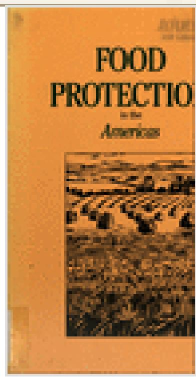
FROM THE ARCHIVES



Food Protection in the Americas (1987)

Pages
359

Size
5 x 9

ISBN
0309311098

Committee on the Inter-American Conference on Food Protection; Food and Nutrition Board; Commission on Life Sciences; National Research Council

FOOD PROTECTION
in the *Americas*

Committee on the Inter-American
Conference on Food Protection

Food and Nutrition Board

Commission on Life Sciences

National Research Council

National Academy of Sciences

NATIONAL ACADEMY PRESS
Washington, D.C. 1987

NATIONAL ACADEMY PRESS • 2101 Constitution Avenue, NW • Washington, DC 20418

NOTICE: The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the councils of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

This report has been reviewed by a group other than the authors according to procedures approved by a Report Review Committee consisting of members of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.

The Research Council was established by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and of advising the federal government. The Council operates in accordance with general policies determined by the Academy under the authority of its congressional charter of 1863, which establishes the Academy as a private, nonprofit, self-governing membership corporation. The Council has become the principal operating agency for both the National Academy of Sciences and the National Academy of Engineering in the conduct of their services to the government, the public, and the scientific and engineering communities. It is administered jointly by both Academies and the Institute of Medicine. The National Academy of Engineering and the Institute of Medicine were established in 1964 and 1970, respectively, under the charter of the National Academy of Sciences.

The work on which this publication is based was performed pursuant to Contract No. 223-84-2064 with the Food and Drug Administration.

Printed in the United States of America

Food and Nutrition Board

RONALD C. SHANK, Ph.D., Professor of Toxicology, Department of Community and Environmental Medicine and Department of Pharmacology, University of California, Irvine, California
ROBERT H. WASSERMAN, Ph.D., Professor, Department of Physiology and Chairman, Section of Physiology, New York State College of Veterinary Medicine, Cornell University, Ithaca, New York
MYRON WINICK, M.D., Director, Institute of Human Nutrition, College of Physicians and Surgeons, Columbia University, New York, New York

Ex-Officio Members

J. MICHAEL MCGINNIS, M.D., M.P.P., *Ex Officio*, Deputy Assistant Secretary for Health and Director, Office of Disease Prevention and Health Promotion, Department of Health and Human Services, Washington, D.C.
ARNO G. MOTULSKY, M.D., *Ex Officio*, Professor of Medicine and Genetics and Director, Center for Inherited Diseases, University of Washington, Seattle, Washington

National Research Council Staff

SUSHMA PALMER, D.Sc., *Director*, Food and Nutrition Board

Committee on the Inter-American Conference on Food Protection*

NEVIN S. SCRIMSHAW, Ph.D., M.D. *(Chairman),* Institute Professor and Director, International Food and Nutrition Program, Massachusetts Institute of Technology, Cambridge, Massachusetts

HAROLD J. SIMON, M.D., Ph.D. *(Vice Chairman),* Professor of International Health Policy and Director of International Programs, University of California, San Diego, La Jolla, California

JOHN E. DAVIES, M.D., M.P.H., M.R.C.P., Professor and Chairman, Department of Epidemiology and Public Health, Director, WHO/PAHO Collaborating Center for Human Pesticide Epidemiology, University of Miami, Miami, Florida

ROBERT B. GRAVANI, Ph.D., Associate Professor, Department of Food Science, Cornell University, Ithaca, New York

RICHARD L. HALL, Ph.D., Vice President, Science and Technology, McCormick and Company, Inc., Hunt Valley, Maryland

DIETRICH W. KNORR, Dr. Rer. Nat. Techn., Professor, Department of Food Sciences, University of Delaware, Newark, Delaware

RAJ K. MALIK, M.Sc., Chief, Food Quality and Standards Service, Food Policy and Nutrition Division, Food and Agriculture Organization, United Nations, Rome, Italy

ALEXANDER B. MORRISON, Ph.D., Chairman, Department of Food Science, University of Guelph, Guelph, Ontario, Canada

FERNANDO QUEVEDO, Ph.D., D.P.H., Regional Advisor on Food Safety, Pan American Health Organization, Washington, D.C.

*See Appendix B for further information on committee and staff.

Consultant

ABRAHAM HORWITZ, M.D., Director Emeritus, Pan American Health Organization, Washington, D.C.

National Research Council Staff

DARLA E. DANFORD, M.P.H., D.Sc., *Program Officer*
FRANCES M. PETER, *Editor*
CARMEN C. MARTINEZ, *Senior Secretary*
EILEEN B. GREEN, *WANG Secretary*
SUSHMA PALMER, D.Sc., *Director,* Food and Nutrition Board

Preface

The Food and Drug Administration (FDA) of the U.S. Department of Health and Human Services asked the National Research Council (NRC) to organize a Conference on Food Protection in the Americas and to prepare a report based on the Conference Proceedings. Accordingly, the Inter-American Conference on Food Protection was convened by the U.S. National Academy of Sciences from August 5 to 9, 1985, in Washington, D.C., to review the status of food protection measures in the Americas, to improve the public health, and to promote international trade in food. The Conference was concerned with both the safety of foods for consumption within countries and safety in the shipment of foods between countries. Nearly all countries were represented by officials concerned with food protection, and many specialists in various aspects of food safety also participated.

The overall objective of the Conference was to develop recommendations of direct practical value that the participants and their governments could use to accelerate progress in food protection activities in both public and private sectors. The conferees recognized that strategies for improvements in food safety would require legislation and infrastructure development, increased community participation, improved intercountry cooperation, better means of information exchange, identification of the most appropriate technologies, and enhanced education and training.

Additional sponsorship was provided by the Canadian Department of Oceans, the Food and Agriculture Organization (FAO) of the United Nations, the Food Safety and Inspection Service of the U.S. Department of Agriculture (USDA), the Health Protection Branch of Health and Welfare Canada, the National Marine Fisheries Service of the U.S. Department of Commerce (DOC), the Office of Pesticide Programs of the U.S. Environmental Protection Agency (EPA), the Pan American Health Organization (PAHO), and several sponsors from the food industry (Coca-Cola Company, CPC International, Inc., General Foods Corporation, H. J. Heinz Company Foundation, Kellogg Company, National Pork Producers Council, McCormick and Company, Inc., PepsiCo, Inc., Pillsbury Company, and Proctor and Gamble Company).

In October 1984, the National Academy of Sciences/National Research Council (NAS/NRC) convened a Committee on the Inter-American Conference on Food Protection under the auspices of the Food and Nutrition Board (FNB). The Committee was charged with organizing the Conference and ensuring participation by the needed experts and appropriate food control and public health authority representatives from the countries of the Americas.

To provide requisite expertise for the Conference, the Committee's multidisciplinary membership included specialists in food science and technology; food safety and related fields of toxicology; epidemiology; nutrition; food regulatory affairs and related fields such as food standards, food law, and infrastructure development; and international health and trade policy issues. Acknowledged experts were commissioned to write papers on the principal topics for presentation and discussion at the Conference.

The Committee's task appeared formidable in part because of the short lead time before the scheduled Conference. Two factors made it possible to organize what was to be a highly successful Conference. First, an interagency steering group had already identified the critical issues and proposed an agenda for the Conference that formed the basis of the Committee's planning. Second, an extraordinary degree of enthusiasm and cooperation characterized all who became involved in the project, both in the preparatory stages and during the actual Conference. This spirit of cooperation was essential because the format of the meeting called for the development of an Action Plan.

On the basis of the five plenary sessions and discussion summaries, four working groups and two task forces, and a full day of country reports, all of which make up the body of the Proceedings, the chairs of these groups and sessions met to draft an Action Plan that was unanimously adopted by the Conference. The Conference Proceedings are thus the work of many dedicated and knowledgeable people, and the Action Plan represents a consensus based on their first-hand experiences.

The success of the Conference will be determined by the degree to which the Action Plan is implemented. Of necessity, this will depend upon the commitment and actions of the individual governments, the cooperation of the food industry in its own self-interest, increased manpower development for work at all levels involving food protection, and development of better information about the requirements for food safety on the parts of food handlers and the general public.

As the Action Plan suggests, the international agencies—the Pan American Health Organization and the Food and Agriculture Organization of the United Nations—play important leadership roles in mobilizing resources, stimulating international actions, and providing technical assistance to individual countries upon request. The cooperation of the United States and Canada will be of particular importance in this respect because of the advanced state of their food protection systems.

This volume begins with the Action Plan produced during the Conference (Section I). Section II contains the Committee Report, and Section III comprises the Conference Proceedings themselves. Section III begins with the plenary presentations (Session 1) and continues with discussions of the principal problems concerning food safety in the Americas (Session 2): food hazards and health issues, food control infrastructures and mechanisms, recurring problems in the international trade of food, and international food standards and trade. Session 3 includes food protection activity reports from the United Nations University (UNU), the World Health Organization (WHO), PAHO, and FAO. Individual country reports are also summarized in Session 3. Working group reports (Session 4) focused on four important topics: Legislative and Infrastructural Needs for Food Control; Food Inspection, Monitoring, and Enforcement; Improved Food Handling and Good Manufacturing Practices; and Intercountry and Regional Cooperation. These are supplemented by reports of Task Forces on Education and Training and on Information Systems.

The Committee's Report (Section II of this volume) is based on the Conference, the Action Plan, and deliberations of the Committee. It consists of an Executive Summary, which outlines the major findings and outcomes of the Conference and the Committee's conclusions and recommendations. The Conference agenda, magnitude of food protection problems, and objectives of the Conference are discussed in the second chapter. The issues raised in the commissioned papers and the discussions at the conference are summarized in Chapter 3. Chapter 4 describes the outcomes of the Conference (Conference Proceedings and the Action Plan) as well as the intangible outcomes. The Committee's comments and conclusions are presented in Chapter 5.

This Committee Report was reviewed in accordance with procedures established by the NAS/NRC. The Action Plan was reviewed by the participants at the Conference and has been widely disseminated in English, Portuguese, and Spanish. The Conference Proceedings were not subject to review. The Conference was conducted in English, French, Portuguese, and Spanish, and this volume is available in English and Spanish.

The Committee believes that the findings and recommendations in its Report, the Action Plan, and the Proceedings are applicable not only to the Americas but also to the entire world. Safe food is important for maintaining the health of all the world's peoples, and for preventing losses that occur when food is rejected both within and across national borders.

ACKNOWLEDGMENTS

The Committee appreciates the support it received during the Conference from country delegates, food industry representatives, government workers concerned with food safety in Latin America and the Caribbean, and individual scientists from universities and research institutions.

Various agencies provided invaluable assistance to the success of the Conference. Special thanks are due to three people from the FDA: Merton Smith of the International Affairs Staff; John Lupien, Director of the International Affairs Staff; and Elizabeth Campbell from the Center for Food Safety and Applied Nutrition. The Committee is also grateful to Karen Mitzner of the International Nutrition Foundation, Dieter Koch-Weser of the Educational Development Center, Alan Oslic and John Gardner of the U.S. Department of State, the staffs of the embassies of the participating countries in the United States, representatives of the U.S. Agency for International Development (USAID), and the FAO and PAHO representatives in the participating countries.

The Committee wishes to commend and thank particularly the FNB Program Officer for the Committee, Darla E. Danford, for her dedication and effectiveness. The Committee acknowledges the dedicated administrative and secretarial assistance provided by Carmen C. Martinez, Eileen B. Green, Susan G. Barron, Shirley A. Ash, and Vernelle C. Menkir, also of the FNB staff, and the cooperation of others from the NRC, including Sushma Palmer and Robert E. Rehwoldt of the FNB, Alvin G. Lazen and Frances M. Peter of the Commission on Life Sciences, Nancy E. Geasey and Robert A. Smith of the Meetings Office, and Gail J. Porter of the Office of Government and Public Affairs.

Contributing to the success of the Conference was the assistance received from the steering group members, including Sanford A. Miller of the Food and Drug Administration, Chairman, whose support deserves special acknowledgment; Primo Arambulo III, Veterinary Public Health Program, PAHO; Gene Cope, National Marine Fisheries, DOC; Paula Feeney, USAID; Mário Fernandes, Veterinary Public Health Program, PAHO; C. H. Pals, Deputy Administrator, USDA; J. F. Riou, Director, Bureau of Field Operations, Health and Welfare Canada; and Susan Sherman, Office of Pesticide Programs, EPA

Special thanks go to PAHO for providing excellent facilities and services, including the Spanish translation of this report, and to the many PAHO staff members who made the Conference function, including Luis Gonzales, Conference Officer, Pericles Stussi, and the other interpreters; Janice Barahona, Muriel Vasconcellos, and the other translators; and Marcela Bacigalupo, Food Protection Secretary; and secretaries and other support staff.

NEVIN S. SCRIMSHAW, *Chairman*
Committee on the Inter-American
Conference on Food Protection

Contents

SECTION I
ACTION PLAN

SECTION II
COMMITTEE REPORT: RECOMMENDATIONS FOR FOOD PROTECTION IN THE AMERICAS

SECTION III
PROCEEDINGS OF THE INTER-AMERICAN CONFERENCE ON FOOD PROTECTION

Session 1: Introduction to the Conference and Conference Objectives

Session 2: Issues in Inter-American Food Protection and Trade

Session 3: Activities of International Agencies and of Nations

Session 4: Recommendations for Improved Inter-American Food Protection

SECTION I

ACTION PLAN

Inter-American Conference on Food Protection

Introduction

In August, 1985, a week-long Conference was held at the Pan American Health Organization in Washington, D.C. This Conference consisting of reports of the plenary sessions, individual countries, working groups, and task forces form the basis for the most important outcome of the Conference, the Action Plan. The draft of this plan, as prepared by the task force, was discussed in plenary session, amended on the basis of the discussion, and then approved unanimously by the Conference delegates.

During the Conference high-level government officials, representatives, and participants from 33 countries in the Western Hemisphere, France, the Netherlands, and the United Kingdom urged prompt implementation of the Action Plan to upgrade standards for food protection in order to enhance food trade and improve public health throughout the Americas. After years of inadequate recognition of the magnitude and importance of the problems of food safety by all but a few trained and involved professionals, there was consensus on the parts of country and industry representatives and policymakers on the steps that should be initiated promptly.

The two most directly concerned international agencies, the Pan American Health Organization (PAHO) and the Food and Agriculture Organization (FAO) of the United Nations, are asked to begin at once to develop their own 5-year action plans for strengthened programs to ensure adequate food protection in the Region. They are also urged to seek additional funds to establish a joint secretariat, housed within PAHO headquarters in Washington, D.C., to help build the diverse capacities required to deal effectively with existing and emerging problems.

Action Plan

INTER-AMERICAN CONFERENCE ON FOOD PROTECTION WASHINGTON, D.C. AUGUST 5-9, 1985

INTRODUCTION

The safety of the food supply markedly influences public health. Contaminated food and/or water play major roles in the causation of diarrheal diseases, which are leading causes of death in the developing countries of Latin America and the Caribbean. Food wastage, resulting from inadequate food sanitation and improper food handling, storage, and distribution systems, contributes to the chronic malnutrition that affects millions of infants and children in the developing countries. Food losses also adversely affect the development and economic well-being of the peoples of Latin America and the Caribbean.

Both raw and processed foods are of great economic importance to the countries of the Region as sources of income necessary for development. Serious interruptions in the international trade of foods and large losses to shippers from developing countries occur because of the lack of adequate food quality and safety mechanisms in many food-producing, processing, and marketing systems. The strict requirements of many importing countries with regard to food standards, labeling, and contaminants mandate that countries establish adequate governmental and industrial systems to assure quality and safety if large scale losses are to be prevented.

Foregone export markets and other economic limitations, together with the serious public health consequences of low-quality foods, present arguments for the development of programs of food protection by governments with the support of international organizations and the private sector.

Based on examination of background papers, plenary and working group discussions, and country and task force reports, the Conference adopted the following five-year Action Plan for food protection in Latin America and the Caribbean.

GENERAL OBSERVATIONS

The plan of action to improve food protection in the Americas should be considered in light of a series of complex, interrelated problems that have impeded progress in the past. As identified by the working groups on Legislation and Infrastructural Needs for Food Control; Food Inspection, Monitoring, and Enforcement; Improved Food Handling and Good Manufacturing Practices; and Intercountry and Regional Cooperation, as well as the task forces on Education and Training, and on Information Systems, these problems include the following:

Major Differences in Levels of Development

The Americas Region is characterized by extreme diversity. At one end of the spectrum, some countries are highly developed economically and have food protection programs in place, which, in the main, provide reasonable assurance against unsafe or fraudulent foods. On the other hand, many developing countries of the Region are struggling to provide services of all types, including necessary food protection, to their populations. Social and economic problems of the developing countries are accentuated by rapid but disorganized urban growth, rising unemployment, decreasing purchasing power and increasing dependence on imported foods, and heavy foreign debt loads.

Inadequate National Commitment to Food Protection

A recurring problem in many countries of Latin America and the Caribbean is the lack of a firm national commitment to a safe food supply. Many countries do not yet have a clearly defined national food control policy. Enforcement of existing laws is often sporadic and deficient.

Fragmentation of the Food Sector

In many countries the food systems are fragmented, and formal and informal sectors exist simultaneously. Small-scale producers and processors do not have the necessary technical know-how or access to appropriate advisory services.

Legislative and Regulatory Deficiencies

In many countries food legislation is incomplete or duplicative; either situation can result in lack of clear assignment of responsibility for food protection. Failure to separate the basic food law from regulations makes legal changes in response to technological and scientific advances extremely difficult to achieve. Codes of technological and hygienic practice and similar guidelines often are nonexistent.

Lack of Coordination at National Levels

In most countries, several government ministries share responsibilities for food control. Under such circumstances, effective food control is possible only if a very high degree of interministerial cooperation and coordination exists. Unfortunately, fragmentation and duplication of efforts and competition for resources often occur.

Infrastructural Problems

In addition to legislative and regulatory deficiencies, serious problems result from the lack of or inadequate use of the infrastructures necessary for food control. At the same time, many small- to medium-sized firms lack the financial resources and physical facilities for proper quality assurance. The social and economic problems mentioned earlier encourage the proliferation of street vendors of food. These are almost completely outside any system of control and can give rise to serious public health problems.

Lack of Trained Personnel

A serious lack of trained personnel is apparent in many countries. These personnel include inspectors, food analysts, managerial and legal experts, and others in the public sector who deal with food control. There is also a lack of analogous personnel in the industrial sector at all points in the production-processing-distribution-marketing chains.

Information Needs

A vast array of information is needed for adequate control over the safety and quality of foods. These needs range from technical and commercial information required by regulatory officials and industrial firms to the need by consumers to have timely and effective information that will permit them to make appropriate choices regarding food safety and quality. In none of the countries of the Region is this array of information fully available, but the situation in developing countries is more serious and requires prompt improvement.

Participation in Promoting Acceptance and Application of International Standards

Many countries continue to have problems in accepting and applying the Codex Alimentarius standards for foods. The lack of attendance of technical personnel at the meetings to develop international food standards impedes the expression of the interest of the countries, does not allow for full understanding and commitment to the standards and their application, and is detrimental to the protection of consumers and to international trade.

THE NEED TO SET REALISTIC PRIORITIES

Faced with this variety of problems, it is necessary for national governments to determine realistic priorities and attainable objectives within the context of their own social, economic, and political realities. Each country must choose its own path in developing and applying food protection programs. What is appropriate in one country may not apply in another because of differences in stages of development, size, availability of human or financial resources, and differences in political systems or sociocultural characteristics. No country can by itself effectively meet all the requirements for fully effective food protection. International cooperation is needed. Current national and international food protection programs require strengthening, augmentation, and periodic reorientation in light of changing priorities.

GENERAL RECOMMENDATIONS

- Countries should update and/or unify national food laws, using the FAO/WHO model food law as a guide, with appropriate adaptation to the needs of each country. Interministerial cooperation and coordination are required. PAHO and FAO should continue to provide needed assistance to countries upon request.

