codex alimentarius commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

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IMPLICATIONS OF BIOTECHNOLOGY ON INTERNATIONAL FOOD STANDARDS AND CODES OF PRACTICE

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1. The new technologies for production of food, food ingredients, and food additives by biotechnology including genetic engineering are rapidly approaching the stage in development where their impact on food safety evaluation, Codex standards and codes of practice should be addressed. Many Member States of the Codex Alimentarius Commission (the Codex) have already dealt with issues such as safety evaluation of the intended uses for products of biotechnology at the country level. This paper addresses general issues that may arise in the Codex system's consideration of the products of biotechnology including:

(i) the role of new technologies in food production;

(ii) the effect of biotechnology on existing Codex definitions;

(iii) the safety evaluation of foods, food ingredients, and food additives developed through biotechnology, and

(iv) the designation of substances derived by biotechnology on the label of food products.

I. GENERAL CONSIDERATIONS OF THE ROLE OF BIOTECHNOLOGY

2. Biotechnological production of foods, food ingredients, and food additives has a long, safe history. Biotechnology, in the broad sense, is the technology used for any food production accomplished by living organisms or their components. Traditional food products such as vinegar, bread, cheese, and alcoholic beverages, among others are prepared by biotechnological processes. There have been successive improvements in quality of these traditional foods by changes in the microorganisms used in production. Additionally, new varieties of foods produced by conventional genetic techniques of breeding and selection are an integral part of the global food supply.

3. Food products produced through "new" biotechnology, such as recombinant DNA techniques and cell fusion, are emerging from research and development. These methods represent new tools that permit the scientist to transfer

genetic traits among diverse organisms. In most cases, genetic traits manipulated by recombinant DNA methods result from single (or a few) genes that encode well-known cellular functions, and these can be transferred to desired host organisms more rapidly and precisely than would be possible by conventional genetic methods.

4. This enhanced technology to modify food products will yield an expanding array of new food, food ingredients, and food additives and new processes to produce food ingredients and additives that are currently in use. Most of the applications of new biotechnology to food substances will be well-defined, incremental changes to improve economic, nutritional, or organoleptic properties. The nature of these new modifications will not differ fundamentally from changes accomplished by conventional means and can be assessed by standard molecular, chemical and toxicological methods.

5. Considerable public attention has been focused on recombinant DNA methods, but other methods of finding, selecting and manipulating genetic traits are being applied to develop new food and food ingredients, including cell and protoplast culture, somaclonal variation, electroporation, microinjection and microprojectile techniques. These methods are often used in concert with conventional methods of plant and animal breeding and microbial strain selection and improvement. The safety evaluation should focus on the characteristics of the finished product. Knowledge of the methods used is important to identify relevant scientific questions that should be answered, just as knowledge of a new chemical process is necessary to determine whether chemical impurities may be present in the finished product and whose safety must be examined.

6. Research and commercial experience, especially in pharmaceutical products, in recombinant DNA technology have demonstrated the power and safety of this technique to modify genetic structure and function. There is no evidence of unique hazards associated with the new technologies and potential risks that may occur are the same in kind as those associated with conventional methods. Safety evaluation should be based on accumulated experience and scientific knowledge based on the characteristics of the finished food substance. Policies and practices that the Codex system may develop should be flexible to accommodate evolving scientific developments and the diversity of application of biotechnology.

II. DEFINITIONS

7. Applications of food biotechnology will involve most aspects of the Codex system. The Codex through its Commission and subsidiary committees has established definitions for food additives, contaminants, pesticide residues, and veterinary drug and hormone residues in food. These definitions have been used successfully in international food trade for many years. Applications of food biotechnology will not necessitate changes in the existing Codex definitions, rather the definitions will provide an established, accepted framework for new technology.

III. SAFETY EVALUATION AND BIOTECHNOLOGY

FOOD ADDITIVES

8. The definition of food additive as adopted by the Codex Alimentarius Commission (Procedural Manual of CAC, 6th Ed. p. 33) includes general substances that:

(i) are not normally consumed as food;

(ii) are not normally used as a typical ingredient of the food;

(iii) are intentionally added for a technological purpose, and

(iv) are intended to become a component (or affect the characteristics) of food.

9. The goal of many applications of new biotechnology will be to design improved source (production) microorganisms or to employ new organisms to produce food additives that are already on the market. Food additives produced by improved strains include well-defined substances with substantial history of safe use such as citric acid, propionic acid, succinic acid, lactic acid, glutamic acid, tryptophan, lysine and xanthan gum. The safety evaluation of those food additives produced by improved microorganisms should focus on factors such as:

(i) the identity of the host organism;

(ii) any evidence of pathogenicity or toxin production;

(iii) the function of the inserted gene(s);

(iv) the identity of organisms that contribute genetic material to the final construct;

(v) characterization of the inserted genetic material to ensure the absence of sequences that may encode harmful substances;

(vi) insertional and genomic stability;

(vii) chemical specifications;

(viii) dietary use and exposure and other relevant information.

This information can be used to determine whether the finished food additive is sufficiently equivalent (including potential impurities from the source organism) to the conventional product. Food additives produced by new technology that are sufficiently equivalent would not require extensive toxicological evaluation or new ADI's to be established. Food additives that deviate significantly from their conventional counterparts should be evaluated on a case-specific basis.

