known as the Coordinated Framework, was adopted by Federal agencies in 1986 (51 FR 23302, June 26, 1986). Under the Coordinated Framework, FDA regulates bioengineered plant-derived food in conjunction with the United States Department of Agriculture (USDA) and the Environmental Protection Agency (EPA). FDA has authority under the FD&C Act to ensure the safety of all domestic and imported foods for man or other animals in the U.S. market. The exceptions to this are meat, poultry, and processed egg products, which are regulated by USDA. The safety of animal drug residues in meat and poultry, however, is regulated by FDA's CVM. Pesticides, including those bioengineered into a food crop, are regulated primarily by EPA, which reviews safety and sets tolerances (or establishes exemption from tolerance) for pesticides. FDA enforces the pesticide tolerances set by EPA. USDA's Animal & Plant Health Inspection Service (APHIS) oversees the agricultural and environmental safety of planting and field testing of bioengineered plants.

Bioengineered foods and food ingredients must adhere to the same standards of safety under the FD&C Act that apply to their conventionally bred counterparts. This means that these products must be as safe as the traditional foods on the market. FDA has broad authority to initiate regulatory action if a product fails to meet the requirements of the FD&C Act.

FDA relies primarily on two sections of the FD&C Act to ensure the safety of foods and food ingredients that are produced using biotechnology:

(1) The adulteration provisions of section 402(a)(1). Under this postmarket authority, FDA has the power to remove a food from the market (or sanction those marketing the food) if the food poses a risk to public health. It is important to note that the FD&C Act places a legal duty on developers to ensure that the foods they market to consumers are safe and comply with all legal requirements.

(2) The food additive provisions in section 409. Under this section, a substance that is intentionally added to food is a food additive, unless the substance is generally recognized as safe (GRAS) or is otherwise exempt (e.g., a pesticide, the safety of which is overseen by EPA). Unapproved food additives are subject to the adulteration provisions in 402 (a)(2)(c) of the FD&C Act.

The FD&C Act requires premarket approval of any food additive, regardless of the technique used to add it to food. Thus, substances introduced into food are either: (1) new food additives

that require premarket approval by FDA; or (2) GRAS, and are therefore exempt from the requirement for premarket review by FDA. Generally, foods such as fruits, vegetables, and grains are not subject to premarket approval under the FD&C Act because they have been safely consumed over many years. Other than the food additive system, there are no FDA premarket approval requirements for foods generally.

In 1992, recognizing that bioengineered products were on the horizon, FDA published a policy explaining how existing legal requirements would apply to products developed using the tools of biotechnology (57 FR 22984; May 29, 1992; "Statement of Policy: Foods Derived from New Plant Varieties"). The 1992 policy was designed to answer questions about these products and to assist developers prior to marketing to meet their legal duty to provide safe and wholesome foods to consumers. The basic principle of the 1992 policy is that the traits and characteristics of the foods should be the focus of safety assessment for all new varieties of food crops, no matter which techniques are used to develop them.

Under FDA policy, a substance that would be a food additive if it were added during traditional food manufacturing is also treated as a food additive if it is introduced into food through bioengineering of a food crop. Our authority under section 409 permits us to require premarket approval of any food additive and, thus, to require premarket approval of any substance intentionally introduced via bioengineering that is not GRAS.

Examples of substances intentionally introduced into food that would be reviewed as food additives include those that have unusual chemical functions, have unknown toxicity, or would be new major dietary components of the food. For example, a novel sweetener bioengineered into food would likely require premarket approval. In our experience with bioengineered food to date, however, we have reviewed only one substance under the food additive provisions, an enzyme produced by an antibiotic resistance gene (kanamycin), and we granted approval as a food additive. In general, substances intentionally added to or modified in food via biotechnology to date have been proteins and fats that are, with respect to safety, similar to other proteins and fats that are commonly and safely consumed in the diet and, thus, are presumptively GRAS. Therefore, they have not needed to go through the food additive approval process.