- Countries should accept and apply food standards and other recommendations of the Codex Alimentarius as fully and as rapidly as possible, including the codes of technological and hygienic practice. The Regional Codex Coordinating Committee for Latin America and the Caribbean should play an important role in stimulating acceptance and implementation of Codex standards and other recommendations.

o International food shipments rejected by an importing country because of noncompliance with safety requirements should not be reshipped to other countries, and a mechanism should be developed to quickly inform other countries of such shipments. The food industry and trade should accept and comply with the Codex Code of Ethics for International Trade in Foods.

o Countries should, within a legal framework, establish or strengthen interdisciplinary, interministerial national coordinating committees for food regulation. Whenever possible such committees should also serve as national Codex Committees with responsiblity to ensure proper dissemination of information about Codex matters among and within national government agencies, industry, and consumer organizations.

o Countries should strengthen national food control, monitoring, and surveillance programs, and improve food handling systems. The functioning of existing government laboratories should be strengthened.

o Stimulus should be provided for the designation of regional reference laboratories that can carry out highly specialized analyses to satisfy the eventual needs of other countries in the Region in which their establishment is not feasible.

o Upon request, importing countries should provide analytical, monitoring, and surveillance information to assist exporting countries to meet requirements.

o The important role that the food industry and trade associations can play in food protection should be considered by national authorities. The industry and these associations should be kept fully informed about problems and potential solutions and should implement complementary programs among their members.

o Food must be both nutritive and safe; national food and nutrition policies and programs must, therefore, include food safety as an integral component.

SPECIFIC RECOMMENDATIONS: REGIONAL ACTION PLAN

The Conference requests that PAHO and FAO jointly develop a five-year Action Plan for strengthened programs to assure adequate food protection in the Region. The Conference established the following frames of reference for such a Plan:

- the plan must be designed to utilize all the skills and available resources existing in all countries of the Region;

- the plan must incorporate the concept of a single focus to assure coordination, efficient planning, and proper control of these efforts;

- the plan must be designed to utilize and integrate existing instruments of cooperation, such as the collaborating centers mechanism of FAO and PAHO, bilateral agreements between countries and the regional Codex Alimentarius Coordinating Committee;

- the plan must include evaluative components that regularly analyze the progress of each part of the plan and its programs; these evaluations should be used to modify existing plans and programs as well as to develop future activities.

The Conference identified four broad areas for regional cooperation among countries in matters of food protection. These are:

Manpower Training and Development

Governmental Sector

Opportunities and financial support should be provided for training inspectors, analysts, administrators, lawyers, and others involved in food protection in the Region, including those concerned with instrument maintenance and repair. Needed training should, wherever possible, be provided in agencies and institutions within the subregion, such as a FAO/PAHO Collaborating Center, industrial laboratory, or elsewhere, as determined by the availability of resources and needs of the individual trainee. Those trained should be awarded fellowships/training grants covering transportation, living costs, and tuition. Candidates, estimated at 200 per year, would be proposed by national governments. The duration of training would vary with the needs, but would in general be for a period of one to six months. Necessary analytical and other equipment required for demonstration and training purposes should be provided to the training institutions.

Food Industry and Food Service

There must be a different, but parallel and complementary, effort to develop and implement appropriate education and training programs in good manufacturing practices directed at managers and key employees of food processing and handling establishments. In comparison with the training of inspection and monitoring personnel discussed above, these programs will be less technical and more country- and industry-specific. The primary target is the small industry with few or no technical personnel, but these programs can be utilized by all industries. The effective design of such programs will require substantial input from all appropriate professional and technical personnel, including those responsible for food control. To be effective, programs must receive both participation and financial support from industry.

Technical Support and Advisory Services

Technical support and advisory services should be provided in specific priority areas determined by the national authorities and at the request of the government involved. These could, inter alia, take the form of consultancies, workshops, secondments, analytical reference services, and related support to institutions. The activities should also include facilitating bilateral interactions between developing countries and developed countries.

Information Exchange and Consumer Information

Information should be collected, processed, and provided by a centralized unit located at PAHO Headquarters. Examples of such information include:

- o sampling and analytical methodology
- o food standards
- o regulatory requirements and Codex acceptance status of various countries, including timely updates on regulatory and other changes likely to influence international trade
- o scientific and technological data on such problems as food contamination and adulteration
- o epidemiological data on diseases transmitted through food
- o governmental or commercial rejections, market withdrawals, and similar actions
- o planned training and educational activities in countries of the Region
- o availability of skilled personnel for consultancies and other functions

Dissemination of information on consumer issues should be an important aspect of the work. Particular emphasis should be placed upon safe food handling at the street-vending, food-service, and household levels.

In addition, workshops and meetings to exchange technical and scientific information should be held.

Research, Institutional Support, and Evaluation

High priority should be given to specific research topics, and financial support provided as necessary. Examples of such high-priority research include:

- o quantification of the nature and extent of foodborne disease in developing countries of the Region and the health benefits of food control;
- o measurement of the economic benefits derived from food control policies;
- o the social, economic, and health aspects of street vending of foods;

o improvement in microbiological and functional quality of food and reduction of post-harvest losses.

Provision should also be made for limited institutional support required to carry out research projects and special investigations. The program should be evaluated periodically and adjusted or modified as indicated.

ESTIMATED ADDITIONAL RESOURCE REQUIREMENTS

PAHO and FAO already provide significant resources to support development of food control programs in the Region. Additional resources are, however, urgently required to build capacities of the diverse types required at the speed necessary to deal effectively with existing and emerging problems.

For an initial five-year period of the Plan, the annual costs are estimated as follows:

	U.S.$ per Year
Manpower Training and Development of Human Resources	2,600,000
Technical Support and Advisory Services	500,000
Information Exchange and Consumer Information	700,000
Research, Institutional Support, and Periodic Evaluations	1,200,000
Total	5,000,000

Note: These are indicative figures only. They require refinement and quantification but are of value for illustrative and comparative purposes.

POTENTIAL SOURCES OF FUNDING

The Conference identified the following potential sources of funding which, inter alia, should be approached for financial support:

- international financial institutions
- developed country donor agencies (such as USAID, CIDA, IDRC)
- industrial organizations and other nongovernmental organizations

In addition, "in-kind" support and other alternatives should be sought from national authorities and industrial organizations.

MEANS FOR ACTION

- It is recommended that a small working group be established, under the auspices of PAHO and FAO, to prepare a detailed program and budget, using these recommendations as its frame of reference. It should complete its work within one year and be supported by PAHO/FAO. Work of other agencies relevant to the subject area should be taken into consideration.

- It is recommended that FAO/PAHO, with the support of the governments of the Region, present the requested project proposal as quickly as possible to potential donors for financial support.

- Given the urgency of the problems, the Conference recommends that PAHO and FAO strengthen their activities in food protection now and not await the formal development and implementation of the new Action Plan in its entirety.

COORDINATION AND FOLLOW-UP COMMITTEE

The executive agencies should establish a Coordination and Follow-Up Committee to provide advice and orientation and to monitor implementation of the technical aspects of the Action Plan program. The Committee could consist of seven to nine members representing member governments and donors, and could also include technical experts selected in their individual capacities. The Chairman of the Codex Coordinating Committee for Latin America and the Caribbean should be a member. The Committee should meet at least once yearly to evaluate the implementation of the Action Plan program and to report to PAHO/FAO.

SECTION II

RECOMMENDATIONS FOR FOOD PROTECTION IN THE AMERICAS

Committee on the Inter-American Conference on Food Protection

1

Executive Summary

BACKGROUND

In August 1985, an Inter-American Conference on Food Protection was held at the headquarters of the Pan American Health Organization (PAHO) in Washington, D.C. The Conference was organized by a Committee appointed by the National Academy of Sciences/National Research Council (NAS/NRC) under the auspices of the Food and Nutrition Board (FNB) of the National Research Council's Commission on Life Sciences (CLS). In addition to organizing the Conference, the Committee was asked to ensure participation by the appropriate experts and food control authorities from the countries of the Americas. The Committee had been asked to focus particularly on the following food-related areas:

- consumer protection
- trade
- current national food control programs
- assessment of needs
- strategies for improvement

The Committee commissioned acknowledged experts in these fields to prepare papers for presentation and discussion at the Conference. These, together with the results of the concerted activities of working groups composed of country delegates and technical experts, are recorded in the Conference Proceedings, and led directly to the formulation of an Action Plan which was unanimously adopted by all 36 country delegates.

FINDINGS AND RECOMMENDATIONS

The major categories of risks from unsafe foods are microbiological hazards (NRC, 1975), toxicants and environmental contaminants, and improperly used pesticides and food additives (FAO/WHO, 1985a,b). Reliable statistics on the incidence of foodborne diseases or intoxications do not exist, and gross underreporting appears to be the rule (Puffer and Serrano, 1973). Chronic malnutrition magnifies the adverse effects of food hazards (Black et al., 1983; Chen, 1983). Risk reduction depends on public health monitoring, an effective system of food control, trained and motivated personnel in health, agriculture, and industry, and an educated public that demands quality and safety.

Foods themselves are vulnerable to attack by microorganisms, insects, rodents and other pests, resulting in direct food losses or removal of unfit foods from human food marketing systems. Food production, harvesting, storage and processing systems should be designed to reduce or eliminate such problems and, at the same time, assure that raw or processed foods meet at least the legally set minimum levels of quality and safety. An improved food system must ensure integrity of food for the consumer so that problems of contamination and adulteration are avoided.

The food industry in the Americas consists of many small- or medium-sized firms that often lack the resources or the knowledge necessary for effective food control, monitoring of food safety criteria, and proper storage, transportation and distribution of their products. The infrastructure for improved food handling and expertise necessary for proper quality control of foods in the production, processing, storage and distribution chain are lacking in many areas of the Region. Consequent food losses can amount to 50% of production (PAHO/WHO, 1982). A large number of small food distribution outlets compound the problems. Preparation and sale of foods through the informal sector prevalent in most of the countries of the Americas, i.e. sale of food through street vendors, was a focus of considerable concern at the Conference.

National authorities, both in the interests of the health of consumers and the country's economy in terms of prevention of food losses and promotion of trade, have a special responsibility to design and implement an effective system for food control. Such a system would be based on a basic legal and regulatory framework, an infrastructure consisting of food laboratories and inspectorate, monitoring and enforcement components, and an economic, political, and social climate that permits and demands the success of the system. To succeed, the system must be adapted to the particular needs and conditions of each country and involve active cooperation between government, food industry, academia, and consumer groups. As all the countries of the Americas are interdependent for food supplies, food protection requires international cooperation. No country by itself can meet all the requirements of a fully effective program for the protection of the nation's food supply, when such supplies are received from all over the world and the country is also an exporter of foods.

Food producers and manufacturers have a social responsibility to produce and distribute good quality foods. An effective governmental structure for food control and food protection requires the commitment of all involved parties, including consumers, industry, governments and the academic community. Food protection should therefore not be viewed only as a governmental activity but requires cooperation from the food industry and trade sectors.

Lack of harmonization of standards among food importing and exporting countries can result in adverse economic repercussions and nontariff trade barriers, and generally impedes international food trade. Corrective actions, both technical and financial, are needed to redress such problems. A useful and necessary approach toward harmonization is the widespread acceptance of and adherence to international food standards as developed by the Codex Alimentarius Commission. Acceptance of the Codex standards by industrialized countries of the Americas would stimulate international trade and, in turn, assist developing countries of the region. A common practice in developing countries is to apply international standards only to products destined for export. This raises many problems of quality assurance for such products and for those destined only for domestic use. The industrialized countries of the Americas can do much to assist their developing country neighbors to cope more effectively with the issues pertinent to international trade in foods. International agencies, such as FAO and PAHO, can provide technical support for the efforts of the developing countries to strengthen their capabilities in food control to meet the requirements of international food standards, both for domestic consumption and for export.

An integrated and effective food protection system in the Americas depends upon the development of well planned, organized, and implemented education and training programs in every country of the Region. Such programs can, in the long run, further the implementation of food control laws and regulations, and promote food quality control measures at different stages of the food processing and distribution chain. In the long run, they can help reduce the incidence of foodborne diseases and expand trade. Development of appropriate programs requires a national commitment to provide adequate resources to obtain improvements in food quality and safety, support from the international agencies, governments and food professionals in the Region, as well as effective communication among them about problems and accomplishments. Such communication should be facilitated through periodic conferences and the establishment of a clearing house for the collection, dissemination, and exchange of information.

At the same time there is a great need for intercountry and regional cooperation in food protection to achieve meaningful long-term solutions to the complex interrelated problems which impede food control in the Region. Cooperation must involve governments of developing and industrialized countries of the Region, international agencies such as FAO and PAHO, the food industry and other private groups, national donor agencies, and international financial institutions. Use should be made of various existing regional or global mechanisms, i.e. the regional Codex Coordinating Committee for Latin America and the Caribbean.

Although not specifically addressed by the Committee or by the Conference, the importance of identifying and assigning priorities to research needs and the necessary resources therefore is self-evident. Note should be taken of emerging technologies and of newer food products which, in years to come, may influence consumer habits and thus food production, processing, and trade. Toward that end, consideration should be given to convening a meeting of experts to address the research needs and priorities, and to develop specific recommendations for their implemention.

OUTCOMES OF THE CONFERENCE

The Conference was characterized by an unusually high level of personal interest in and commitment by all participants to the achievement of its objectives. As a direct consequence, it yielded two important tangible products: the Action Plan, pages 5-15 and the Proceedings, pages 59-324. The Action Plan is the direct outcome of the plenary discussions and the activities of the working groups and task forces. It addresses matters of food safety and control of immediate importance to the 36 countries of the Region. It also addresses the problem issues and the mechanisms necessary for effective international cooperation on food safety and control, and recommends strategies and tactics for their implementation. As detailed in pages 5 to 15, the Action Plan calls for updating and unifying national food laws by using the FAO/WHO model as a guide, accepting and applying international food standards, strengthening interdisciplinary and intragovernmental coordination of food regulation, improving national food control and surveillance programs and the functioning of national and regional food monitoring laboratories, training the individuals needed for the required professional and paraprofessional tasks, and supporting the important roles that the food industry and trade associations must play in food protection.

Less tangibly, but not less importantly, the Conference opened and strengthened channels of communication among agencies, officials, and experts in the diverse countries of the Americas. The desire of the international agencies to further the causes of food protection in the Americas was readily apparent and contributed significantly to the achievements of the Conference.

COMMENTS AND CONCLUSIONS

The strong consensus among all Conference participants on each issue, and on the actions required to address them, reinforces the Committee's belief that the problems and needs were appropriately identified by the Conference. The Action Plan comprehensively and appropriately addresses these problems and needs, and was deemed feasible by the participants despite the great diversity in backgrounds, needs, and resources among the 36 countries of the Region. In agreement with the Conference's conclusions about the inadequacy of food control infrastructure, and problems with laboratories and other support facilities within the Region, the Committee specifically emphasizes the urgent need for development and funding of a regional initiative as proposed in the Action Plan to improve human resource development, technical capabilities, research, information exchange, consumer education, institutional support, and periodic program evaluation.

The Committee is convinced that the rationale behind the Action Plan is sound, and that its unanimous adoption by country representatives is fully justified. The Committee is also convinced that prompt and effective implementation of the Plan and consequent progress toward food protection in the Americas depends on cooperative interactions among the countries and on initiatives still to be taken by the countries, themselves. The leadership and technical support capabilities provided by PAHO and FAO should be utilized and augmented by the technical resources available through the food protection agencies of the United States and Canada.

2

Introduction and Background

THE CONFERENCE AGENDA

The Conference agenda dealt with food safety and consumer protection issues, including microbial contamination, pesticide residues, other food contaminants (such as mycotoxins), additives, food processing practices, labeling, and commercial fraud. In examining issues of trade, the Committee focused on nontariff trade barriers, food standards, and recurrent problems in the food trade.

Current national programs for ensuring quality and safety of foods were examined for their adequacy, quality protection during production, harvesting, processing, storage and distribution, provision of extension and advisory services, introduction of good pest control practices, and for their capability to deal with issues relating to the export of foods. Against this technical background, participants examined policies and strategies, legislation, regulation, food control infrastructure, and interministerial and international cooperation.

A major focus of the Conference concerned strategies for improvement of food control. Topics reviewed included development of the infrastructures, legislation, appropriate technologies for improved food handling, community participation, intercountry cooperation, information exchange, and appropriate education and training of personnel. These discussions culminated in recommendations comprising a five-year, $25 million Action Plan.

NATURE AND MAGNITUDE OF THE PROBLEMS

Trade

In 1985 the United States alone imported more than $8.5 billion worth of foods from the countries of the Americas. In the same year, the United States detained 2,450 food shipments from these countries involving more than 51 thousand metric tons of food valued at $72 million (FDA, 1986). Of these actions, 33% involved rejections because of mycotoxins (natural toxicants); 26% were due to filth; and problems with labeling, chemical contamination, microbiological contamination, and other unsafe practices and conditions accounted for the remainder.

Failure to meet food safety standards is equally significant for domestic trade. Recalls often occur in response to an outbreak, consumer complaints, or governmental inspections. Whatever the reason, recall is expensive. In Canada, for example, 272 recalls of food worth $403,631 were ordered between April 1982 and March 1983. During the same period, 33 products worth more than $205,785 were seized. The time spent by the government in making these recalls amounted to about one-third the cost of the products, for another $200,000 (Todd, 1984).

As the lack of harmonization between various international food standards can create nontariff trade barriers, the work of the Joint FAO/WHO Codex Alimentarius Commission in developing worldwide food standards and codes of practice assumes great importance. Most countries of the Region are members of the Codex Alimentarius Commission. Notwithstanding, failure to adhere to recognized food standards and the resulting attempts to sell foods of inferior quality are the primary causes of food detention or rejection within the Region. Rejections and detentions in the food trade will continue until common standards are accepted by all nations, and the food industry, trade and national authorities ensure that foods do, in fact, conform to these standards. Better utilization and enforcement of Codex standards is the recommended approach.

Public Health

The magnitude of the problem of foodborne diseases, especially diarrheal diseases, is not known with any accuracy. In many countries surveillance of foodborne disease is passive and depends on voluntary reporting. It is generally accepted that the true incidence of foodborne disease is underreported and that economic losses may be underestimated (Archer, 1985). Studies suggest that the ratio of actual to reported cases varies between 25 and 100 to 1 (Todd, 1984).

Recent estimates indicate that at least 24 million and perhaps as many as 81 million cases of foodborne diarrhea occur in the United States each year (Archer, 1985). The economic impact of foodborne diseases in the United States alone has been estimated to range from $1 to $10 billion annually (Todd, 1984). This figure includes direct medical costs, lost wages and productivity, and industry loss through embargo, voluntary destruction, and recall. Salmonellae appear to be responsible for great losses, estimated at between $774 million and $1,200 million annually (Todd, 1984).

Systematic attempts at isolation and identification of the etiologic agents of foodborne illness in developing areas is at least as scattered and incomplete as the reporting of the outbreaks themselves. The few published studies tend to focus on the common occurrence of enteropathogenic _Escherichia coli_, _Staphylococcus aureus_, _Clostridium welchii_, and _Bacillus cereus_. But it is probable that these seem prominent, not only because they do occur widely, but also because they are the species most often looked for. The study by Jiwa et al., (1981) on food and water in an Ethiopian community suggests that in fact a very broad spectrum of enterotoxigenic organisms actually occurs. Even these scanty data make clear that the first priority must not be particular etiologic agents, but rather control measures to eliminate all contamination.

Contaminated food and water are major factors in the high prevalence of infant diarrhea in the Americas. Even when not fatal, diarrhea precipitates or severely exacerbates malnutrition (Black et al., 1983; Chen, 1983). In 35,000 cases studied, 56% of the deaths due to malnutrition were caused by diarrhea and measles (Puffer & Serrano, 1973). For the developing countries (exclusive of China), it has been estimated that 10 children under the age of 5 years die from diarrhea every minute of every day of the year (Snyder and Merson, 1982).

Nondiarrheal foodborne diseases also represent important problems. These range from intoxications to viral, microbial, and parasitic infections. Some of these manifest as acute illnesses with high death rates. Others appear as chronic diseases and disabilities, resulting in decreased productivity. The costs of treatment associated with foodborne diseases and the losses of productivity and earnings resulting from foodborne-disease related morbidity and mortality impose economic and health burdens on all countries.