10. The Codex system has established procedures to review biological or natural products through the Codex Committee on Food Additives and Contaminants (CCFAC) and the Joint Expert Committee on Food Additives (JECFA). The products of new technology can be reviewed through the existing system. It will be important to establish priorities for review of food products developed through biotechnology because:

(i) many applications of biotechnology will result in minor changes to food additives or the production (source) organism;

(ii) the scientific questions involved do not differ fundamentally from those for conventional products, and

(iii) a review of all products of new biotechnology would greatly strain the resources of organizations such as the JECFA.

11. Biotechnology may yield some new food additives that have not been used in food or evaluated previously. New food additives can be evaluated by the established Codex system using fundamentally the same criteria and guidelines. The preliminary review should focus on the factors discussed above concerning the nature of the modified organism, chemical specifications, and dietary exposure that will establish the appropriate level of toxicological concern.

ENZYMES

12. The Codex considers enzyme preparations to be food additives or processing aids based generally on whether the enzyme is removed from the finished food during processing. In either case, the safety assessment procedures are conducted through the established mechanisms of JECFA and CCFAC. As is the case for other food additives, enzyme preparations derived from microorganisms modified by recombinant DNA methods will often involve incremental changes in traditional enzymes and microorganisms that may not warrant extensive review. for example, the gene for common enzymes such as amylase, glucoamylase, protease, lipase, catalase, lactase and glucose isomerase will be obtained from new organisms and cloned into traditional production organisms such as Bacillus subtilis, Aspergillus niger or Aspergillus oryzae. Such enzymes and organisms may be modified to increase gene expression by amplification or altered regulatory signals, to increase resistance to higher temperature or lower pH, to improve substrate affinity, or to improve other properties. Generally, common enzyme preparations and production organisms can be assessed in the light of the factors discussed above for food additives. Those enzymes judged to be sufficiently equivalent to conventional products would not require review. New enzymes or source organisms should be evaluated on a case-specific basis.

VIABLE MICROORGANISMS AS STARTER CULTURES

13. A number of foods are produced traditionally by the fermentative action of microorganisms; these include dairy products, meat and vegetables. Many applications of biotechnology will be to improve the functional properties of the culture, and these modifications can be evaluated by the factors discussed for food additives. In some cases, certain factors may present specific concern for starter cultures. A new gene product expressed by a starter culture may be considered in some cases as a new food additive, in which case it may need to be evaluated as such. The use of antibiotic markers that also have therapeutic uses may need to be carefully evaluated in the light of possible transfer of antibiotic resistance to pathogenic food-borne contaminants during processing or to human intestinal flora. Because of the above considerations, new microorganisms should be evaluated on a case-specific basis before being accepted for use as starter cultures.

TRANSGENIC AGRICULTURAL FOOD CROPS

14. The first transgenic food crops have been tested in small-scale field tests and are expected to reach the commercial market by 1992. These plants

contain single (or a few) well characterized genes that encode resistance to pests or disease, tolerance to herbicides, improved protein content, or improved shipping or processing qualities (e.g., delayed fruit ripening). The safety assessment should focus on the inserted traits and their stability in the food, rather than on the food *per se*.

15. Some food crops have been genetically engineered to express a pesticide in the plant. For example, the gene that encodes the delta endotoxin of *Bacillus thuringensis* can be inserted and expressed into tomatoes to make the plant resistant to insects. In this, or similar cases, Codex may wish to consider whether the incorporated pesticidal function should be included in existing maximum residue levels, whether new permitted levels should be set, or whether any other specification is needed.

TRANSGENIC FOOD ANIMALS

16. The first transgenic animals used for meat and poultry will be developed through the introduction of one or a few well characterized genes into traditional livestock breeding lines. The safety of these new breeds can be evaluated by asking fundamentally the same scientific questions that would be posed for new traits introduced by classical breeding based on the knowledge of the genetic changes introduced into transgenic animals and the health history of the modified animal line. If the product of the introduced gene is an animal drug, its safety should be evaluated in a manner similar to other animal drugs.

IV. DESIGNATION OF SUBSTANCES DERIVED BY BIOTECHNOLOGY ON LABELS OF FOOD PRODUCTS

17. There have been successive improvements in foods (bread, cheese, alcoholic beverages, vinegar) by changes in the production microorganisms, and these changes have not resulted in new names for the foods but the traditional name has been maintained. Likewise, new varieties of foods produced by conventional plant breeding have retained their traditional names. The Codex may consider that those products of biotechnology that are deemed to be safe and that are identical to traditional foods, food ingredients, or additives shall be designated on the labels by the common name of the food, food ingredient, or additive.

18. From the points of view of quality and identity, however, Codex may also have to give some consideration, in specific cases, as to whether genetically altered edible fruits, vegetables or animal products essentially retain the quality factors and composition of the original product, or whether this food represents a new product or a sub-species of the original food and would therefore warrant the use of a new common name.

SUMMARY

19. The Codex through its component organizations has been used successfully in international food trade for many years. Applications of new biotechnology can be evaluated under the existing Codex system as are other foods, food ingredients, food additives, pesticide residues, and animal feeds and drug residues. FAO and WHO should serve to disseminate information concerning these new technologies to member nations and to develop food safety assessments and guidelines as necessary to meet the needs of new technology.