In 1994, following the 1992 policy, FDA conducted a comprehensive scientific review for the first bioengineered product planned for introduction into the market. FDA reviewed Calgene's data on the Flavr Savr? tomato and the use of the kanamycin resistance marker gene. Calgene submitted food additive petitions for the enzyme product of the marker gene for use in food and feed. We subsequently approved the petitions. FDA also held a public meeting of our Food Advisory Committee to examine applicability of the 1992 policy to products such as the Flavr Savr? tomato. The Advisory Committee members agreed with FDA that the scientific approach presented in the 1992 policy was sound and that the questions regarding the Flavr Savr? had been addressed. The Advisory Committee members also suggested that we provide an expedited decision process for the marketing of bioengineered foods that do not raise substantive scientific issues.

In response, FDA established a voluntary consultative process to help companies comply with the FD&C Act's requirements for the bioengineered foods that they intend to market. The

results of our consultation are public information and are available on our website. Since the consultation process was created, companies have used the consultative process more than 60 times as they sought to introduce genetically altered plants representing more than 16 different crops into the U.S. market. We are not aware of any bioengineered plant-derived food intended for commercialization that is subject to FDA's jurisdiction that has not been evaluated by FDA through the current consultation process.

Typically, the consultation begins early in the product development stage, before it is ready for market. Company scientists and other officials meet with FDA scientists to describe the product they are developing. In response, the Agency advises the company on what tests would be appropriate for the company to assess the safety of the new food.
After the studies are completed, the data and information on the safety and nutritional assessment are provided to FDA for review. The Agency evaluates the information for all of the known hazards and also for potential unintended effects on plant composition and nutritional properties, since plants may undergo changes other than those intended by the breeders. For example, FDA scientists evaluate data and information to assure that the newly expressed compounds are safe for food consumption, and that there are no allergens new to the food, no increased levels of natural toxicants, and no reduction of important nutrients. They also determine whether the food has been changed in any substantive way such that the food would need to be specially labeled to reveal the nature of the change to consumers.

Some examples of the information reviewed by FDA include:

? The name of the food and the crop from which it is derived;

? The uses of the food, including both human food and animal feed uses;

? The sources, identities, and functions of introduced genetic material and its stability in the plant;

? The purpose or intended technical effect of the modification and its expected effect on the composition or characteristic properties of the food or feed;

? The identity and function of any new products encoded by the introduced genetic material, including an estimate of its concentration;

? A comparison of the composition or characteristics of the bioengineered food to that of food derived from the parental variety or other commonly consumed varieties with special emphasis on important nutrients, anti-nutrients, and toxicants that occur naturally in the food;

? Information on whether the genetic modification altered the potential for the bioengineered food to induce an allergic response; and

? Other information relevant to the safety and nutritional assessment of the bioengineered food.

If a plant developer used a gene from a source whose food is commonly allergenic, FDA would presume that the modified food may be allergenic. The developer, however, is allowed the opportunity to demonstrate that such food would not cause allergic reactions in persons allergic to food from the source.

If FDA scientists have questions about the safety data, the company may, for example, provide more detailed answers or conduct additional studies. Our experience has been that no bioengineered product has gone on the market until FDA's questions about the safety of the product have been answered.

Labeling

Section 403 of the FD&C Act sets labeling requirements for all foods. All foods, whether derived using bioengineering or not, are subject to these labeling requirements.
Under section 403(a)(1) of the FD&C Act, a food is misbranded if its labeling is false or misleading in any particular way. Section 201(n) of the FD&C Act provides additional guidance on how labeling may be misleading. It states that labeling is misleading if it fails to reveal all facts that are "material in light of such representations (made or suggested in the labeling) or material with respect to consequences which may result from the use of the article to which the labeling or advertising relates under the conditions of use prescribed in the labeling or advertising thereof or under such conditions of use as are customary or usual."