According to WHO (1984), approximately 500 million people travel as tourists every year, and more than 50% of them experience diarrhea. From 20% to 50% of these cases are caused by enterotoxigenic *Escherichia coli*, Rotavirus, and other infectious agents transmitted through contaminated food and water (WHO/FAO, 1984).

Adherence to good food handling practices and improved utilization and enforcement of international standards through effective food control systems can provide enhanced consumer protection.

Finally, the presence of chemical contaminants such as arsenic, lead, mercury, cadmium, PCBs, dioxins, mycotoxins, and drug residues in foods is of increasing concern for the public health in all countries involved in international trade. However, many of these substances are of environmental origin and beyond the direct control of the food producer or manufacturer (Haworth, 1983).

OBJECTIVES OF THE CONFERENCE

Inadequate food safety and quality problems can exert major impacts on international trade in food and on the health status of populations. Given the importance of these impacts, there was a need for a consensus statement that would stimulate appropriate actions by policymakers.

The overall objective of the Conference, therefore, was to develop recommendations of direct, practical value that the participants and their governments can use to accelerate progress in food protection activities in both public and private sectors.

The specific objectives were:

- o to initiate closer and more effective communication among all countries in the Region on matters relating to food safety and quality;
- o to establish priorities and develop recommendations to foster cooperation toward improving food protection activities in all countries of the Region;
- o to improve collection and dissemination of appropriate data concerned with food control, food regulations, food contamination and public health problems, including epidemiological data; and
- o to identify and implement ways to educate and train individuals in food control procedures.

Strategies for improvement in food control are expected to include:

- o legislation and infrastructure development;
- o increased community participation;
- o improved intercountry cooperation;
- o better means of information exchange;
- o identification of technologies most appropriate for each level of production, processing and distribution; and
- o enhanced education and training programs.

The Committee recognized that to be useful, the Conference participants' efforts had to extend beyond defining the state of the art; to explore what is practical and feasible; and to take into account national similarities and differences as well as regional needs.

3

Findings and Recommendations

FOOD HAZARDS AND HEALTH ISSUES

A safe, nutritious, and adequate food supply depends on keeping food hazards as low as feasible, and at or below levels consistent with other contemporary environmental risks. As emphasized in the Proceedings, no country of the Region produces completely reliable statistics on the incidence of foodborne diseases. To the extent such statistics even exist, they reflect gross underreporting. In Latin America and the Caribbean there are particularly grave shortcomings in the nature, amount, and quality of available data. The available data strongly suggest several broad conclusions:

- The incidence and severity of foodborne illness directly reflect the shortcomings in a system for food protection. Where effective components exist, overall incidence and risks of foodborne illness are low, but never absent;
- Even when effective, commercial food control procedures are in effect, foodborne illness still occurs as a result of careless handling in the home; and
- Specific patterns of foodborne illness vary in different areas, and over time, but the overall ranking of the major categories of risks remains generally the same.

These risk categories identified in the Proceedings are, in order of importance:

o risks from microbiological hazards
o risks from natural toxicants and environmental contaminants
o risks from the improper use of pesticides and food additives

All of these risk categories are adversely influenced by poor nutritional status.

Foodborne diseases are of major importance throughout the world. Of the approximately 4.6 million deaths among children under five years old in Asia (excluding China), Africa, and Latin America in 1980, more than a third were associated with diarrhea due to bacterial or viral infections, usually in combination with malnutrition (Snyder and Merson, 1982). Such infections are acquired from contaminated food and water, unsanitary living conditions, and poor personal hygiene.

Natural toxicants are produced and consistently encountered throughout the food chain. In more developed societies, they are usually a minor hazard because they are reduced by monitoring or selective breeding, removed by processing, avoided by an educated public, or minimized by dilution in a balanced and varied diet. Thus, alert regulatory agencies detect toxins such as aflatoxin and remove their sources from the market. But where one or more of the components of food protection are missing or ineffective, the hazards from toxicants become greater.

Risks from the improper use of pesticides or food additives are never absent, and must continuously be appraised. If efforts were made to avoid them completely, the result would be to substitute much larger risks of foodborne illness, increased costs, or shortages. The safe use of food additives and pesticides lies in careful regulation, adequate monitoring by regulatory agencies, and application by well-trained persons in agriculture and industry who recognize fully the need for disciplined self-regulation. Uninformed or careless use can raise these normally low risks to major hazards in specific circumstances.

Effective reduction of these risks thus depends on:

o public health monitoring sufficient to establish specific priorities;

o an effective system of food control, including the necessary legislation, regulation, training, and enforcement;

o personnel in agriculture and industry trained and motivated to make the food protection system largely self-regulatory and -enforcing; and

o an educated public that demands quality and safety and effectively plays an essential role in proper food handling in the home.

In summary, education, improvement in the economic condition of the citizens in any area, the provision of potable water, elimination of unsanitary living conditions, the teaching of good personal hygiene, and providing a sanitary environment would go far toward achieving the overall objectives of this report.

FOOD CONTROL SYSTEMS

A country's food control program has the dual objective of ensuring the safety of food supplies, thereby protecting the health of its people, and of ensuring fair trade practices in foods, thus avoiding economic losses to the country and consumers and promoting food safety and trade. Confronted by a variety of problems, national governments must establish realistic priorities and attainable objectives within the context of their own social, economic and political realities. Each country must choose its own path in developing and applying food protection programs. What is appropriate in one country may not apply in another because of differences in their stages of development, size, availability of human or financial resources, social organization or cultural determinants, and the nature and magnitude of the specific threats to food safety and economic interests.

No country by itself can meet all the requirements of a fully effective food protection and control program. International cooperation is needed. Existing national and international food protection programs require strengthening and periodic reorientation to adapt to changing priorities and advances in knowledge and technology. All this requires a broad national commitment. Thus, a system for food protection must depend on government commitment, and consist of a basic legal framework, an infrastructure of essential components, and an economic, political and social climate that permits and demands the success of the system. These are discussed in the following paragraphs.

The Legal Basis: Legislation and Regulation

Legislation

Effective food legislation establishes the major goals of food protection, including food safety, and such critical quality aspects as nutritive value, informational content and accuracy of labeling, and protection against fraud. It assigns responsibility and authority to appropriate government agencies to pursue these goals and defines the extent of their authority. It confers the power to carry out the intent of the law by authorizing the issuance of detailed regulations and food standards, and the establishment of adequate services and provisions for effective inspection, monitoring, and enforcement, including prosecution and penalties for violations. National food control laws should not contain details subject to frequent amendment because of changing technology and scientific advances. Thus, legislation which changes slowly, should be uncoupled from regulations, which may require rapid adjustment to reflect new scientific findings. Nonetheless, food legislation must itself be flexible, and should permit regulations to adapt readily to new problems, or to advances in knowledge or technology.

To encourage the government to speak with one voice concerning food control policy, a national strategy must be designed for the purpose. When responsibilities for food control must be divided, as may occur between the ministries of agriculture, health, and commerce, for example, the basic food laws should provide for effective interministerial coordination. A unified national administration can be more effective and economical than divided responsibility or fragmentation through separate regional spheres of responsibility. Regional and local authorities will, however, often play key roles in inspection and enforcement.

In many countries of the Region food laws are obsolete or incomplete and need to be adapted or improved. For this, the FAO/WHO model food law is a useful guide (FAO, 1976).

Regulations

Food laws require elaboration and focus through regulations that:

- o provide further definition of the intent of the laws;
- o establish standards for food composition and quality;
- o require sound hygienic practices in production, processing, transportation, storage, distribution, preparation, and sale of food;
- o prescribe safe conditions for the use of food additives, packaging, components, and pesticides;
- o ensure safe use of processes, such as retorting or irradiation;
- o require truthful and informative labeling;
- o establish procedures for inspection, monitoring, food analysis, and administration; and
- o provide clear guidance on requirements, flexibility for quick response, and easy amendment to cope with change.

Those aspects of the regulations that deal with food standards, codes of sanitation and good manufacturing practices (GMPs), regulations for the safe use of additives, packaging components, pesticides, and certain processing and labeling requirements should reflect both national needs and international standards. The Codex Alimentarius provides a broad and increasingly useful base of international agreement on food standards and codes of practice.

Joint expert committees established by FAO and WHO evaluate the safety of food additives and pesticide residues. A committee for food irradiation is sponsored by FAO, the International Atomic Energy Agency (IAEA), and WHO. From these committees, which act as advisory bodies of the Codex Alimentarius Commission, has come a set of conclusions and recommendations on these topics

(FAO/WHO, 1985a,b; FAO/IAEA/WHO, 1985). Wherever possible, their incorporation into national regulations not only utilizes a base of expertise unavailable within any single country, but goes far toward removing nontariff barriers to trade. The recommendations of the Codex Alimentarius can therefore be particularly helpful in the use of these resources in the Americas Region.

Virtually every major decision reached in framing regulations requires that a balance be struck between dealing effectively with a significant problem, avoiding an undue burden on agriculture or industry with potentially adverse consequences to the food supply, and making good use of the resources available for monitoring and enforcement to provide for food safety and consumer protection. What happens to food in the home may be at least as important as any factors earlier in the food chain. Therefore, the active and informed participation of the population is needed if regulations are to be effective.

Infrastructure: Inspection, Monitoring, and Enforcement

The purpose of a surveillance-compliance program is to ensure that food is safe and uncontaminated, that it complies with applicable standards and regulations, and that it is truthfully and adequately labeled or presented so that it meets the legitimate expectations of the purchaser.

Inspection

The two principal functions of a food inspector are:

- inspection of facilities, food processing, and finished products principally for compliance with sanitary regulations and good manufacturing practices; and
- collection of samples for laboratory examination.

Inspectors must be well-trained, impartial, and protected from threats and corruption. Thus, they must receive adequate pay, professional recognition, and competent and supportive supervision. Their activities must be well planned, coordinated, nonduplicative and flexible, and priorities must be assigned in the interests of cost-effectiveness. Their performance must be consistent with national and international standards.

Inspections of sanitation in food processing and distribution facilities as well as monitoring, i.e. sampling and analysis of foods, are essential to correct weak links in the system. Thus, they not only protect the public health, but help shield law-observant producers against substandard or unethical competition.

Analytical Services

Services for chemical and microbiological analyses of food should be developed and operated in close cooperation with inspectors. Every food control system needs a tiered approach to food analysis, emphasizing simple, reliable methods for field use that address the most common and serious needs. More complex problems should be referred to regional, national, or international facilities. In all cases, the equipment and personnel skills must be tailored to the country's needs and resources. Equipment that is overly elaborate for its purpose is not only difficult to maintain but also is an inexcusable waste of scarce resources. Collaborative use of laboratories, including all governmental, academic, and industrial facilities, should be encouraged and formal agreements reached. Analytical methods must conform to international standards to assure the credibility of results.

Quality assurance and control activities of the food industry, including individual firms and trade associations should play a critical role. When effective, these services provide far more complete coverage than those that could be provided by any governmental food control system. Located at the processing site, they should detect problems early when they are small and when correction is easier. Their other very useful roles include employee training, and increasing the general awareness of regulatory requirements.

A major need throughout the Region is for improved training programs, particularly for field inspectors and bench analysts. When these are lacking, the small cadre of personnel with adequate technical training may be catapulted prematurely or inappropriately into administrative positions, leaving the field and the bench without the needed skilled personnel.

Enforcement

Procedures for enforcement and the authority, skills, resources, integrity, and accountability to make them work represent another essential component of any food control system. A food control agency's principal means for obtaining compliance should be through publicity, education, and training in which governmental, academic, and industrial sectors participate. Both prosecution and penalties for violators are necessary components. Because the emphasis should be placed on deterrence, involuntary compliance with the regulatory laws must be effective to be credible, and credible to be effective. Broad governmental and societal support is required (see below).

A major need for adequate enforcement is good communication, both internally among the components of the national food control system, and internationally with other systems and agencies. International communication is vital if those directly concerned are to learn of developing problems and of emerging solutions. An issue of particular concern can be the interception of food shipments previously rejected at one national border and sent on to some other country. Rapid and effective communication between national food control systems serves all these needs.

Economic, Political, and Social Factors

A nation's food control system must match in scope and focus the critical needs of the society. These will evolve with improving standards of public health, with growth in economic development, industrialization, urbanization, consumer purchasing power, the country's role in international trade, and with changes in virtually every other major facet of social and economic progress. If a major public health need in a country is a hygienic drinking water supply, or if many members of the population are outside the market economy, other urgent needs will take precedence over pursuing trace amounts of a contaminant, or ensuring the proper order in which ingredients are listed on the label of a food that few can afford to buy.

In any nation, a continually shifting balance will need to be struck between changing needs and the resources necessary to meet them. Maintaining that proper balance will require a public with the education and economic power to demand and support an effective system for ensuring a safe food supply, and a government responsive to that demand through adequate legislation, regulation, inspection, monitoring, and enforcement.

Further, agricultural organizations and the food industry must also become major participants in efforts to ensure effective food protection. Although most desirable, governmental systems of food control can never hope to affect directly more than a small and superficial portion of a nation's food supply. In addition to the work of the essential government regulatory agencies, close attention must therefore be paid by consumers to the handling of food in the home. Their education thus becomes an essential component of food control. In the last analysis, the effectiveness of a food protection system depends upon general public awareness and a broad national commitment.

Many countries of the region do not yet have clearly defined and articulated national food control policies. As a result, fragmentation of efforts by various government agencies and departments is common. Even within governments there may be some nonregulatory agencies that exert powerful effects on food control, i.e. national planning agencies, treasury, and export agencies. Key parts of that commitment are competent and conscientious performance by the producers and processors of food to meet established laws and regulations, as well as additional industrial requirements, and an informed consuming public that demands such performance.

IMPROVED FOOD HANDLING AND GOOD MANUFACTURING PRACTICES

Developing countries of the Region tend to be primarily producers of fresh, unprocessed, raw food materials for direct consumption and processing. One of the characteristics of the food industry in the Americas is its fragmentation into many small- or medium-sized firms. Many of these firms lack the capital, facilities, equipment, methods, and trained personnel to exercise effective processing and quality control. Furthermore, problems of sanitation during food production, processing, storage, and distribution often receive inadequate attention. Adequate storage facilities are frequently lacking, and the procedures and mechanisms for the transportation and distribution of food are often deficient.

The amounts of food available to distributors and to consumers are further decreased by large food losses resulting from contamination by rodents, insects, microorganisms, and other causes or vectors of spoilage and disease as well as from mechanical damage and chemical changes during production, processing, storage, and distribution. In short, the infrastructures and expertise necessary for proper quality control of foods at all points in the chain of production, processing, storage, and distribution are frequently lacking or do not function effectively in many countries. Food losses due to defective harvesting, storage, transportation, handling, and processing can in some cases amount to 50% of production (PAHO/WHO, 1982).

Many small- and medium-sized firms lack up-to-date technologies. Their principal problems with implementing proper food control measures are traceable to processing equipment, causing great difficulties with assuring the quality of their products. In some cases, imported technologies, processes and equipment are utilized with no effort to adapt them to the appropriate scale or to the cultural, socioeconomic, climatic, and sanitary conditions of a particular country. Only rarely are processes or processing equipment purposefully adapted to improve and optimize local technologies. Too few local firms make the capital investments needed for sufficient improvements in equipment, nor do they maintain adequate sanitary conditions at food processing facilities.

Much food is distributed through small outlets, especially street vendors. The food safety problems characterizing sale of cooked or prepared food through street vendors received considerable attention at the Conference. The number of street vendors has increased enormously, due in large part to the migration of populations to urban areas and changing food habits.

This increase poses major problems for the public health, and its economic and social significance and impacts are just beginning to be appreciated.

Government inspection does not release food manufacturers from their social responsibility to produce and distribute good quality foods. Although an effective governmental structure for food control is essential to achieve an acceptable level of food safety, good manufacturing practices should prevail with or without government inspection. The private and public sectors engaged in producing, processing, storing, and distributing foods can greatly assist government food control agencies and consumers by assuring the quality of their operations and products. The success of the Conference-generated recommendations that follow will be fully dependent on the commitment of all involved parties, including industry, governments, and the academic community. Significant health, economic, and social benefits can be realized through the adoption and implementation of good food manufacturing and handling practices.

Key needs identified at the Conference and described in the Proceedings include:

- the provision of technical assistance for the development of good food manufacturing practices and quality control throughout the food processing and handling chain;
- the establishment or strengthening of educational programs in good manufacturing practice directed at key employees of food processing and food handling establishments; and
- the provision of funding for essential food protection activities.

The emerging impacts of novel technologies such as improved storage techniques (i.e. controlled atmosphere storage), improved preservation techniques (i.e. aseptic packaging), and the advances in biotechnology on food handling and manufacturing also received attention.

RECURRING PROBLEMS IN INTERNATIONAL TRADE OF FOODS

Food standards can promote or inhibit intercountry trade in foods. Developing countries may be hard pressed to bear the costs involved in upgrading their industrial and food regulation structures to meet standards of importing countries, particularly at a time of deteriorating prices for agricultural commodities on the world market. It is common practice for developing countries to apply the more stringent international standards of importing countries only to products destined for export, and not necessarily to those for their own domestic market. This causes many problems of quality assurance for both export and domestic products. Lack of harmonization of standards among food importing and exporting countries makes it necessary for exporters to meet a variety of standards, with resultant increases in costs. In some instances, importing countries may impose higher standards on food products exported to them than they require of their own domestic industry. This may represent a nontariff barrier to trade and hence, may be a violation of the General Agreement on Tariffs and Trade (GATT).

On the other hand, standards to control contaminants in foods may be so stringent that they are technically achievable by developing countries only at costs considerably in excess of the potential public health benefits that may ensue. Excessive concerns about very low levels of contaminants that are not fully justifiable on public health grounds may, therefore, unnecessarily impede international trade in foods.

Alleviation of these recurring problems requires several corrective actions, both technical and financial. Widespread acceptance of and adherence to international standards for foods, as negotiated and developed by the Codex Alimentarius Commission, would reassure importers about the quality and safety of foods they import and at the same time protect exporters from the need to adhere to a variety of different standards. Industrialized countries of the Americas, in cooperation with international agencies, such as PAHO and FAO, could do much to assist their developing-country neighbors with technical assistance in upgrading their legislative and regulatory infrastructures necessary for adequate food protection. They could provide timely information on new methods of food analysis and on other technical aspects of food control, and provide information needed to ensure that food shipments are not refused entry into the industrially advanced countries. Multinational food companies could assist national governments and international agencies in helping the food industry in developing countries to upgrade its technological capabilities and levels of performance. Means of providing financial assistance necessary to effect these improvements should be examined by international financial institutions, such as the World Bank and the Inter-American Development Bank.

INTERNATIONAL FOOD STANDARDS AND TRADE

International standards play increasingly important roles in expediting intercountry trade in foods. Responsibility for the development of uniform, internationally accepted standards to facilitate the international movement of foods falls on the Codex Alimentarius Commission and its subsidiary bodies. The Codex Commission, a joint initiative of FAO and WHO, has two major objectives: protection of the health and economic interests of consumers on a global scale and reduction of nontariff barriers to trade in foods.

These objectives are accomplished by negotiating international agreements on such matters as food labeling, composition, permitted food additives, allowable maximum levels of pesticide residues, and codes of hygienic and technological practice. Each member country is required to allow products meeting accepted Codex standards "to be distributed freely...within its territorial jurisdiction." Conversely, "The country will also ensure that products not complying with the standard will not be permitted to be distributed under the name and description laid down in the standard." Enforcement of Codex standards is not carried out by the Commission, which has no enforcement capability, but by individual member governments.

International standards provide national food control authorities and the food industry with the information necessary to ensure that foods moving in international commerce are safe and that consumers are not misled as to the character, composition, value, quantity or merit of those foods. National acceptance and application of international standards are keys to improving intercountry trade in foods. As described on pages 33-38 and in the Proceedings, many shipments of food from developing countries are now rejected by importing countries because they do not comply with standards or codes of practice such as those concerning pesticide residues, filth and extraneous matter, or acceptable hygienic practice. Furthermore, acceptance of the standards and their enforcement by food exporting countries also increases the efficiency with which they can produce, store and distribute foods, thus providing additional economic incentives for use of the standards.

More international standardization of foods is required. For this to occur, countries must increase their participation in the work of the Codex Alimentarius Commission, and their acceptance of and adherence to its standards and codes. A special obligation in this respect lies with industrialized countries. International agencies such as PAHO and FAO can provide valuable technical assistance to developing countries to help them adopt and implement Codex standards. The Codex Coordinating Committee for Latin America and the Caribbean plays a vital role in harmonizing food regulations in the Region. For its part, the food industry should be encouraged to include Codex standards and codes in commercial contracts between buyers and sellers.

INTERCOUNTRY AND REGIONAL COOPERATION IN FOOD PROTECTION

The Region is characterized by extreme diversity in development and application of food protection activities. At one end of the spectrum, some countries with highly developed economies have effective food protection programs that provide reasonable assurance against unsafe and fraudulent foods. On the other hand, many developing countries in the Region are struggling to provide services of all types to their populations, including necessary food protection.

Many countries in the Americas do not have sufficient human and financial resources to embark on extensive projects to seek comprehensive solutions to their food control problems. Indeed, no country can by itself meet all the requirements for fully effective food protection. International cooperation is needed. To achieve meaningful, sustained long-term solutions to the complex interrelated problems that impede food control in the Region, the use of existing resources must be optimized through intercountry and regional cooperation.

For maximum effectiveness, there must be cooperation between the national governments of industrialized and developing countries of the Americas; international agencies such as PAHO and FAO; the food industry and other private sector groups; industrialized country donor agencies [U.S. Agency for International Development (USAID), Canadian International Development Administration (CIDA), International Development Research Center (IDRC), etc.]; and international financial institutions such as the World Bank and the Inter-American Development Bank (IDB). Use should also be made of various existing regional or global mechanisms, i.e. the regional Codex Alimentarius Coordinating Committee for Latin America and the Caribbean.

Intercountry and regional cooperation in food control is required in the following areas: manpower training and development, technical support and advisory services, information exchange and consumer information, research, institutional support, and periodic evaluation. In developing cooperative programs in these areas, full use should be made of existing instruments of cooperation, such as the collaborative centers programs of FAO and PAHO, bilateral agreements between countries, and the work of the regional Codex Coordinating Committee. However, additional resources must be provided to attain adequate levels of food protection in the Region at a rate necessary to deal effectively with existing and emerging problems.

INFORMATION RETRIEVAL AND EXCHANGE

Food safety in the Americas requires effective and timely communication of relevant information among countries. The rapid advances in computing and telecommunications technology are providing new opportunities to support many aspects of the needed food protection initiatives. Information obtained by national governments in the course of their food control activities is often of value to other countries. For example, food shipments that have been refused entry into a country because they do not meet quality or safety requirements are often sent to other countries in the hope that they will slip through the national surveillance network.

Food control agencies generate large amounts of data that form the basis for monitoring the quality of national food supplies. Some countries have informal mechanisms whereby they routinely notify each other of such problems. It is difficult to keep track of contaminated food shipments and to identify ships and airplanes carrying such food. A rapid and reliable information network for this purpose does not yet exist. Successful rapid communication systems are in operation for other purposes, as for example, the airline ticket information processing (SITA, Societe Internationale de Telecommunications Aeronautiques--a computerized/ satellite-based system connecting all the countries of the Americas). A similarly effective system is needed for the rapid exchange of food safety information.

Information obtained by one country on foodborne disease outbreaks and on actions to ban the use of a pesticide or food additive may also be useful to other countries. International information exchange has traditionally been complicated by the diversity of government policies, regulations and standards, administrative infrastructures, and resources available in different countries as well as by the diversity of the information required. The Committee recognizes that the development of a practical and useful food protection information system will require careful consideration of the needs and resources of the countries involved. All practical alternatives should first be considered, and the system should be based on mutually agreed upon priorities and resource commitments.

EDUCATION AND TRAINING

At the Conference, education and training were mentioned in almost every presentation, working paper, and task force report. Although training programs are conducted in most countries of the Region, their frequency, intensity, and focus vary considerably. The key to an integrated, meaningful, and effective food protection program for the Americas is the development of well planned, organized, and implemented education and training programs in every country of the Region, and a strong and aggressive commitment to such programs.

Conference participants agreed that education and training programs must be developed to increase knowledge, competence, and skills in three important areas:

- o prevention of foodborne diseases;
- o food handling and good manufacturing practices; and
- o analysis and inspection.

For programs to be effective, they must be specifically designed for those involved in every phase of the food chain from production to consumption. These target audiences include:

- o food policy makers
- o food producers
- o food inspectors, food technologists, public health personnel, and epidemiologists
- o food processors and quality control personnel
- o chemists, microbiologists, entomologists, and other biological scientists
- o food service and distribution personnel
- o food retailers and street vendors
- o educators, marketing personnel, and media professionals
- o consumers

Other important groups that must receive training are those that deal with food protection during emergencies and disasters, and those involved with training the trainers.

Specific programs developed for each of these groups should not only improve knowledge, competence and skills in food protection, but would also be significant factors toward reducing the overall incidence of foodborne diseases. Information generated through these training activities should help to further implementation of food protection legislation, food quality control programs, and in the overall improvement of food handling and good manufacturing practices.

Before any meaningful education and training programs can be designed, developed, and implemented, a thorough audience analysis and needs assessment must be undertaken.

Without adequate planning, program development, and a coordination of efforts, any sustained training effort will be very difficult, if not impossible to achieve. Careful consideration must be given to many factors including the following:

- o specific needs of the region and country;
- o purposes and specific objectives of the training activity;
- o nature of the audience and of the material being taught;
- o training methods, financial resources, facilities, teaching aids, and curriculum models;
- o time and frequency of the training activities;
- o interest, enthusiasm, and abilities of the trainer and trainees; and
- o evaluation of the training programs and follow-up of the trainees.

Educating the people of the countries in the Region is essential, but poses extensive problems. To improve the chances of successfully dealing with the complex constraints involved in developing these educational programs, Conference participants noted that international agencies will need to assist by providing funds and experienced personnel. Strong support will also be required from the government and food professionals of each country in the Region.

All channels of communication should be used to facilitate development of high quality foods and effective food protection, education, and training programs. Accordingly, the Committee endorses the following recommendations of the Conference Task Force on Education and Training:

- o Annual or bi-annual conferences should be organized to encourage communication about training programs among food professionals in the Region. In this context, modern communication technologies for education and training should be explored and evaluated. FAO, PAHO, and WHO should be urged to coordinate activities and include support for regional education and training in their programs.
- o A cooperative clearing house should be organized for the collection, dissemination, and exchange of

educational and training materials and relevant scientific publications should be distributed to national institutions and laboratories for use in education and training programs. Also, food microbiologists should be called upon to assist in the development and dissemination of specific information on food protection.

o Strong efforts should be made to ensure adequate compensation and attractive work conditions for food professionals to avoid loss of their expertise to other activities.

RESEARCH NEEDS

The Committee and the Conference were not charged with, nor were opportunities presented to address specifically the research needs on food protection in the Americas. However, the Conference participants repeatedly stressed the importance of identifying and setting priorities for such research needs and providing resources for meeting them. Moreover, the Conference emphasized that all aspects of the food safety problem, including public health, food production, harvesting, storage, processing, quality control, and safety, have important research requirements. The Committee strongly endorses this emphasis and urges that the Academy seek support for a meeting to not only define specific research priorities but to also develop feasible recommendations for their implementation.

4

Outcomes

PROCEEDINGS OF THE CONFERENCE

The Conference was characterized by a high level of personal interest and commitment by all participants to the achievement of its objectives. This is evidenced in its two important tangible products. The Conference Proceedings, pages 59-324, contain commissioned papers on food hazards and health issues, food control infrastructures and mechanisms, recurring problems in international trade of foods, and international food standards and trade. There are also summaries of discussions of these papers; working papers on legislative and infrastructural needs for food control, food inspection, monitoring, and enforcement, improved food handling and good manufacturing practices, and on intercountry and regional cooperation; task force papers on education and training and on information systems; reports from the participating international agencies; and a summary of the country reports. The Action Plan (see below) developed at the Conference is reproduced on pages 5-15.

ACTION PLAN

The Action Plan proposes the following specific measures:

- to update and unify national food laws under the auspices of interministerial cooperation and coordination, and universally accept and apply the Codex Alimentarius as rapidly and completely as possible;
- to prevent the transport to other countries of foods rejected as unsafe at the border of an importing country;
- to establish or strengthen interdisciplinary and interministerial coordination of food regulation activities at the national level;
- to strengthen national food control, monitoring and surveillance programs, food-handling systems, and laboratories;
- to designate regional reference laboratories to carry out highly specialized and costly analyses;
- to assist exporting countries by providing analytical monitoring and surveillance information upon request;
- to inform the food industry and trade associations about problems and potential solutions and to involve them in the implementation of food protection activities; and
- to incorporate food safety into national food and nutrition policies and programs.

The Action Plan also calls upon PAHO and FAO to jointly develop a more detailed regional program of action and to seek necessary resources for its implementation in keeping with its objectives.

INTANGIBLE OUTCOMES

Channels of communication were opened and strengthened within and between concerned country agencies and between officials and experts in the diverse countries of the Americas. The results are likely to be both immediate and long lasting. The Conference also offered opportunities for the International Agencies to explain their activities and to obtain increased cooperation. FAO, PAHO, United Nations University (UNU), and WHO received strong support for their Codex Alimentarius, food control, and fellowship and training program efforts. Workers in the hemisphere in disciplines and positions related to food safety, food quality control, and food protection in the Americas in general received encouragement and suggestions to increase their effectiveness.

5

Comments and Conclusions

The findings described in the preceding sections are based on the reports and discussions of people with extensive backgrounds in and first hand experience with the issues from all countries of the Region. There was remarkable consensus on all issues and on the actions required to deal with them. The Committee is satisfied that the problems and needs have been appropriately identified. More extensive information and documentation are found in the Proceedings of the Conference, pages 59-324.

The nature and magnitude of food protection problems in the Americas are recognized by those responsible for the public health and safety of the food supply and for international trade of food in the countries of the region. The Conference served to bring these problems to the attention of a wider group, particularly policy makers, but its major task was to identify and recommend specific practical measures for dealing with them.

This was not an easy task because of the great diversity in background, needs, and resources among the 36 countries of the Region. Nevertheless, the Conference succeeded in developing and unanimously adopting an Action Plan that the Committee judges to be comprehensive, appropriate and feasible, even within existing constraints. This document takes into account the needs of countries with varying levels of sophistication regarding food safety and protection, and can benefit them all.

The Action Plan assigns responsibility to PAHO and FAO for developing a regional action plan and for mobilizing significant additional resources for its implementation. However, the Action Plan places major responsibility for improving food safety in the Americas directly on the individual countries, beginning with their need to set realistic priorities, to update and unify national food laws, to accept and apply the food standards and recommendations of the Codex Alimentarius and other international standards, and to strengthen their national food control, monitoring, surveillance, and food-handling systems.

This will require greater than current levels of commitment by each of the governments to improve food protection, to correct legislative and regulatory deficiencies, to improve coordination at national levels, to begin vigorous efforts to overcome the lack of trained personnel in the relevant sectors, and to improve laboratory facilities.

Regulations and enforcement systems must encourage the food industry and trade associations to play their important roles in food protection without disadvantage to those who comply. More effective commitment among national regulatory agencies is also required to prevent movement of substandard foods between countries, particularly the sale of food shipments rejected within countries or at national borders. This will require better mechanisms for the prompt exchange of information related to food protection among countries and improved facilities for storing and retrieving information related to food safety within countries.

A regional plan should be developed by PAHO and FAO in cooperation with the member countries to mobilize at least $5 million yearly for an initial period of 5 years to support personnel training and human resource development, technical support and advisory services, information exchange and consumer information, research, institutional support, and periodic program evaluation. Given the importance of the problems, the Committee urges that, as suggested in the Action Plan, PAHO and FAO develop and present a funding proposal to potential donors as soon as possible and act immediately to strengthen their own activities in food protection in the Region. A coordination and follow-up committee established by PAHO and FAO as executive agencies could help to provide advice and orientation, and to monitor implementation of the technical aspects of the Action Plan.

The Conference Proceedings provide a sound basis for the unanimously adopted Action Plan. That Plan is a realistic guide to the improvement of food safety and protection in the Region, to food consumption within a single country, and in international trade. If its purposes are to be achieved, however, those who participated in the Conference, and the national and international agencies to which the report is addressed, must now act upon its conclusions and recommendations. The Committee believes that the strong commitment of the country representatives and others who took part in the Conference can result in prompt and effective implementation of the Action Plan to the benefit of the health and food supply of the peoples of the Americas.

References

Archer, D. L., and J. E. Kvenberg. 1985. Incidence and cost of foodborne diarrheal disease in the United States. J. Food Protect. 10:887-894.

Black, R. E., et al. 1983. Prevention and control of the diarrhoeal diseases. Pp. 299 in Diarrhoea and Malnutrition Interactions, Mechanisms, and Interventions. Plenum Press, New York.

Chen, L. C. 1983. Interactions of diarrhoea and malnutrition. Pp. 3-5 in Diarrhoea and Malnutrition Interactions, Mechanisms, and Interventions. Plenum Press, New York.

FAO (Food and Agriculture Organization). 1976. Guidelines for Developing an Effective National Food Control System. Food and Agriculture Organization of the United Nations, World Health Organization, Rome. 169 pp.

FAO/IAEA/WHO (Food and Agriculture Organization, International Atomic Energy Agency, and World Health Organization). 1985. International conference on food irradiation. Food and Agriculture Organization of the United Nations, World Health Organization, Geneva.

FAO/WHO (Food and Agriculture Organization and World Health Organization). 1985a. Joint FAO/WHO expert committee on food additives. Food and Agriculture Organization of the United Nations, World Health Organization, Geneva.

FAO/WHO (Food and Agriculture Organization and World Health Organization). 1985b. Joint FAO/WHO meeting on pesticide residues. Food and Agriculture Organization of the United Nations, World Health Organization, Geneva.

FDA (Food and Drug Administration). 1986. FDA Import Detention List. Food and Drug Administration, Rockville, Maryland.

Haworth, J. 1983. Global review of information on the extent of ill health associated with chemically contaminated foods. Joint FAO/WHO Expert Committee on Food Safety. World Health Organization, Geneva.

Jiwa, S. F. H., K. Krovacek, and W. Torkel. 1981. Enterotoxigenic bacteria in food and water from an Ethiopian community. Appl. Environ. Microbiol. 41:1010.

NRC (National Research Council). 1975. Prevention of Microbial and Parasitic Hazards Associated with Processed Foods. National Academy of Sciences, Washington, D.C. 436 pp.

PAHO/WHO (Pan American Health Organization and World Health Organization). 1982. Sanitary control of food. Scientific Publication No. 421. Pan American Health Organization, Washington, D.C. 51 pp.

Puffer, R. R., and C. V. Serrano. 1973. Patterns of mortality in childhood. Scientific Publication No. 262. Pan American Health Organization, Washington, D.C.

Snyder, J. D., and M. H. Merson. 1982. The magnitude of the global problem of acute diarrheal disease: a review of active surveillance data. Bull. W.H.O. 60:605-613.

Todd, E. C. D. 1984. Economic loss resulting from microbial contamination of food. Pp. 151-165 in Proceedings of the Second National Conference for Food Protection. Department of Health and Human Services, Washington, D.C.

WHO/FAO (World Health Organization and Food and Agriculture Organization). 1984. The role of food safety in health and development. Technical Report 705. World Health Organization/Food and Agriculture Organization, Rome. 79 pp.

SECTION III

THE INTER-AMERICAN CONFERENCE ON FOOD PROTECTION

Proceedings of a Conference Held August 5-9, 1985, in Washington, D.C.

SESSION 1
Introduction to the Conference and Conference Objectives

Introduction

These Proceedings contain the plenary presentations that addressed the principal problem areas for food safety in the Americas: Food Hazards and Health Issues, Food Control Infrastructures and Mechanisms, Recurring Problems in the International Trade of Foods, and International Food Standards and Trade in Foods. A summary of the discussions on each of these issues is also provided. Representatives from the Food and Agriculture Organization (FAO) of the United Nations, the Pan American Health Organization (PAHO), and the World Health Organization (WHO) presented reports outlining their programs and activities for strengthening food control in the Region; these are reproduced herein. In addition, the representative of the United Nations University (UNU) described the International Network of Food Data Systems (INFOODS) as a possible model for the exchange of food safety data; this paper is also reproduced.

The individual country reports, which were too lengthy and varied to reproduce, referred repeatedly to the deficiencies in food safety and protection activities in the Region. They are summarized, and generalizations are drawn from them.

The critical substance of these Proceedings lies in the reports of the four concurrent working groups and three task forces. The working groups met for a day and a half, and additional time was given to drafting reports, in order to deal effectively with four important topics: Legislative and Infrastructural Needs for Food Control; Food Inspection, Monitoring, and Enforcement; Improved Food Handling and Good Manufacturing Practices; and Intercountry and Regional Cooperation.

The working groups were supplemented by task forces that dealt with education and training and with the classification, storage, retrieval, and dissemination of information on food safety. The chairs of these working groups and task forces and of the drafting groups for the four plenary topics, as well as the chairs of the sessions on the country reports, then formed an Action Plan Task Force to draft the recommendations of the Conference.

A Pervasive Issue, Jointly Addressed

WALTER A. ROSENBLITH

The program of the Inter-American Conference on Food Protection promises participants an important, discussion-packed week, at the end of which they can develop a plan oriented to both study and action. The National Academy of Sciences and its President, Frank Press, are proud to be a cosponsor and partner in this enterprise, along with the Pan American Health Organization, the Food and Agriculture Organization, our neighbor to the north, Canada, and the Food and Drug Administration as well as other U.S. agencies.

A few words about the National Academy of Sciences are appropriate. From its very inception in 1863, when President Lincoln and our Congress chartered the Academy in the midst of our Civil War, the U.S. government looked to this organization not only to promote the progress of science, but also to "investigate, examine, experiment and report upon any subject of science." Among the first questions the federal government posed to the young National Academy of Sciences, one had to do with the quality of whiskey and another dealt with counterfeiting. Both questions remain in some sense still on the table. During World War I, the Academy established the National Research Council (NRC) in order to be able to draw upon the resources of the entire technical and scientific community of the Nation, and not just upon the Academy membership. The National Research Council--perpetuated by an executive order of President

Wilson--is to this day the principal operating agency of the Academy complex, which now includes the National Academy of Sciences, the National Academy of Engineering (established in 1964), and the Institute of Medicine (established in 1970).

My scientific background does not permit me to comment with technical competence on the Conference program. I have had modest exposure to some aspects of the program's topics when I was Provost of the Massachusetts Institute of Technology at a time when Dr. Nevin Scrimshaw chaired with distinction its Department of Nutrition and Food Science; his colleagues invited me to participate in one or two symposia concerned with sensory properties of food. Another experience related to the program was my chairing a National Research Council Committee for a Study on Saccharin and Food Safety Policy--an issue that is far from having been permanently resolved.

More than half a century ago I read Upton Sinclair's naturalistic novel The Jungle, which depicted conditions both sanitary and social in the Chicago stockyards. The novel ironically aroused indignation at the quality of processed meat, leading the author to comment, "'I aimed at the public's heart and by accident I hit it in the stomach'" (Sinclair, 1906). Since then a great deal has happened, both in medicine and in biology. Today we look at the questions of food safety and food protection from a scientific perspective that is singularly different from what it was when many of the early food inspection laws were written.

An impressive number of countries are represented at this Conference on Food Protection. All aspire to mutually beneficial and appropriately high food standards. A conference of such size and scope is undoubtedly needed if an impact upon the issues of public health and international food trade is to be made. However, in order to discuss these issues at a time when large parts of the African continent are haunted by famine, it must be assumed that the supply of food is sufficient (at least at first approximation) and that focus can indeed be brought to bear on public health and trade. I have been able to learn some of the relevant data: food imports from the Western Hemisphere to the United States in 1984 amounted to roughly $11 billion; exports from the United States are, in dollars, about five times as large, if a recent Encyclopedia Britannica

Yearbook is correct. Thus the amount of trade is perhaps massive enough to come up at the next General Agreement in Trade and Tariffs (GATT) meeting, given the related subsidy problems.

Clearly food safety is a pervasive issue. Many countries share similar problems, as the NRC's saccharin committee learned when it heard scientific counsellors from several Washington embassies tell how their countries regulated saccharin. Even though there was anything but unanimity, the discussion broadened the committee's understanding and gave members some insight into how different countries approached the issue of risk.