Although the legislative history of section 201(n) contains little discussion of the word "material," there is precedent to guide the Agency in its decision regarding whether information on a food is in fact material within the meaning of 201(n). Historically, the Agency has generally limited the scope of the materiality concept to information about the attributes of the food itself. FDA has required special labeling on the basis of it being "material" information in cases where the absence of such information may: (1) pose special health or environmental risks (e.g., warning statement on certain protein diet products); (2) mislead the consumer in light of other statements made on the label
(e.g., requirement for quantitative nutrient information when certain nutrient content claims are made about a product); or (3) in cases where a consumer may assume that a food, because of its similarity to another food, has nutritional, organoleptic (i.e., affects taste, color, odor, or feel), or functional characteristics of the food it resembles when in fact it does not (e.g., reduced fat margarine may not be suitable for frying).

FDA does not require labeling to indicate whether a food or food ingredient is a bioengineered product, just as it does not require labeling to indicate which conventional breeding technique was used in developing a food plant. Rather, any significant differences in the food itself have to be disclosed in labeling. If genetic modifications materially change the composition of a food product, these changes must be reflected in the food's labeling. This would include its nutritional content (for example, more oleic acid, or greater content of the amino acid lysine) or requirements for storage, preparation, or cooking, which might impact the food's safety characteristics or nutritional qualities. For example, one soybean variety was modified to alter the levels of oleic acid in the beans. Because the oil from this soybean is significantly different

when compared to conventional soybean oil, we advised the company to adopt a new name for that oil, a name that reflects the intended change.

If a bioengineered food were to contain an allergen not previously found in that food, information about the presence of the allergen would be material as to the potential consequences of consumption of the food. If FDA determined that labeling would be sufficient to enable the food to be safely marketed, the Agency would require that the food be labeled to indicate the presence of the allergen.

FDA has received comments suggesting that foods developed through modern biotechnology should bear a label informing consumers that the food was produced using bioengineering. We have given careful consideration to these comments. However, we do not have data or other information to form a basis for concluding that the fact that a food (or any of its ingredients) was produced using bioengineering is material within the meaning of 201(n) and, therefore, constitutes information that must be disclosed as part of a bioengineered product's labeling. Hence, we believe that we have neither a scientific nor a legal basis to require such labeling. We have developed, however, draft guidance for those who wish voluntarily to label either the presence or absence of bioengineered food in food products.

The Agricultural Biotechnology Working Group

The interagency Agricultural Biotechnology Working Group, which includes the Office of Science and Technology Policy (OSTP), FDA, EPA, USDA, and others, has addressed regulatory issues related to the potential for low, intermittent levels of materials from bioengineered food crops to inadvertently get into food or feed.

In August 2002, OSTP published a Notice in the Federal Register (67 FR 50578) which proposed coordinated actions by FDA, EPA, and USDA aimed at strengthening controls over field trials to address the potential of material from field trials to inadvertently get into food or feed. As part of this OSTP initiative, on November 24, 2004, FDA issued a draft guidance document entitled, "Guidance for Industry: Recommendations for the Early Food Safety Evaluation of New Non-Pesticidal Proteins Produced by New Plant Varieties Intended for Food Use." This draft guidance outlines procedures to address the possible intermittent, low-level presence in food and feed of new non-pesticidal proteins from biotechnology-derived crops under development for food or feed use but that have not gone through FDA's premarket consultation process. Under this guidance, FDA encourages developers to submit protein safety information once field testing reaches a stage of development such that there could be concerns that new non-pesticidal proteins produced in the field-tested plants might be found in food or feed. FDA's focus would be on proteins new to such plants because FDA believes that any potential risk from the low level presence of such material in the food supply would be limited to the possibility that it would contain or consist of a new protein that might be an allergen or toxin. FDA would still expect developers to conduct a complete consultation with FDA prior to marketing food or feed from the plant, consistent with current practices. The comment period for the draft guidance closed on January 24, 2005. FDA is reviewing the approximately 3000 comments received and expects to complete the final guidance by the end of the calendar year.