Years ago, in response to a directive from Congress, the U.S. Food and Drug Administration contracted with the National Academy of Sciences to conduct a study of institutional means for risk assessment. The Research Council's Committee on the Institutional Means for Assessment of Risks to Public Health examined the topic thoroughly and concluded that risk assessment was only one aspect of the process of regulatory control of hazardous substances (NRC, 1983). Even improved methods of assessment would not eliminate controversy over risk management decisions.

A year earlier, another National Research Council committee had produced a major report entitled Diet, Nutrition, and Cancer (NRC, 1982). This report has been widely disseminated and seems to have had a significant impact on the nation's food habits.

If one were to answer the question, "How much of the disease burden in any given country is foodborne," the numbers would seem to be rather soft. That's certainly true in the United States, and is probably true in other countries where epidemiological statistics may be even less reliable. Hence there is a need to increase communication among scientists, governmental agencies, and industry regarding the public health aspects of food. Our ability to account for the incidence of foodborne disease is insufficient to establish a code for all times--thus the need to be responsive to new scientific information in matters of codification. Science is increasingly capable of more effective analysis and intervention. The Inter-American Conference on Food Protection should help to create in the future a common data base, a pool of technical information drawn from all countries that will reflect differences in those countries, just as the Action Plan adopted by the Conference must contain sufficient common elements and be flexible enough to allow each country to go forward, taking account of its diverse needs.

REFERENCES

NRC (National Research Council). 1982. Diet, Nutrition, and Cancer. National Academy Press, Washington, D.C. 478 pp.

NRC (National Research Council). 1983. Risk Assessment in the Federal Government: Managing the Process. National Academy Press, Washington, D.C. 191 pp.

Sinclair, Jr., U.B. 1906. The Jungle. Doubleday, New York.

The Importance of Food Safety—A Canadian Perspective

ALLAN GOTLIEB

The Inter-American Conference on Food Protection is unique in that it is the first time that senior food control officials from the Americas have assembled to discuss and attempt to resolve issues of mutual concern. The Conference focus is the development of a consensus on future actions to improve food quality and to facilitate international trade in food. This will be no easy task. The issues are diverse and the topics complex. However, since no other commodity area is perhaps as important as food to the physical, social, and economic health and well-being of a nation, the effort is clearly justified. Canada is proud to have been among those countries and international organizations sponsoring this landmark event.

Wholesome food is a major factor in maintaining good health and preventing illness. It is also an important component of a nation's economy through its contribution to the gross national product and trade. Food protection contributes to a nation's riches by reducing the social costs of food contamination--the costs of treating foodborne diseases and the costs due to loss of output or earnings resulting from illness, disability, or premature death. Food protection also contributes by reducing food losses due to preventable spoilage; in some cases losses can run as high as 30 percent of the total crop.

The impact of foodborne illness on human health and the economy of a nation is profound. The report of a

1983 Expert Committee on Food Safety--a joint committee of the Food and Agriculture Organization and the World Health Organization--concluded that illness resulting from contaminated food is perhaps the most widespread health problem in the contemporary world and an important cause of reduced economic productivity.

Unsafe food thus places an immense socioeconomic burden on countries where food systems are inadequate. This can become a major constraint to economic growth and development.

Food is an integral part of everyone's life, woven into the cultural fabric of each country. Think of any national, religious, or family festival, and one immediately thinks of certain foods or drinks associated with them. The rich diversity of the Americas ensures that our diets will be dissimilar in many respects. The common link is that for our economic and social well-being, our diets must be adequate and safe.

Easy to say. The reality of the Americas is that we are all at various stages en route to that common goal. The Americas have about 15 percent of the world's population and almost a third of its landmass. Within this huge area, stretching from the North Pole almost to the South Pole, every conceivable climatic condition prevails. Similarly, almost every possible social and political framework can be found.

Social indicators such as life expectancy, infant mortality rates, and per capita income figures document the significant disparities among our various countries. Specifically, life expectancy in the Americas varies from less than 49 to more than 70 years; infant mortality rates range from less than 20 to more than 100 deaths per thousand births; and per capita annual incomes range from 300 to well over 10,000 U.S. dollars.

It is obvious that there are acute differences to be found among us. In the Conference deliberations, it is necessary to bear in mind that the priorities of one nation will not, and possibly should not, be the priorities of another. It is the task of the Conference to search constantly for the shared factors that will be beneficial to each of our countries and to all our peoples.

There is one certainty on which to focus: no country has achieved stability and reasonable living standards by ignoring the health of its citizens or by relegating food protection to a subordinate role in its continuing development. For a nation to progress, food protection must of necessity always be high on the government's agenda. To achieve these aims, food regulations and their enforcement are required, but governments must also seek to educate and inform both professional and domestic food handlers on safe practices in order to make safe food a habit rather than just an obligation.

Canada, like many countries, is both an exporter and importer of food. Canadian laws and regulatory mechanisms are consistent and compatible with the Codex Alimentarius Code of Ethics for International Trade in Food. The basic principle of this code is that exported food should be safe for human consumption. In line with the code, Canadian food exports meet applicable Canadian food safety requirements. I emphasize, however, that the existence of this code should not be considered as a substitute for an effective food control system in any country.

Imported food accounts for a relatively small part of the total Canadian diet. However, since the climate of my country precludes cultivation of tropical and most semitropical crops, foods of this type are almost totally imported. The multicultural mosaic and the increasingly cosmopolitan nature of Canadian society has influenced market demand for tropical products, so that today most Canadians include such products as a part of their diet on a year-round basis.

These dietary expectations present significant challenges to Canadian food regulatory officials in that all food, whether of domestic or import origin, must comply with applicable federal standards of safety and quality. However, as is the case with most countries, Canada does not have sufficient inspection or analytical capability to check every lot of imported food. Confidence in the food control system of the exporting country is therefore highly desirable. Without such confidence, regulatory officials are reluctant to permit imported products on the Canadian market in the absence of certification or other evidence respecting safety and quality.

The life-styles and dietary expectations of many consumers in the Americas create favorable conditions for increased food trade. Mutual confidence in the food protection and food control systems of trading partners is one of the keys to success in creating and maintaining export markets.

I would like to stress that food control activities should not be driven by or exclusively related to export programs. Food laws and regulations must be administered and enforced equitably, so that all consumers are afforded equal protection. In other words, differential systems of control should not develop where higher standards are required on export products to the possible detriment of domestic populations.

An increase in confidence among participating countries could be one of the significant benefits of this Conference. Of course, as part of such a process, individual governments must commit themselves firmly to the principles of food protection. This involves well-coordinated and rational legislation and regulations rigorously enforced by trained and conscientious officials.

The Conference provides an excellent opportunity for delegates to get to know each other and to develop that personal rapport which will facilitate the future solution of food protection problems arising among the Region's countries. This has been a unique opportunity.

The program for the Conference is very demanding, but among the delegates are many distinguished experts in the fields of nutrition, food science, food safety, and international trade. A cooperative effort to utilize the skills and practical knowledge of these experts cannot help but be productive and rewarding.

The real challenge resulting from this Conference will be implementation of the Action Plan, which translates the subjects of discussions into programs that provide improved food protection for all citizens of the Americas.

The Opportunity for a Better Future

JOHN R. BLOCK

The United States is honored to be host country for this important Inter-American Conference on Food Protection. This gathering of distinguished international visitors would not have been possible without the diligence, harmony, and hard work of a great number of women and men throughout the Americas, representing governmental agencies, international organizations, and private research institutions. Working together, a magnificent endeavor has been undertaken to promote the production of safer food in the Western Hemisphere. The rewards of this work can be tremendous, both for domestic public health in the Americas and for the acceptability of our food products in international markets.

The need for success of this work cannot be underestimated. Our hemisphere has entered an era of challenge. Ease of communications and travel is dissolving long-standing barriers among nations--even the barrier of language.

I have traveled to many of the countries of this hemisphere, looking at their agriculture and meeting with agricultural and other government officials. Even in the past 5 years I have been able to feel the size of this globe shrink, and the absolute necessity of closer relationships. Today we can observe that motives of hope and opportunity--but also, for some unfortunate ones, of crisis and fear--are spurring international migration.

The turn of the twenty-first century will present new demographic and economic imperatives. While the United States and Canada face aging populations, our neighbors to the south will have some of the world's youngest populations. The Latin American economies must create tens of millions of new jobs before the beginning of the new century to meet the needs of the growing population.

The United States' objective regarding the economic and social challenges of our hemisphere is not to raise new barriers, but to remove remaining obstacles to effective cooperation and development. The U.S. administration is guided by President Reagan's words to the Organization of American States in 1982. The President said, "The Western Hemisphere does not belong to any one of us; we belong to the Western Hemisphere. We are brothers historically as well as geographically."

Members of the Conference must bear a message of hope to the young people in the developing countries of our hemisphere. We know that there are massive hurdles to overcome: national debt, structures of poverty, political instability, military threats. But with education, the spirit of enterprise, and the freedom to exercise that enterprise the rising generations of the Americas can accomplish wonders. New technologies and stronger incentives can help them work the miracle of economic growth.

I have often noted that, as countries, we do things for different reasons. Sometimes we act for humanitarian reasons, sometimes we do things simply because they are the right things to do under the circumstances, or from a sense of obligation. But we also act--most of us--much of the time in our own self-interest, because our political systems tend to demand this. It is certainly in the self-interest of the United States, and of U.S. agriculture, to see other countries develop their economies and, in fact, develop their agriculture.

We must all be totally unselfish in sharing our agricultural technology. Furthermore, we must have markets open so that we can accept the products that countries want to sell, while in turn we expect to be able to sell our products to those countries. The world of isolationism for the United States--in trade, politically, and otherwise--is not a good world.

Participants in the Conference have seen wonders of progress in their lifetimes. The scientists and technological experts among them probably recognize the full dimensions of that progress far better than I do. There can be no doubt that if the Conference makes the most of its opportunities, a legacy can be left that will better enable the hungry mouths and the hungry minds of the Americas to find satisfaction, nourishment, and growth.

A sure and steady improvement in public health in the poorer countries of our hemisphere could tremendously increase their attractiveness to tourists and foreign investors. And by approving and making internationally consistent the food safety standards of all countries, our countries can open expansive new horizons for the hemisphere's export trade. It is a tragic setback for developing countries when millions of dollars worth of food commodities are rejected because of failure to meet health and safety standards. This is an impediment to international development.

Countries should be positioned so that they can do what they are best at doing. I am a corn, soybean, and hog farmer from Illinois; there we do not try to raise coffee or bananas and certain other products that we are not good at raising. But there are programs in the United States that tend to encourage production of some commodities that, frankly, ought to be raised someplace else. It is the administration's aim to change those programs so that the doors for trade will be opened. The most important in relation to hemispheric interests is the sugar program. We are working with the Congress to make changes in that program, and indeed in the very structure of all our farm programs.

The Food and Agriculture Organization and the World Health Organization deserve the highest praise for their efforts to promote more universal acceptance of the Codex Alimentarius. The Codex is one of the most important, most constructive projects ever undertaken by international organizations. The United States has a long-term commitment to provide its fullest cooperation, along with a large measure of technical assistance, for the implementation of the Codex throughout our hemisphere.

All delegates to the Conference probably recognize that the people of the United States have labored hard and for many years to attain the conditions of public health that we now enjoy. It will be understood that from our people's perspective there must be no turning back from the standards that we struggled to establish. At the same time, we are fully sensitive that changes in our standards of food, health, and safety can result in hardships for producers in the developing countries, especially where entire national or regional economies are dependent on a few commodities.

I understand how other countries prepare and design their systems, with much investment of money, to meet certain standards. To see those standards change afterward is very, very costly. The sheer complexity of government regulations in the United States has often posed problems to my own country's citizens--so much so that it is easy to empathize with producers, entrepreneurs, and trade officials from other countries who wish to do business with the United States. President Reagan has made it a high priority to eliminate regulations that serve no purpose other than to interfere with the efficiency of the market. He has also directed our administration to streamline the regulations that remain truly necessary to our people's health and welfare. We are accomplishing much toward those ends. But even if we realize our aims fully, the regulatory order in the United States will remain very complex. I will do all in my power to see that this complexity does not pose insurmountable barriers to trade.

I know how important exports are to developing countries; statistical data show that exports are 17 times more important than direct aid in generating revenue. President Reagan, the Secretary of Agriculture, and the rest of the present administration are totally committed to opening markets and helping to develop the countries of the Western Hemisphere.

The Conference has gathered together an enormous wealth of medical, diplomatic, technical, economic, and cultural knowledge and understanding. Its participants have in their power to contribute concretely to a better future for more than 600 million people who share this hemisphere and its splendid resourceful land. My hope is that history will recall and long appreciate the work done by the delegates, because they will have given it all--all their talents, all that their talents can offer.

That the Future May Exceed the Present

CHARLES D. BAKER

It is commendable that representatives of nearly 38 countries are meeting together to discuss the critical issues of food quality and food safety as they relate to trade and public health in the Western Hemisphere. Food quality, food safety, and food trade are very important matters. How are the nations of the Americas doing in these areas of concern? The answer seems to be, pretty well, but by no means well enough. An equation comes to mind: improved food safety plus enhanced food quality equals fewer trade barriers and more food trade (IFS plus EFQ equals FTB and MFT). But how, indeed, are improved food safety and enhanced food quality to be achieved?

Nearly 30 years ago the distinguished scientist Linus Pauling commented that science is the search for truth. It is not a game in which one tries to beat his opponent, or to do harm to others. Clearly the spirit of science is needed in international affairs to promote efforts to find right and just solutions to international problems; the effort by each nation to get the better of other nations should not dominate. And it is, indeed, in the spirit of scientific cooperation that the seminars, workshops, and special task force activities of the Inter-American Conference on Food Protection take place. This spirit should also be applied to the exchange of information leading to an action plan by which the findings of the Conference are translated into real and tangible improvements in the national economies of the Region and in the health and safety of all.

In recent years international activity to meet the challenges of food protection has been considerable. Efforts have been made to increase the supply of food, to improve the safety of food, and to increase free trade in food. Much of this work has been focused on areas outside the Western Hemisphere, as in the efforts to alleviate the tragedy of African famine and to solve other Third World problems in the Eastern Hemisphere. Truly this work is of the utmost importance, and energies must continue to be devoted to it. At the same time, however, there remains a real need to direct efforts to the Region of the Americas. President Reagan's Caribbean Basin Initiative is critical to the future economic development of the Americas. By providing the developing Central American and Caribbean nations with duty-free access to the U.S. market, the U.S. government can facilitate the expansion of their productive capacities and open their trade to new markets. Because multilateral economic relationships among nations of the Americas are in a continuing state of development, the activities of the Conference take on particular importance. The decisions and conclusions reached at the Conference, and the cooperation achieved, will most certainly affect future U.S. policy, for change is the watchword, as well as the norm.

Too often, food safety efforts in the Western Hemisphere are fragmented, with individual nations planning separately, attempting to solve problems of disease and health care separately, and working individually to increase food production or to ease trade restrictions. Or sometimes work is done collectively, but only on parts of a problem. Individual initiatives can be important in and of themselves. But just as a fine symphony orchestra produces a full and total sound from the individual performances of its members, so should the hemisphere's nations unite in approaching the challenge of food protection, combining efforts and resources in the hope of performing better in the future in all individual roles.

The U.S. Department of Health and Human Services, through its Food and Drug Administration and its Public Health Service, is particularly mindful that the promotion of safe food supplies and proper nutrition are among the most essential components of primary health care, and are critical to health throughout the world. Not only must food of adequate nutritional content be available in sufficient quantity, but it must also be safe for consumption and not endanger consumer health through infection or intoxication. Developments in food chemistry and other food sciences, in the United States and in many of the Region's countries, are contributing to the capacity to produce ever more safe and wholesome foods and to maintain the wholesomeness of food throughout the production and distribution processes. Newly evolving technologies in food irradiation, for example, provide new means of improving food safety. At the same time, it is important not to neglect the basic principles of sanitation during each step in the production, processing, and distribution of food.

But health and safety are only one part of the concerns of the Conference. The complexities associated with international trade policies regarding food and agricultural items are obvious to all. The United States believes strongly that free trade in food as well as other commodities is a goal well worth striving for. By increasing access to foods not available locally, such a policy can enable countries to obtain a safe and adequate food supply. Each country, however, must assume responsibility for its own citizens; as a result, an importing country's food safety and quality requirements can and often do constitute nontariff trade barriers that hinder free trade. Yet countries necessarily must set their own standards for foods, both imported and domestic, in order to protect the public health, so it is not the existence of such standards in themselves that is the trade barrier. Rather, the barrier arises because each country set its standards independently, without regard for the standards of others, and the various standards therefore often contain significant differences. One obvious way to remove the barrier is to have the importing and exporting countries agree on the same standards. Put another way, the Region's nations must get together in order to progress together. To this end, the Food and Agriculture Organization, the World Health Organization, and the Codex Alimentarius Commission have made significant advances in harmonizing food standards on a global basis. But these are not yet fully integrated international food standards, so importing countries must make good-faith efforts to inform exporting nations of their special food safety requirements, so that food can be produced, processed, and shipped accordingly and less food will be rejected at international boundaries.

What of science and technology, of regulations and control, of quality, labeling, and trade practice? The Conference agenda is impressive, paying attention as it does to microbiological, chemical, and physical hazards to food, to nutritive value, fraud, and mislabeling, to food inspection, monitoring, and standards enforcement, to recurring problems in international trade, and to the exchange of information among governments, international organizations, and industry. It offers an opportunity for countries to help one another to improve domestic food standards and health quite as much as to enhance trade and exchange. This Conference should result in a new consensus that new progress can be made in defining the food protection challenges to be faced and in outlining approaches to improved food production and protection in the Americas. The countries of the Americas must go beyond simply informing each other about what they are doing to develop plans to improve what they are doing. The individuals participating in this effort are among the most knowledgeable about national food control goals and the current state of endeavors on the national and international levels. It is to be hoped that as a result of the Conference they are committed to enacting new approachs to food protection and to considering fresh ideas. Four centuries ago the English philosopher Francis Bacon remarked, "He that will not apply new remedies must, indeed, expect new evils." Conference participants should make sure that the remedies are applied in time. Let the future exceed the present. This Conference should be remembered as a unique event, whose work applied new remedies to not-so-new problems. The countries of the Americas can, indeed, overcome their differences.

Food Safety: A Step Toward Health and Well-Being for All

CARLYLE GUERRA DE MACEDO*

Never has a hemisphere-wide meeting on food protection been more needed or timely than right now, nor has it ever been more urgent to pool and coordinate all efforts and resources in order to come to grips with the problems that plague our countries because of the lack of a supply of wholesome, safe, nutritious, and inexpensive foods. Without such coordinated efforts, the countries of the Americas will not be able to attain the level of development and continued progress they deserve, and the malnutrition, hunger, disease, and poverty found in so many places in the hemisphere will worsen. Food contamination is itself a hindrance to the development of nations.

Food safety and protection activities are special concerns of the Pan American Health Organization (PAHO). Without a safe food supply throughout the Americas, PAHO and the countries will not attain the goal of "Health for All." Health can and must be a bridge for understanding among countries in the common effort toward peace, tolerance, and justice. In a world scarred by differences and turmoil, there is a remarkable degree of

*Translated from the original Spanish manuscript.

consensus on issues pertaining to health. We must make use of that consensus to foster cooperation and commitment by all to attain good "Health for All" in our hemisphere.

Without the appropriate national food protection and environmental sanitation programs, however, that goal will not be reached. For example, contaminated foods and water are among the leading causes of diarrhea, which is responsible for a high infant mortality rate in some countries of the Region. The World Health Organization recently noted that in 1980 alone, more than a billion cases of acute diarrhea occurred in developing countries among children under 5 years of age of whom 5 million died--a rate of 10 deaths in each minute of every day of the year. Children who do not die during the acute episode can become chronically ill as a result of the malabsorption that accompanies diarrhea and which results in malnutrition and loss of immune competence. These children are predisposed to and defenseless against a variety of secondary infections. In 1984, Brazilian scientists documented the risk of secondary infections in a study of the changes occurring in the ultrastructure of the small intestine among well-fed children during episodes of acute diarrhea.