The Agricultural Biotechnology Working Group is also working on the issue of pharmaceutical crops. FDA has the authority and responsibility for regulating pharmaceuticals, including human biologics, whether they are produced in traditional manufacturing facilities or from crops in the field. Regulations found in parts 210 & 211 of Title 21 of the Code of Federal Regulations outline practices that must be followed by pharmaceutical manufacturers as part of good manufacturing practice. These regulations are general in nature and apply to all pharmaceutical manufacturing methodologies, including plant-made pharmaceuticals. For crops in the field, however, there are particular issues to be addressed, for example, the disposition of the residual crop left over after a pharmaceutical is extracted. The interagency working group is working to clarify authorities for regulating genetically engineered crops ordinarily used to produce food (e.g., corn), whether they are intended for food, pharmaceutical, or industrial use, and to make sure there are no gaps in protecting human health and the environment. We are evaluating ways to help keep pharmaceutical and industrial compounds out of food when they are not supposed to be there. We are looking at ways that would be science- and risk-based, enforceable, complementary with the USDA-APHIS regulatory scheme, and that would not pose too high a barrier to development of these products.

In September 2002, FDA and USDA jointly published the Draft Guidance for Industry on the use of bioengineered plants or plant materials to produce biological products, including medical devices, new animal drugs, and veterinary biologics. This draft guidance, which contains sections on FDA oversight and sections on APHIS oversight, outlines the important scientific questions and information that should be addressed to FDA by those who are using bioengineered plants to produce medical or veterinary drug products. FDA and USDA are working to finalize this guidance document.

Other Activities

FDA has made a commitment to ensuring that consumers have access to information about new bioengineered food products in a timely fashion and has made more information about these foods available on FDA's website.

To ensure that FDA has the best scientific advice on issues related to bioengineered foods, we have added experts in this field to our foods and veterinary medicine advisory committees and created a Food Biotechnology Subcommittee of the Food Advisory Committee.

In addition, NAS has formed a standing Committee on Agricultural Biotechnology, Health and the Environment. FDA, EPA and USDA requested that the committee assess the potential for unintended effects of genetically engineered foods and how to evaluate their impact on human health. The committee's report, "Safety of Genetically Engineered Foods: Approaches to Assessing Unintended Health Effects," was published in July 2004. According to the committee, all evidence evaluated to date indicates that unexpected and unintended compositional changes arise with all forms of genetic modification, including conventional methods and genetic engineering techniques. The committee noted that a "policy to assess products based exclusively on their method of breeding is scientifically unjustified." The

committee recommended that compositional changes that result from any method of genetic modification in food, including genetic engineering, undergo an appropriate safety assessment. The committee presented an approach to scientifically assess whether unintended effects that result from the genetic modification could lead to adverse health concerns. The approach suggested by the committee is generally consistent with FDA's approach.

FDA provided international leadership in the work of the Codex Ad Hoc Intergovernmental Task Force on Foods Derived from Biotechnology, a task force established for a four-year time span by the Codex Alimentarius Commission (Codex). The work of this task force was especially important because it developed internationally accepted principles and guidelines for the evaluation of the safety of bioengineered foods. Those principles and guidelines were adopted by Codex in 2003, at the conclusion of the life of the task force. These principles and guidelines are the international standards for ensuring the safety of genetically engineered foods, and they are consistent with FDA's approach. Codex recently re-established the task force for another four-year span. It will have its first meeting this coming September, when it will decide on new work.

FDA also is actively participating as a member of the Organization for Economic Cooperation and Development's Task Force for the Safety of Novel Foods and Feeds. This task force is in the process of writing scientific/technical consensus documents aimed at compiling current information that is important in food and feed safety assessment. These consensus documents serve as references to Codex and regulatory bodies.

Mr. Chairman, FDA, in cooperation with EPA and USDA, will continue its oversight of new and emerging food biotechnology products and will be vigilant in ensuring the safety and integrity of the food supply. I thank you again for the opportunity to address these issues. I am happy to answer any questions you might have.