Children are not the only ones at risk. Adults can also experience severe complications from diarrhea caused by contaminated foods. Short-lived diarrheal episodes were once regarded merely as untimely and disagreeable nuisances. Today, we know that enteric pathogens and the diarrhea they cause can lead to such chronic diseases as allergies, autoimmune disorders, neoplasms, malnutrition, and immunologic dysfunction. Very severe consequences ensue when enteric pathogens stray from the intestine to other parts of the body.

These findings are also applicable to the millions of tourists and business people who fall victim to bouts of diarrhea as a result of food eaten while traveling in the Region. The consequent restriction of their activities and reductions in spending adversely affect the foreign exchange earnings and economies of Latin American and Caribbean countries.

Most of the Region's countries rely on food exports for much of their foreign exchange income. They experience economic setbacks when their products are rejected by importing countries because of nonconformance with chemical or biological safety standards. In 1984, more than $1.7 million worth of food products exported by one Central American country alone was seized upon arrival in the United States.

Other countries have experienced even greater losses. The Latin American and Caribbean countries stand to lose enormous sums of money in foreign exchange when their food exports are turned away by the United States, Canada, the European Common Market, and countries on other continents.

Each country also suffers losses at home as a result of food contamination. These losses significantly reduce the food supply and contribute to higher prices for food, which then becomes less affordable, particularly for the poorest population groups.

All these factors affect the food supply in a hemisphere where more than 130 million people suffer from some form of malnutrition. There is no need for further examples to stress the importance of the discussions on food protection at this Conference. The delegates and guest specialists face these problems daily. The abilities and experience of the participants and the dialogues that have taken place during the discussions have resulted in useful recommendations of utmost importance for the development of the hemisphere's countries, for the improvement of the health status of our peoples, and consequently for the facilitation of international trade in food.

The talent, creativeness, and ingenuity of the hemisphere's first inhabitants of Mexico, Guatemala, Paraguay, and Bolivia resulted in the gift of maize to the world, and also showed us how to make it more digestible and its nutrients more effectively available. The ancient Peruvians domesticated the potato, ridding it of natural toxins and contributing the improved product to humanity. This hemisphere also saw development of the first freeze-dried foods. Here, peanuts from Brazil (so rich in fats and proteins) were cultivated; cocoa was grown and chocolate prepared--both gifts of the ancient Mexicans; and many other fruits and vegetable foods were provided to benefit the world. Therefore, the countries of the Americas, which have presented mankind with so many gifts of food and contributions to nutrition, should feel confident about advancing new ideas on valid or widely applicable solutions to food problems.

Report of Food Protection Activities in the United States to the Inter-American Conference on Food Protection

FRANK E. YOUNG

The Inter-American Conference on Food Protection is unique in that it brings together for the first time individuals from the entire Americas Region who have responsibility for the technical leadership of food protection activities. The international development of food safety has long been an area of interest to the U.S. Food and Drug Administration (FDA), and will be an area of enlarged FDA activities in the future. The safety of the food supply is the single most important component in ensuring health for people. Without adequate nutrition, it is very difficult to achieve advances in personal or community health. Thus it is essential that representatives from countries throughout the hemisphere meet in conference to participate openly and freely in the development of health programs in all nations.

In the United States, the assurance of a safe and wholesome food supply requires the services of many people of differing skills and interests, in both the public and the private sectors. Government regulators alone could not begin to do the job if most of the food industry were not dedicated to providing safe and wholesome products, and if educators and university scientists did not help us to understand how to produce and maintain a food supply of high quality. An increased focus on the quality of foodstuffs in the United States, coupled with a stress on preventive measures in public health, has resulted in emphasis being placed on the science of nutrition and on the methods by which food safety can be achieved.

Regulation of food in the United States is shared by federal, state, and local governments. The federal government is responsible for ensuring the quality of most food, since it focuses on the food products that are traded outside of the state in which they are produced. Because the United States has a national food economy, virtually all of its food, whether produced domestically or imported, is federally regulated. Local governments focus on food that is to be consumed in the communities within their jurisdictions. But even here model codes developed by the federal authorities form the basis for state and local regulation. Essentially, the United States has a centrally directed food control system whose policies are implemented by regional laboratories and facilities.

The FDA is a public health agency within the Department of Health and Human Services; it is responsible for regulating most of the nation's food supply to assure safety and wholesomeness. A notable exception is the regulation of meat and poultry, which is accomplished by the Food Safety and Inspection Service of the U.S. Department of Agriculture (USDA). Although seafood falls under the jurisdiction of the FDA, the National Marine Fisheries Service of the Department of Commerce makes available to any interested seafood producer a voluntary fee-for-service inspection program similar to the inspection provided for meat and poultry by the USDA. The Environmental Protection Agency regulates the use of pesticides and other chemicals that could contaminate food. However, it is the FDA that enforces these regulations. In addition to the regulations of these agencies, there are federal government programs to promote the production and distribution of food.

The various regulatory agencies report to many different authorities. Because these agencies are located in different departments of the government, much effort is given to avoiding duplication and inconsistency among activities and regulations and to ensuring that the law is applied equitably. This is accomplished both formally through interagency task forces and agreements and informally through working relationships among colleagues in different agencies. Such informal contacts keep the food protection system responsive to the national needs. If communication occurred only through departmental bureaucracies, the job could not be done in a timely fashion. It has been possible to work in the same informal way with colleagues in other countries. In this manner, not only can we solve problems quickly, but we can also prevent many problems from occurring.

Although all data available tend to support the view that food protection has been successful in the United States, problems do occur nevertheless. Problems usually provide clues to ways in which the system could be modified to meet contemporary needs. Recent outbreaks of illnesses associated with food have involved milk, cheese, and watermelons, to mention just a few examples. All these incidents reflect problems in both old and new technologies; they also reflect the need for regulatory agencies to base their activities on the most contemporary scientific principles.

The success of the food control system in the United States would seem to be based in large measure on several important factors, including the following: first, a focus on the quality of food protection through good manufacturing practices by the food industry itself; second, steadily improving sanitation in food handling and in food distribution; third, the enforcement of standards by well-trained, highly motivated inspectors of high integrity; fourth, recognition by the state that science must serve as the basis for regulatory activity; fifth, a high degree of coordination among the many agencies who are responsible for food safety and food quality; sixth, public participation in the development of regulations, and open enforcement and regulatory activities; seventh, a willingness on the part of policymakers and legislators to separate statute and regulation so that agencies can deal effectively with contemporary problems; and eighth, public recognition of the need for a safe and wholesome food supply.

The United States looks forward to working with the international community to promote health for all by the year 2000. An abundant, high-quality food supply is the most important ingredient in reaching that goal.

Need for Food Protection in a Changing World

PAUL LUNVEN

It is with great satisfaction that the Food and Agriculture Organization (FAO) of the United Nations has cosponsored the Inter-American Conference on Food Protection, which is an event of utmost importance. In 1985, FAO celebrated the 40th anniversary of its foundation. As many know, it was founded as a result of a recommendation made by the United Nation's Conference on Food and Agriculture held in Hot Springs, Arkansas, which was convened on the initiative of the U.S. President, Franklin D. Roosevelt, in May 1943. The mandate of the proposed organization was to put heavy emphasis on human nutrition, and it included specific recommendations to improve national diets, diets of vulnerable groups, and dietary standards.

It is appropriate at this time to look at today's food supplies and nutrition in light of the generous resolutions adopted by the Hot Springs Conference. One crude but simple indicator of the global food situation is the average number of calories available per person in the form of dietary energy, which can be compared with minimum nutritional requirements (taking into account such factors as the age structure of populations).

According to FAO estimates, since the food crisis of the mid 1970s there has been a distinct improvement in the food situation of the developing world as a whole. In terms of average-level dietary energy available to all developing countries, there was as much as a 10 percent improvement between the mid 1970s and the early 1980s. For the first time, that average has moved above the minimum necessary to meet nutritional requirements.

Of course, the picture varies widely from one country to another, and progress is far from being satisfactory everywhere. In sub-Saharan Africa, it is generally disastrous.

In spite of improvements in food supplies, the world is experiencing a phenomenon that is creating increasing concern among many governments of the developing world. This is the rapid increase in the urbanized population. From 1980 to 2000, it is likely that nearly 500 million migrants will move from rural to urban areas in developing countries, helping to raise the percentage of the urban population from 31 percent to 44 percent of the total. Insofar as Latin America is concerned, the percentage of urban population among the total population is expected to show a rise from 65 percent to 76 percent during the same period. The phenomenon is therefore particularly intense in the Americas.

Urban growth and the migration of rural people to towns and cities are normal characteristics of the evolution and modernization of most countries. Encouragement of nonagrarian pursuits, along with improved productivity of those who stay in agriculture, are part of most development strategies. However, the tendency of people and enterprises to concentrate in a few, relatively large cities creates many economic, environmental, and social problems, among which the quality of food supplies and of nutrition are crucial.

In terms of dietary patterns, one implication of the sharp increase in urban population is that from now to the year 2000 those 500 million people will shift from their traditional basic foodstuffs to processed "urban" foods. Such a shift cannot be resisted, because an urban life-style implies exposure to food advertising, fewer meals eaten at home, the inability of working mothers to readily nurse their babies, and, above all, the fact that access to food is almost totally dependent on income as a result of the near impossibility of relying on self-produced food.

In order to face this situation and to satisfy consumer preferences, the only possible strategy is to help food systems to adjust to the increasing demand for food--especially for processed food. Such a strategy implies better production, marketing, and distribution of food through food price and import policies; the development and regulation of food marketing systems; and special subsidy and nutrition programs for disadvantaged urban groups. As part of this strategy, protection of the consumer and the facilitation of trade within and among countries, through appropriate food standards and food quality control, are crucial in order to ensure improved nutrition and levels of living in the world of tomorrow.

The Hot Springs Conference noted the role of government services in ensuring "protection of the public, through the medium of pure-food laws, against impurities or adulterations and against unfair competition and undesirable trade practices." It recommended in Resolution 28, that FAO, when established, "assist governments to extend and improve standards of nutrient content and purity of all important foods, consider also the formulation and adoption of similar international standards to facilitate and protect the interchange of such products between countries, and agree upon international methods of determination".

It was only in 1961 that this recommendation could be considered as effectively fulfilled. In that year the Eleventh FAO Conference, acting on the recommendations of the Regional Conference for Europe and the Director-General of FAO (B. R. Sen), endorsed the proposal of a joint FAO/WHO (World Health Organization) Food Standards Program and established the Codex Alimentarius Commission. The commission's basic objectives were precisely those put forward at Hot Springs: the removal of nontariff barriers to trade caused by differing national food legislation, and protection of the consumer against health risks and fraud.

The role of the Codex Alimentarius is discussed in the paper on "International Food Standards and Trade" by E. Kimbrell. But I would add that FAO is actively engaged in strengthening national capabilities for food control in order to implement food standards and protect food supplies and the consumer. In this work, FAO collaborates very closely with WHO and the Pan American Health Organization (PAHO).

FAO takes the recommendations of the Inter-American Conference on Food Protection most seriously. Their implementation, through the cooperation of FAO member countries in the region and PAHO, will be of mutual benefit and will foster the cause of improved food protection in the Americas.

Objectives of the Conference

Food safety and quality problems have major consequences for international trade in food and for the health status of populations. Given the importance of these effects, there is need for a consensus statement that will stimulate appropriate actions by policymakers. Such a statement should be supplemented by the identification of the specific food control needs of the various countries, localities, industries, and populations.

The overall objective of the Conference, therefore, is to develop recommendations of direct, practical value that the participants and their governments can use to accelerate progress in food protection activities in both public and private sectors.

The specific objectives are:

- to initiate closer and more effective communications among all countries in the Western Hemisphere on matters relating to food quality and safety;
- to establish priorities and develop recommendations to foster cooperation toward improving food protection activities in all countries of the Western Hemisphere;
- to improve collection of epidemiological data on the occurrence of food contamination and the public health consequences;

o to consider the most appropriate means of storing, retrieving, and exchanging epidemiological and food control data at national and regional levels;

o to establish improved communication, coordination, and consistency in food control activities among responsible agencies and industry in the hemisphere;

o to identify and implement ways to educate and train individuals in food control procedures.

Strategies for improvement in food control are expected to include:

- o legislation and infrastructure development
- o increased community participation
- o improved intercountry cooperation
- o better means of information exchange
- o identification of technologies most appropriate for each level of production, processing, and distribution
- o enhanced education and training

The recommendations must go beyond defining the state of the art. They must explore what is practical and feasible, and take into account both national similarities and differences and regional needs.

SESSION 2
Issues in Inter-American Food Protection and Trade

Food: From Producer to Consumer—Microbiological, Chemical, and Physical Risks*

JESUS KÚMATE and ARMANDO ISIBASI

Food is a complex, diverse, and varying mix that serves multiple human needs. Chief among these are needs related to nutrition, culture, and esthetics (Alberts et al., 1983).

The microbial universe is present in all ecological niches. It consists of a flora that has adapted itself, over thousands of millions of years of evolution, to use all those molecules described as food as a source of mass or energy. Metabolic versatility has allowed for great capacity in adaptation, so that microbes can grow and reproduce in minimal media in a prolific manner, not unlike the process observed in culture media.

Food can support the growth of bacteria, fungi, and parasites. The names of some common culture media, such as bouillon, beef broth infusion, brain infusion, blood agar, and lactose agar, remind us that the culture media currently in use in microbiology have their roots in nineteenth-century cooking practices (Wilson and Miles, 1975).

From the moment of its production up to its consumption, food is subject to possible microbiological

*Translated from the original Spanish manuscript.

contamination throughout the chain of production, manufacturing, storage, distribution, and marketing of the products. During this time, contaminating organisms can proliferate and reproduce, and produce toxins or become an infectious inoculum for the consumer. Such unwanted microbial activity renders foods inedible, and, too often, dangerous.

When humans obtained food solely by gathering and hunting, the consumption of the food thus collected did not present danger of microbial contamination, except for any danger existing prior to the gathering or hunting. Food was consumed immediately after acquisition or soon thereafter in the course of the same day (Barnes, 1970).

Approximately 12,000 years ago, the invention of agriculture and the domestication of animals transformed the human species from hunters and gatherers into farmers and shepherds. The availability of plant- and animal-based foods in quantities that exceeded daily consumption needs made it necessary to develop systems for preserving and storing this excess food in an acceptable manner for future consumption. Salting, smoking, heating, and drying of meat, fermenting of milk, and adding acidic substances such as vinegar were all systems developed throughout prehistory and ancient history to preserve food over long periods. Modern technology has enormously increased the range of available agents and methods.

The possibility of chemical contamination has always existed because of the production of toxic substances by contaminating microorganisms. In recent years, pesticides and antimicrobial preparations have been used on an unprecedented scale in intensive agriculture and animal husbandry. But in some cases the successive steps in the food chain serve to increase rather than reduce the concentration of a toxic contaminant. When this happens, the risk for the last link in the chain--the human consumer--is at a maximum.

The importance of food additives in food production has been increasing as a result of continuing pressures for reduced food costs and for the improved appearance, texture, nutritional quality, and preservation of foods. Safe and effective use of additives is an ongoing concern of the agencies responsible for food safety. National and international policies are directed toward keeping the risks attendant on additive use well below those inherent in foods themselves.

Heating (pasteurization, cooking, retorting) is a principal method of food processing. It reduces or eliminates microbiological loads, but also alters substantially the physical and nutritional characteristics of food. Some of these changes, such as the destruction of thermolabile vitamins or leaching of water-soluble nutrients, are adverse. Other changes are advantageous. Trypsin inhibitors are destroyed, natural toxicants such as cyanide are reduced, and palatability is improved.

MICROBIOLOGICAL RISKS

Endogenous Contamination

Microbiological or parasitic contamination can be present in food before harvest or slaughter. This class of endogenous contamination may occur as natural disease in a plant or in an animal's dietary source (Acha and Szyfres, 1977). Examples are cysticercosis in pigs, toxoplasmosis in hooved animals, and trichinosis in pigs. The organisms responsible for bovine tuberculosis and brucellosis in goats, sheep, and cattle are present in the milk and milk products obtained from these animals. Contamination of poultry eggs is associated with salmonellosis and campylobacteriosis.

Fish present the hazard of diphyllobothriasis and paragonimiasis. _Anisakis_ sp. larvae contaminate humans as an aberrant host through the ingestion of raw, lightly salted, or smoked fish infested with that organism. In eating shellfish there is the risk of cholera, hepatitis type A, typhoid fever, and infection with _Vibrio parahaemolyticus_.

Exogenous Contamination

In most cases, food is obtained under microbiologically innocuous conditions, but subsequent contamination in some phase of the chain from production to consumption introduces inocula of varying magnitudes

(OMS, 1984). Storage conditions and the nature of the microbes are two elements that determine whether or not the microbial load will be hazardous. Some representative examples of contamination by bacteria, parasites, and viruses are listed below.

Bacteria

Bacillus cereus can contaminate cooked rice, cooked meats, vegetables, or puddings.

Clostridium botulinum, an anaerobic bacterium, is a potential contaminant in sausages and canned foods. The contamination of bee honey by spores of this microbe has been associated with cases of botulism in nursing infants.

Clostridium perfringens is another anaerobic bacterium that frequently contaminates cooked meats and vegetables. Its reproduction in foods and its production of exotoxins produce a highly variable set of clinical symptoms. In New Guinea, the type known as "pig bel" is particularly serious.

Pathogenic strains of *Escherichia coli* are the most frequent cause of diarrhea in the world, particularly among the 500 million tourists who annually visit countries having deficient environmental sanitation and potentially contaminated foods. Salads, vegetables, and milk are the foods most frequently involved.

Salmonellae spp., in the form of the typhoid bacillus and others of the more than 2,000 classified species of salmonellae, can contaminate foods and produce illnesses with clinical symptoms ranging from mild diarrhea to bacteremia and death. They frequently cause the more serious outbreaks of foodborne illness in more developed countries, affecting particularly infants and the infirm.

Shigella sp. is the causative agent of bacillary dysentery, and inocula of as few as 100 bacteria are capable of producing clinical symptoms of dysentery.

Staphylococcus aureus by virtue of its enterotoxin, is responsible for the most frequent kinds of food poisoning, through the contamination of sausages, salads, ice cream, milk products, and cream.

Vibrio sp. is responsible for diarrheal symptoms resulting from a very powerful exotoxin. The organisms can contaminate shellfish, salads, or solid plant-based foods that have been irrigated with or in contact with nonpotable water. A group of vibrios other than *Vibrio cholerae* has been found capable of producing septicemia.

Vibrio parahaemolyticus contaminates raw fish and seafoods and is responsible for diarrheal symptoms of varying magnitudes.

Listeria monocytogenes is a bacterial infection increasingly recognized as a cause of severe and sometimes fatal meningitis resulting from ingestion of contaminated milk and dairy products.

Yersinia enterocolitica in the meat of fowl and pork and in milk is associated with diarrheal symptoms that are almost always very serious.

Parasites

Entamoeba histolytica is responsible for intestinal and extraintestinal amebiasis (OMS, 1981). The cysts ingested with contaminated foods and beverages become trophozoites in the intestinal tract, without pathological consequences (carrier state). They may invade to cause intestinal amebiasis and may spread to other organs to cause serious systemic disease.

Giardia lamblia can cause diarrhea and malabsorption after ingestion of contaminated foods or beverages (OMS, 1981).

Poorly cooked pork contaminated with *Taenia solium* cysts can cause intestinal infestation with this pork tapeworm (OMS, 1981). With poor sanitation, this can lead to cysticercosis in human beings--a chronic, debilitating, and often fatal disease.

Sarcocystis hominis and *S. suishominis* are the causative agents of human coccidiosis (OMS, 1981). Humans, such as the final hosts, become ill as the result of ingesting raw or insufficiently cooked pork or beef.

Viruses

Hepatitis A virus infection is one of the most common food and waterborne viral infections, causing disability, jaundice, and sometimes death.

Norwalk and Rotavirus infections are common causes of waterborne sporadic and epidemic diarrhea, especially in infants and children.

CHEMICAL RISKS

Foods can contain toxic substances as the result of endogenous production of microbial, environmental, industrial, or accidental contamination, or of the misuse for food (through accident or ignorance) of components intended for nonfood use.

Endogenous Toxicants

Plants and animals naturally produce toxic compounds on which evolution has conferred a role in the survival of the plant or animal. Fruits such as wild cherries, or mushrooms that appear to be edible but are not, are examples of materials that are sometimes consumed even though they are hazardous because of the presence of toxic compounds.

Exogenous Contamination

Frequently encountered, but rarely at levels known to be hazardous, are the mycotoxins (particularly aflatoxins) (OPS, 1983), which result from the proliferation of certain strains of *Aspergillus flavus* and *A. parasiticus* fungi.

Food for human consumption and feed grains for animals, especially in tropical and subtropical areas, are particularly susceptible to contamination by fungi and to the production of four aflatoxins: B_1, B_2, G_1, and G_2. These toxins can also be found in the milk or meat of animals that have been fed contaminated feed grains.

Some plant products, such as the peanut, are particularly susceptible to contamination by fungi and to the production of aflatoxins. Throughout the world, the incidence of contamination by shelled peanuts is between 15 percent and 78 percent. Close surveillance is necessary, both to exclude hazardous levels from the market and to detect poor processing and storage conditions that require correction.

Aflatoxins have teratogenic effects in animals and potential carcinogenic effects in humans. A direct positive association has been reported between the consumption of aflatoxins and the incidence of primary cancer of the liver among some population groups in Africa that consume highly contaminated foods and beverages.

An example of exogenous contamination from consumption of adulterated foods is the epidemic of the toxic-oil syndrome that occurred in Spain (Kilbourne et al., 1983). Between May and June 1981, a set of clinical symptoms consisting of respiratory disorders arose in epidemic proportions: dyspnea, nonproductive cough, pleuritic pain, fever, headache. Chest x rays showed bilateral lung infiltrates and, on occasion, generalized adenopathies, splenomegaly, and exanthema.

The etiology, which was taken initially to be microbial and in particular to result from legionellas, was soon associated epidemiologically with the ingestion of an olive oil that had been adulterated with aniline derivatives. The oil, intended for industrial use, had been denatured with aniline. The chemical processing that was supposed to eliminate the aniline was not effective, and the contaminants were associated with the appearance of these symptoms. One year later, in June 1982, 19,828 patients were diagnosed, of whom 11,731 (59 percent) required hospitalization and 315 (1.6 percent of those affected) died.

The recent occurrence of a disaster such as that caused by the contaminated oil in a country that now belongs to the European Economic Community gives an idea of the possibilities that can arise when surveillance is not carried out properly in the course of large-scale management of industrialized foods.

The risks associated with the contamination of food are clearly tied to socioeconomic and cultural factors. In rural populations, the problems consist of the consumption of raw or contaminated foods and nonpotable water, the presence of fecal matter in the environment, and inadequate systems for storage. Thus, these physical and environmental aspects enhance the pervasive biological risk.

An important risk in the handling of meat in Third World countries is the improper operation of slaughterhouses. Indeed, the conditions for slaughtering and the handling of meat, viscera, and other products are propitious for microbial contamination. Deficient or incomplete inspection leads to the consumption of endogenously parasitized products (Bobenrieth, 1985).

In marginal urban sectors, there is in addition the large danger presented by food sold by vendors in the streets. Improper handling, from preparation up through sale, poses very high risks to the urban population despite that population's greater economic resources.

The population belonging to the middle and upper classes consumes or can consume foods that are microbiologically innocuous. However, contamination can occur in the processing, storage, or transportation stages. It is almost always a result of enteropathogens in foods such as eggs, powdered milk, cheeses, and milk products.

Finally, it must be recognized that careless food preparation or handling in the home or food-service establishment constitutes in all societies a major component of risk from foodborne illness.

What Liebig stated a century ago still holds true: Man is what he eats (Der Mann ist was er isst).

REFERENCES

Acha, P. N., and B. Szyfres. 1977. Zoonois y enfermedades transmisibles al hombre y a los animales. Publicación Científica No. 354. Organización Panamericana de la Salud, Washington, D.C. 708 pp.

Alberts, B., et al. 1983. Small molecules, energy, and biosynthesis. Pp. 43-89 in Molecular Biology of the Cell. New York & London: Garland Publishing, Inc.

Aguilar-Contreras, A., y C. Zolla. 1982. Plantas tóxicas de México. Instituto Mexicano del Seguro Social, México. 271 pp.

Barnes, G. 1970. The biology of pre-neolithic man. Pp. 1-26 in S.V. Boyden, ed. The Impact of Civilization on the Biology of Man. Australian National University Press, Canberra.

Bobenrieth, R., et al. 1985. Saneamiento de mataderos de bovinos, ovinos y porcinos. Bol. Of. Sanitaria Panamericana 98:211-227.

Kilbourne, E. M., et al. 1983. Clinical epidemiology of toxic-oil syndrome. Manifestations of a new illness. N. Engl. J. Med. 309:1408-1414.

Levine, A. S., et al. 1985. Food technology. A primer for physicians. N. Engl. J. Med. 312:628-634.

OMS (Organización Mundial de la Salud). 1981. Infecciones intestinales por protozoos y helmintos. Serie de Informes Técnicos 666. Organización Mundial de la Salud, Ginebra. 163 pp.

OMS (Organización Mundial de la Salud). 1984. Importancia de la inocuidad de los alimentos para la salud y el desarrollo. Serie de Informes Técnicos 705. Organización Mundial de la Salud, Ginebra. 86 pp.

OPS (Organización Panamericana de la Salud). 1983. Micotoxinas. Publicación Científica No. 453. Organización Panamericana de la Salud, Washington, D.C. 131 pp.

Wilson, G. S., and A. A. Miles. 1975. Topley and Wilson's Principles of Bacteriology, Virology and Immunity. Vol. 1. 6th ed. Williams & Wilkins, Baltimore, Md. 1247 pp.

Food Risks in Perspective

RICHARD L. HALL

Dr. Kumate's paper has provided a comprehensive and detailed list of foodborne risks. Among his other interesting points is that of the double impact of the Neolithic revolution. The conversion from hunting and gathering to herding and farming enormously increased the supply of available food. At the same time, it greatly enhanced the risks, through contamination, in that enlarged supply of food. Thus was established a pattern that continues to be valid: virtually every step we take to enlarge or preserve the food supply, no matter how beneficial, carries with it some--usually minor--increase of risk. The purpose of effective food processing and distribution systems and the purpose of food control systems is to retain as many as possible of the benefits while minimizing the attendant risks.

To move effectively toward its objective, this Conference must focus on the greatest risks and those that can most easily be reduced.

Dr. Kumate divided risks into the microbiological and the chemical, and classified the latter as both endogenous and exogenous. One could consider a slight expansion of these risk classifications.

- o microbiological contamination
- o natural toxicants (chemical, endogenous)
- o environmental contaminants (chemical, exogenous)
- o pesticide residues (chemical, exogenous)

- o food additives (chemical, exogenous)
- o loss of nutrients

Morbidity and mortality statistics from Western Europe, Canada, and the United States confirm that foodborne microbiological risks far exceed the chemical hazards (Bryan, 1978; CDC, 1983, 1984), though it is clear that even in these countries only a tiny fraction of the total cases is reported. For developing countries in Latin America and elsewhere, statistics on foodborne risks are scant or nonexistent.

There can be no doubt of the total impact of enteric disease. Snyder and Merson (1982), using 1980 population estimates, calculate that in Africa, Asia (excluding China), and Latin America, there were 4.6 million deaths from diarrheal disease among children under five. What is unclear is how much of this disease burden is foodborne, how much waterborne, and how much is due to the general environment. A number of publications, focusing mainly on weaning foods, confirm the high levels of enterotoxigenic bacterial contamination of these home-prepared foods in several developing countries (Barrell and Rowland, 1979, 1980; Rowland et al., 1978). Other publications (Caparelly and Mata, 1975; Jiwa et al., 1981) provide comparable results on contamination of adult foods. Very few reported studies directly link food contamination to disease rates. One such, on weaning foods in Bangladesh (Black et al., 1982) found a significant relationship between the proportion of a child's food contaminated with *Escherichia coli* and that child's annual incidence of diarrhea associated with enterotoxigenic *E. coli*.

There is no broad data base for developing countries, but the primacy of microbiological risks--or microbiological/nutritional risks--is clear. In any country or area, regardless of economic and social status or organization, the microbiological risks in the food supply are by far the greatest.

Far below microbiological risks in frequency or overall impact, though still extremely serious when they do occur, are the four categories of chemical risks listed above. Compared with other chemical risks, those from endogenous natural toxicants are less often recognized or reported, and therefore are accepted less critically. What data are available suggest that quantitatively they exceed any other category of chemical risk.

Environmental or accidental risk exposures, such as those resulting from contaminated olive oil in Spain or polychlorinated biphenyl (PCB) contamination of animal feed in Michigan, are exceedingly serious when they do occur. They are not common, and because of their unusual nature, garner much public attention. No possible system of monitoring or control can wholly prevent such incidents. Diminishing their probability and potential for harm depends upon the existence of an adequate infrastructure that incorporates regulation, labeling, education, training, and enforcement against the careless and criminal, as well as a public health system capable of providing prompt and effective responses.

The magnitude of pesticide risks in any food supply is directly dependent on the degree of misuse of these agents. Where there exist effective means for safety evaluation and tolerance setting, product labeling, training of applicators, and monitoring for effective compliance, serious problems are rare. No country is free of them, as the recent aldicarb contamination in California watermelons demonstrates. But where infrastructure is lacking, or enforcement is lax, risks from careless or uninformed use of pesticides rise far above an acceptable level. In such an environment, they may not receive adequate attention. For the same reasons, all the other food risks--particularly those from microbiological causes--will be magnified.

The same general statements may be made about risks associated with food additives that are functional minor ingredients or processing aids--not contaminants that find their way into food through carelessness or lack of training. As with all other agents affecting the food supply, additives must be used only with effective evaluation, labeling, training, monitoring, and control. In more developed economies these are the factors that keep such lesser chemical risks at a negligible level.

Nevertheless, we cannot scatter our limited resources by training all these categories of risk, and the detailed causative factors within them, as of equal importance or probability. Everywhere the ranking of the risk categories remains the same. Their total impact falls in proportion to the means available for their control. It is the function of local and regional public health and monitoring systems to identify the specific risks most demanding attention in each category so that inevitably limited resources in government, education, and industry can be focused where they are most needed.

REFERENCES

Barrell, R. A. E., and M. G. M. Rowland. 1979. Infant foods as a potential source of diarrhoeal illness in rural West Africa. Trans. R. Soc. Trop. Med. Hyg. 73(1):85-90.

Barrell, R. A. E., and M. G. M. Rowland. 1980. Commercial milk products and indigenous weaning foods in a rural West African environment: A bacteriological perspective. J. Hyg. Camb. 84:191-202.

Black, R. E., K. H. Brown, S. Becker, A. R. M. Abdul Alim, and M. H. Merson. 1982. Contamination of weaning foods and transmission of enterotoxigenic *Escherichia coli* diarrhoea in children in rural Bangladesh. Trans. R. Soc. Trop. Med. Hyg. 76(2):259-264.

Bryan, F. L. 1978. Disease Transmitted by Foods (A Classification and Summary). HEW Publication (CDC) 78-8237. U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, Bureau of Training, Atlanta.

Caparelly, E., and L. Mata. 1975. Microflora of maize prepared as tortillas. Appl. Microbiol. 29(6):802-806.

CDC (Centers for Disease Control). 1983. Foodborne Disease Outbreaks Surveillance, Annual Summary 1981. Publ. No., HHS CDC 83-8185. Issued June 1983. U.S. Department of Health and Human Services, Public Health Service, Washington, D.C. 41 pp.

CDC (Centers for Disease Control). 1984. Water-Related Disease Outbreaks Surveillance, Annual Summary 1983. Publ. No., HHS CDC 84-8385. U.S. Department of Health and Human Services Public Health Service, Washington, D.C. 15 pp.

Jiwa, S. F. H., K. Korvacek, and T. Wadstrom. 1981. Enterotoxigenic bacteria in food and water from an Ethiopian community. Appl. Environ. Microbiol. 41(4):1010-1019.

Rowland, M. G. M., R. A. E. Barrell, and R. G. Whitehead. 1978. Bacterial contamination in traditional Gambian weaning foods. Lancet 1(8056):136-138.

Snyder, J. D., and M. H. Merson. 1982. The magnitude of the global problem of acute diarrhoeal disease: A review of active surveillance data. Bull. WHO 60(4):605-613.

Food Hazards and Health Issues

DISCUSSION SUMMARY

During the discussion following the presentations on Food Hazards and Health Issues, the following themes, statements, and proposals emerged:

- Comparing food protection to food production, the discussants stressed the need to give at least as great attention to food protection as to food production.
- In the long run, a central measure for food protection must be consumer education resulting in higher standards of demand. In the meantime, more immediate steps have to be taken that require the full commitment of government officials.
- It is important to realize the complexity and heterogeneity of the food production-food consumption chain, as well as the variations that occur as a result of geographic and seasonal differences.
- While well-established factories will usually have good standards and are interested in improving them, in many countries there is a sizable part of the food industry that is very small, cottage industry, or even clandestine; each of these levels requires a different approach.
- While it is often stated that good food-quality control is too expensive for many producers, the

discussants concluded that very simple and affordable measures can assure the core of adequate control.

o Food protection needs to be approached with recognition of the large number of interdependent factors involved. Environmental sanitation, including a safe water supply, is a basic and indispensable requirement for achieving good food-quality control. It is difficult to achieve, but it can be done, as has been shown in Cuba and some other Latin American countries.

o Information on the real magnitude of food protection problems is inadequate. In many countries foodborne diseases incorrectly occupy a secondary place in health statistics because of inadequate or defective reporting and recording of data. The discussion emphasized the need for good information systems, as well as the concept that morbidity from diarrhea is a far more sensitive and important indicator of unsafe food and water than death rates. Chronic consequences should be added to the effects of acute episodes as parameters to measure the frequency and cost of foodborne disease.

Discussants proposed that problems in food protection in Latin America be listed in the following order of priority:

o bacterial contamination
o mycotoxins
o pesticide residues, particularly those resulting from misuse
o residues of antibiotics, hormones, and plant-growth promotors
o parasitic infections, especially amoebiasis and giardiasis
o natural toxicants
o food additives

Since nutritive value is sometimes lost during processing, nutritive value should be included as a parameter for food quality control.

Finally, emphasis was given to:

o improving training in food microbiology in medical, food technology, and nutrition schools o standardization of analytical methodology for the more common problems, but also for so-called uncommon contaminants such as *Campylobacter*

o promoting research, especially that of a very practical and applied nature, to be carried out in the places where the problems occur

Food Control Mechanisms in the Americas

ALEXANDER B. MORRISON

THE DUAL OBJECTIVES OF FOOD CONTROL

National food control services have developed in the Americas during the last hundred years primarily because of two interdependent, yet separate, concerns of consumers. Of these, demands that the food supply be safe to eat is perhaps of greatest importance. However, economic concerns that foods not be sold in ways that are false, misleading, or deceptive have not uncommonly been the primary motivating forces behind national food control legislation. In Canada, for example, it was economic concern over food fraud, and not concerns about health per se, that led to the development of early food control legislation in the 1870s (Chapman and Morrison, 1966). The driving force of economic factors is underscored by the fact that in many developing countries of the Americas Region the quality of food destined for export is often more strictly controlled than that intended for consumption within the country.

It is only relatively recently that many national governments in the Americas and elsewhere have begun to consider food control in its proper perspective: protection of both consumers' health and of the economic interests of the country and the individual (Morrison, 1981). Although there are many factors influencing food control that lie outside the health sphere, failure by national governments to recognize that one of the primary purposes of food control is to protect health will inevitably lead to food control policies and practices that are determined by short-run economic advantages, which may not be in the long-term interests of the nation.

As a vital component of primary health care, food control must be able to influence food handling activities in community health centers and at household levels. Large numbers of food-related illnesses have their origin and solution in the home or in the community. Food control activities must therefore include educational efforts directed toward families, to ensure safe handling of foods at the household level. Focus should be on the two groups--women and children--that have the greatest influence over the quality of food in the home, and should involve such simple but important matters as education in personal hygiene, sanitary waste disposal, and safe methods of food preparation for the family.

The active participation of the community is a basic concept of primary health care. Food control must therefore involve food safety programs at the local, community level. This effort is of particular importance for many countries of the Americas, where vast amounts of food are prepared by small-scale local food processors and distributors.

This is not to say that the establishment of legal standards for the safety of foods, coupled with vigorous compliance activities, are unimportant. Food control authorities, if they are to effectively protect the public, must combine education of families and industrial food processors with vigorous enforcement of food safety laws. The proper mixture of these food control methods will depend upon the particular circumstances in each control situation. Most food manufacturers, for example, either voluntarily abide by their own high standards to ensure safety of their products or will voluntarily comply with such standards when informed and educated about the need to do so. Small numbers of manufacturers in every country, however, are sufficiently irresponsible that they will only respond to vigorous legal actions to control their activities.

In summary, it is apparent from the foregoing that food control has two major objectives: to protect consumers against unsafe foods and to guard them against food fraud. Since many foods sold in ways that are misleading, deceptive, and fraudulent are also unsafe, it is obvious that these two objectives are interrelated. The public health aspects of food control are a major component of primary health care. Thus, food control must embody educational practices and programs. However, food control also involves inspection, analysis, and other compliance activities, all of which have legal and law enforcement ramifications.

FOOD CONTROL PROBLEMS IN THE AMERICAS

Food control in the Americas must be seen against the background of a series of interrelated and complex problems that severely tax the ability of many national governments to provide necessary protection against unsafe and fraudulent foods (Morrison, 1981; PAHO, 1981a,b). These include rapid population growth: in the Region as a whole population is growing faster than food production. Rapid but disorganized urban growth, a commonly observed pattern, places additional strains on already heavily burdened support systems, including housing, the provision of clean water and adequate sanitary facilities, and employment opportunities. With uncontrolled urban growth there is increased dependence on foods produced outside the home and community. There is inevitably less individual safety control over these foods. There is also an increasing dependence by many countries on imported foods, which may or may not be produced, processed, stored, or distributed in ways that are safe.

Domestic food processing industries in most countries of the Americas are characterized by large numbers of small- or medium-sized firms. Many such firms lack the financial resources, physical facilities, and trained staff necessary for proper quality control. As a result, inadequate attention is often paid to the need for close and continuing control over sanitation in food processing, storage, and distribution--or to resultant public health problems. Refrigeration and other storage procedures that help maintain food quality often are lacking, and transportation and distribution facilities and procedures may be deficient. Food spoilage or loss of food quality and quantity through contamination by rodents, insects, bacteria, molds, and other causes or vectors of disease is common. In other words, the infrastructures and expertise necessary for proper food control at all points in the production, processing, distribution, and marketing chains are lacking, or do not function effectively, in many countries of the Region.

A recurring problem is the lack of a firm national commitment to a safe food supply. Many countries in the Region do not yet have clearly defined and articulated national food control policies, and as a result, fragmentation of efforts by various government departments and agencies is common and competition among government departments for staff, funds, and prestige may arise. Enforcement of existing laws often is sporadic at best, and both inspection and analytical components of compliance activities are not uncommonly deficient in quality and quantity.

Within the Americas Region great differences in the effectiveness of national food legislation are apparent. Many Latin American countries enacted food control laws between the two world wars (1920 to 1940). Although the legal systems of most Latin American countries are based, for historical reasons, on those of Spain or Portugal, significant differences have developed in national food laws. The smaller nations of the Caribbean generally have attempted, with varying degrees of success, to enact food laws that reflect those of the former colonial powers. Although the United States and Canada both have food control laws and mechanisms that are reasonably effective within their own national settings, it would be most unwise to assume that the North American experience in food control could or should be the model for other countries. In developing their own national food laws and resources, including national processing industries, other countries of the hemisphere may choose not to follow patterns established in the United States or Canada. Each nation must choose its own path in developing and applying effective food control laws and mechanisms. Developing nations setting up food control services should be able to gain from the efforts and errors of those who have gone before them.

While national food laws must safeguard national interests and reflect national situations, it is important, in light of the growing international trade in foods, that such laws not be in serious conflict with the requirements of the world market. In particular, national food standards should follow those of the Codex Alimentarius--countries need not waste their time reinventing food standards.

Food legislation in many countries of the Region still is obsolete, incomplete, or both, although improvements are being made. All too often national food laws are characterized by jurisdictional dichotomies that weaken their effectiveness. Thus, with a few prominent exceptions such as in Argentina and Brazil, legal provisions concerning food hygiene are commonly found in sanitary codes that also deal with many other aspects of human, or even animal, health. Authority to elaborate food standards may be given to an agency responsible for developing standards for many items other than food. Such a split in jurisdiction makes effective food control possible only if a high degree of interministerial cooperation is obtained. As anyone who has ever worked in a large government bureaucracy well knows, such cooperation is more often the exception than the rule, in every country.

GENERAL FOOD PRINCIPLES FOR FOOD CONTROL

What advice can then be given on general principles to be followed in setting up and administering a national food law that will best meet the dual objectives of food control? According to FAO/WHO/UNEP (1976) and Morrison (1981), guidelines, which should be applicable regardless of the size of the country or stage of its development, should include the following:

Distinguishing between Legislation and Regulation. A national food control law should set forth the principles of control over food safety and fraud; it should not contain details subject to frequent amendment because of changing technology and scientific advances. Within the framework of the principles established by the national food law, the legislation should provide authority to a food control agency to enact detailed regulations, including the establishment of food standards, lists of permitted additives and permitted levels of contaminants, manufacturing requirements, etc. In other words, legislation--which changes slowly and is under direct parliamentary or congressional, rather than bureaucratic, control--should be uncoupled from regulations, which may require rapid adjustment in light of new scientific information.

Focusing Authority in a Health-Oriented Agency. One ministry must be given an important, but not necessarily exclusive, role in developing and administering national food control policies. As long as the national food control agency, in its policies and daily work, maintains the principle that food control is a vital bulwark of public health rather than an economic support activity for food producers and processors, the ministry in which the agency is located or to whom it reports is perhaps of lesser importance. It may be more difficult to retain a health orientation if the food control agency is located in an economic ministry, but if such a decision is made by the national government, the health ministry should be given the final authority for setting health standards.

Collaboration between Health and Agriculture. Food control being a multisectoral field, it is essential that there is a close collaboration between the health and agriculture sectors. It is highly desirable that the relationships between the ministries of health and agriculture be developed and defined by statute in ways that recognize and protect the legitimate concerns of each relative to food control.

The Primacy of National Law. In nations having a federal system of government, state or provincial food control laws must not hamper trade within the country. In such countries, a national food control law that applies in all political jurisdictions is required, as was found necessary in Brazil and Argentina. In Canada, the legal primacy of the Federal Food and Drugs Act over provincial laws in matters relating to food safety is well established (Pugsley, 1967). The Federal Act has proven of considerable value in ensuring the safety of the national food supply, applying as it does to the sale of foods at all points and levels in the food manufacturing, distribution, and marketing chain.

Creative Financing of Food Control Service. Most developing nations within the Region find it difficult to finance an effective food control service from general revenues obtained by taxation. As a result, increasing attention is being paid to the "user pays" principle, whereby the costs of inspection of food manufacturing establishments are borne (at least in part) by the manufacturers, on whom inspection levies are imposed by the national government. These procedures may generate much-needed revenue. However, care must be taken. Manufacturers must not be allowed to insist that since they pay the costs of inspection activities they will determine the nature and extent of those activities. Other mechanisms that national governments might consider for raising revenues for effective food control services include compulsory registration of branded products (with an accompanying fee) or taxes dependent upon the amount of sales. Regardless of the mechanism(s) chosen, when special fees are levied it is important they be used for maintenance of the food control system, and not be subsumed into general government revenues. Lack of appropriate administrative mechanisms to accomplish this objective may, indeed, limit the application of "user pays" procedures.

Safety in Street-Vended Foods. Special mention must be made of problems associated with itinerant street vendors of foods, who play a significant role in food distribution in many urban areas of Latin America and the Caribbean. In many instances food distributed by street vendors may be contaminated or adulterated, and hence pose a serious risk to health. There is no easy way to deal with the problem. Unless vigorously and consistently enforced, laws are of little value, and the itinerant nature of the operators makes control difficult. Public education about the major role of contaminated or adulterated food in causing disease is of special importance. The provision of potable water and other sanitary services for use by street vendors may be of considerable value. From their perspective as international agencies, the Pan American Health Organization (PAHO) and the Food and Agriculture Organization (FAO) could provide much-needed leadership in developing innovative approaches to dealing with this problem effectively and humanely.

Providing for Food Inspection. A national food control law must provide for a strong food inspection capability. In small countries a single food inspection service may cover all levels of trade throughout the country. In larger countries, however, much of the day-to-day administration of food control services may be handled at local or state levels, particularly where products move only in local commerce.

The powers of inspectors must be clearly spelled out in the national food laws so inspectors can carry out their duties without obstruction or harassment. These include the power to examine books, documents, and records; to seize and detain foods and food ingredients; to take samples for analysis; and to inspect food manufacturing, storage, and distribution establishments. Close liaison is required between inspectors and laboratory analysts; each must be fully aware of the activities of the other, and work in close conjunction with their colleagues.

In carrying out their duties, inspectors must remember that quality must be built into each step involved in the production of a product, and cannot be "inspected" into a product. Thus, increased inspection pressure must be maintained on marginal firms until they build quality into their products. Conversely, when a firm shows, on the basis of repeated inspections, analytical data, and measures of quality such as consumer complaints and product recalls, that its products are consistently of high quality, inspection pressure can safely be reduced. Inspectors should also concentrate attention on the most vulnerable or critical points in the food production process, for it is there that problems are most likely to occur.

It is important that food inspectors be adequately trained and recompensed for their duties, which are exacting and demanding. In some countries multipurpose inspectors, who inspect other things besides foods, may be used. Where this is done, it remains important to develop, train, and retain a group of specialized food inspectors who can carry out especially difficult or technically exacting inspections and can train more generalized workers. For long-term personal commitment to the field, it is essential that inspectors have clearly defined career paths. Similarly, adequate levels of remuneration reduce the temptation of corruption to which inspectors in all countries are exposed. In addition to food inspectors trained at the professional level, there is a great need for people trained at the subprofessional level who can provide basic inspection services.

In the Region there is a marked shortage of trained food inspectors who can deal effectively with activities related to food processing and handling, including both microbiological and chemical hazards. Furthermore, the need to upgrade the technical capabilities of existing inspectors remains high. The pace of technological change is so rapid that failure to provide for periodic technical upgrading of inspectors will soon result in a significant drop in the degree of public protection provided by national control services. For example, uncontrolled use of chemical pesticides can leave toxic chemical residues in foods that cause serious health problems. Proper food processing, on the other hand, may significantly reduce chemical residues in the food supply and thus increase its safety. Proper evaluation and inspection activities in this complex area require highly trained and knowledgeable staff. A similar situation prevails vis-à-vis microbiological hazards in foods, which remain the major food safety concern in all countries of the Region. Here, too, the complexity of the problem is increasing as new organisms, such as *Listeria monocytogenes* and *Vibrio vulnificus*, become recognized as important food- and waterborne pathogens.

Providing for Analytical Services. Those providing analytical services must work closely with food inspectors. A food control service without adequate analytical capabilities is like a boxer with only one arm--at a very distinct disadvantage. It is the proper combination of the two that provides maximum power to food control activities. Many countries of the Americas, unfortunately, do not yet have adequate laboratory facilities for analysis of food samples. In developing such capabilities, it is wise to walk before one runs. Countries should start first with relatively simple analytical procedures, and should not attempt more complex, sophisticated analytical methods unless and until they have the trained staff and equipment necessary to do the job adequately.

In nearly all countries some analytical capacity exists, although it may not be in the national food control agency. Under such circumstances, agreements should be sought with other government departments or agencies to carry out food analysis services on behalf of the control agency. National food control agencies in more developed countries, and international agencies such as PAHO and FAO and their research or collaborating centers, can do much to assist less developed countries to train analysts and equip analytical laboratories. In all countries, careful attention must be paid to proper maintenance and repairs in order to avoid long periods when equipment is out of operation because of technical problems.

Monitoring and Surveillance. Food control agencies, if they are doing their work properly, generate large amounts of data, which form the basis for monitoring the quality of the national food supply. Inspection of and analytical information on commodity groups, companies, and industries are of vital importance in assessing the safety of the food supply and in detecting problems. But these internal data must be coupled with external information such as data on the prevalence and frequency of foodborne diseases.

Most countries in the Region lack adequate epidemiological surveillance mechanisms. Even in countries such as the United States and Canada, where reasonably effective surveillance data are available on some foodborne microbial diseases, almost nothing is available on the health effects of chronic, low-level exposure to chemical toxicants. In fact, it is not known with certainty how to carry out such surveillance at reasonable cost and with reasonable expectations of effectiveness.

Although it is not possible to quantify the numbers of people in the Region who become acutely ill from foodborne or waterborne microbial agents, enough data are available to state in general terms the public health problems involved. Diarrheal diseases, in the etiology and dissemination of which contaminated food and/or water play major roles, are leading causes of death in developing countries of the Americas. The economic impact of foodborne and waterborne diseases also is difficult to quantify. It includes not only the direct costs of health care and lost income, but also effects on the movement of tourists from country to country. The health and economic effects of unsafe foods are not known in quantitative terms, but they must be in the range of millions of ill people and billions of dollars annually for the Region as a whole.

Much remains to be done in all countries of the Americas to improve monitoring and surveillance capabilities. Not only funds but also trained staff are in extremely short supply. Research on new, more sensitive and precise methods of monitoring and surveillance desperately is needed. There is a worldwide shortage of trained epidemiologists capable of collecting and analyzing data on all aspects of communicable and noncommunicable diseases.

Although PAHO and its regional centers have been of immeasurable value in providing epidemiological assistance to countries of the Region, in the long run it remains the responsibility of national governments to fund and support epidemiological capabilities necessary to meet their national requirements. Such services should be able to provide rapid responses to foodborne crises, which can reach epidemic proportions in a very short time. For maximum effectiveness, close cooperation is needed between epidemiological and laboratory workers.

Information Exchange. Information obtained by national governments in the course of their food control activities is often of value to other countries. It is common for food shipments that have been refused entry into one country because they do not meet quality or safety requirements to be sent to others, in the hope that eventually they will slip through a national surveillance network and be sold. Almost invariably it is the less developed countries of the Region, who perhaps do not have a sufficiently developed capacity to protect themselves, who fall victim to such unscrupulous practices. Some countries have informal mechanisms, often at the professional, rather than the executive, level, whereby they notify each other of such problems on a routine basis. However, effective mechanisms involving all countries are needed. These must be capable of providing timely and up-to-date information rapidly among countries, given the speed with which foods now move in international commerce.

Other matters relating to food safety that originate in one of the countries of the Region are likely to be of interest to others. They include action to ban the use of a pesticide or food additive, for example, or an outbreak of foodborne microbial disease that involves foods in international commerce. These and other food safety concerns require the development of effective procedures for information exchange among national food control agencies.

Advisory and Educational Services. Although it is essential to give attention to the legal and law enforcement aspects of food control, emphasis must also be given to educational and advisory activities that lead to voluntary compliance with the requirements for safe food. Guidelines for good manufacturing practice, if widely accepted and applied by the food industry in various countries, could do much to improve processing practices, as well as to ensure quality control for high-risk foods moving in international commerce. At the community level, workers in restaurants, hotels, and other food service establishments require education in basic aspects of food sanitation. So, too, do family members at the household level.

Although large industrial firms usually do a good job of assuring the quality of the foods they produce, and normally are fully aware of what is needed in this respect, small- and medium-sized manufacturers often require assistance in problem identification and problem solving. They can benefit from advisory services provided by the national food control agency, as well as those of trade associations and international organizations. Food control agencies that recognize the great dividends accruing from advice and educational activities can avoid the immense workload involved in treating each situation as an impending law suit. This approach requires that food inspectors be oriented toward public health rather than police activities; their motto might well be Legal Action if Necessary, but not Necessarily Legal Action (Morrison, 1975).

CONCLUSION

Without attempting to provide an encyclopedic coverage of the current state of food control mechanisms in the Americas, this paper has tried to focus on general principles that must guide food control agencies if they are to achieve their objectives of protecting the public from health hazards and fraud. The rewards from improved food control programs, in terms of both health and economic well-being, make the effort to obtain such improvement very worthwhile.

REFERENCES

Chapman, R. A., and A. B. Morrison. 1966. Regulatory agencies and food safety. Can. Med. Assoc. J. 94:609-613.

FAO/WHO/UNEP (Food and Agriculture Organization, World Health Organization, and United Nations Environment Program). 1976. Guidelines for developing an effective national food control system. Food and Agriculture Organization, World Health Organization, Rome. 169 pp.

Morrison, A. B. 1975. The Canadian approach to food and drug regulations. Food, Drug, Cosmet. Law J. 30:632-635.

Morrison, A. B. 1981. Sanitary control of food in the Americas. Pp. 9-17 in Sanitary Control of Food, Scient. Pub. 421. Pan American Health Organization, Washington, D.C.

PAHO (Pan American Health Organization). 1981a. Sanitary Control of Food. Background document CD28/Dt/1, prepared for PAHO Directing Council. Pan American Health Organization, Washington, D.C.

PAHO (Pan American Health Organization). 1981b. Sanitary Control of Food. Final report on Technical Discussions, PAHO Directing Council, CD 27/DT/3, Rev. #1. Pan American Health Organization, Washington, D.C.

Pugsley, L. I. 1967. The administration and development of federal statutes on foods and drugs in Canada. Med. Serv. J. Can. 23:387-449.

DISCUSSION SUMMARY

The following themes recurred during the discussion of this topic:

The need for assistance in training and upgrading inspectors and analysts. This can take the form of financial assistance or training opportunities, either within the country itself or in developed countries in the Region that have effective food control programs. Training is of little or no value, however, if trained people are not provided with the physical and financial resources necessary for them to carry out their work effectively. Skilled human resources, including veterinarians and public health inspectors, are often not used effectively now. Adequate salary levels and long-term career paths are essential.

The importance of educational activities. These must include education of consumers in the family and community, as well as educational efforts within the industrial sector to help assure voluntary compliance with high standards of food protection. Some countries require assistance in providing appropriate educational programs.

The need for assistance in acquiring and maintaining essential analytical equipment. Some developing countries lack the funds required to purchase and maintain analytical instrumentation. Analytical programs must reflect the needs and capabilities of the country involved. Simple procedures should be firmly in place before attempts are made to carry out more sophisticated analyses. Because downtime of equipment requiring repairs is often excessive in developing countries, it is important that preventive maintenance and repair capabilities be built into analytical programs.

The need for interministerial cooperation rather than duplication or competition within national governments. Food control in many countries is characterized by the involvement of several government agencies and ministries. While this is, in part, a reflection of the complexity of the field, duplication of effort and lack of integration often ensues. Problems of duplication and competition can only be resolved by firm national commitments at the highest levels of government.

The need to determine realistic priorities and attainable objectives within the context of the social, economic, and political realities of the country involved. Each country must choose its own path in developing and applying effective food control laws and mechanisms. What is appropriate in one country may not be so in another, because of differences in size, stage of development, and availability of human and financial resources, or differences in sociocultural values or political systems. Priorities and objectives can only be set within the context and framework of clearly defined and articulated national food control policies that recognize, inter alia, that food control is an essential component of primary health care.

Food Protection in International Commerce*

ALBERTO DE LAS CARRERAS

The concept of food protection has gradually gained recognition and assumed better definition as progress has been made in the related fields of food science and technology. National legislation in general, especially in the more developed countries, has reflected this progress since the end of the last century. In recent decades, however, a notable acceleration has occurred in the area of food safety. This has led to profound modifications in and additions to legislation and has brought about the establishment of research and teaching institutes as well as the organization of administrative food safety offices in the public sector. It has also promoted the training of human resources and activities in the private sector to implement new food safety standards and procedures. International commerce has had to observe these new rules. As a result, forums have been established for discussion of standards and their compatibility at international levels.

The developed countries naturally lead in the evolution of standards--but this process is also under way in developing nations, including a large group of

*Translated from the original Spanish manuscript.

countries that is interested in advancing such standards more rapidly for domestic reasons as well as for reasons of international commerce. For a variety of reasons, the richer nations seek even more progress in this area among the various countries. First, there are reasons based on international solidarity that give impetus to the development of food protection standards; second, there are reasons arising from the growing process of internationalization throughout the world, which prevents the more advanced nations from insulating themselves from the problems created by the disparity among food standards. Hence, international commerce requires the development of compatible national legislation and food safety requirements, without which the exchange of goods will come up against obstacles that may be insurmountable.

The Inter-American Conference on Food Protection has the sound objective of analyzing these problems in light of the varying points of view and the diversity of interests among the nations of the hemisphere. It will prove most useful if it makes recommendations that can be applied in the near future.

This paper reviews developments in agriculture over the recent past and the outlook for the future. It also examines the international food trade, its most significant trends and expected changes. Emphasis will be on inter-American trade, which is the focus of this Conference. The legitimacy of food protection is also examined along with the principal factors that justify specific legislation and standards that support it. A typical food safety case involving inter-American trade is described to show the complexity of the topic and the investments and costs involved for countries and for the business world and to indicate possible courses of action for achieving a better understanding of common interests. There is also an analysis of the incompatibility of the growing number of food protection requirements with the trend of falling international prices caused by current protectionist policies. Recommendations for action are presented at the conclusion of the paper.

DEVELOPMENTS IN AGRICULTURE: OUTLOOK FOR THE FUTURE

The second half of the Twentieth Century has witnessed some interesting developments in agriculture. At the end of the Nineteenth Century, a variety of factors began to stimulate greater productive vitality; an example would be mechanization, a potent force from its early beginnings. Progress in the agricultural sciences spurred changes in production systems and significantly stimulated growth. The truly great surge in agricultural progress came about during and after World War II as a result of advances made in the United States. The Food and Agriculture Organization (FAO) was established in Quebec in 1945 to assess existing agricultural practices that might be used to relieve the food problems of countries that had been devastated by World War II and to help the developing world in general. The vigor of North American agriculture--which was based on the development of science and technology, on industry's involvement, and on the efficiency of farmers--represented a solid example for potential application by the Organization in accord with these principles.

In the developed countries, including those that suffered most from the war, it did not take long for significant progress to be made in agriculture. Only a few decades after the war, the low rate of population growth in these countries, coupled with this increased agricultural productivity resulted in sizeable food surpluses, which were then exported. In the developing countries, agricultural production also grew, even more rapidly than in the developed world. Here, however, the process was accompanied by population growth--a phenomenon unknown until then--which resulted in significant increases in food requirements. Nevertheless, the food supply has also improved in developing countries. In a passage in Agriculture: Toward 2000, FAO pointed out that "world agricultural production has responded positively to this demographic growth, increasing slightly more rapidly than the population." It added: "The fact that, in these decades of enormous demographic increase, most of the world's population has increased its food intake, and that hunger has been contained, also indicates the progress of food systems" (see Table 1).

In this regard, it is interesting that the grim neo-Malthusian forecasts made by the Meadows team before the Council of Rome in The Limits of Growth (Meadows et al., 1972) have dissipated, as had happened more than a century ago to the predictions made by Malthus himself.

TABLE 1 Average Annual Percentages of Increase in World Agricultural Production for Two Periods: 1961-1965 and 1971-1980[a]

Economic Region	Average Annual Increase, % 1961-1965	1971-1980
Developed countries with market economies	2.1	2.1
90 developing countries	2.8	2.9
Africa	2.8	1.4
Latin America	2.9	3.2
Asia	2.9	3.0
Total (124 countries)	2.6	2.2

[a]Data from FAO, 1981.

NOTE: The population of the developed world has grown at a rate of 0.7 percent per year, and that of the developing world at a rate of 2.6 percent per year.

Not only have these forecasts been contradicted by such other works as Leontief's The Future of the World Economy (Leontief et al., 1977) and Kahn's The Next 200 Years (Kahn et al., 1976), but they have also been counteracted by considerable growth in food production.

The agricultural progress in the last 40 years has resulted from several successive technical revolutions, which are still making significant contributions and which promise to provide even greater benefits toward the end of this century and the beginning of the next. The mechanical revolution provided the first contributions, enormously augmenting human and work-animal muscle power and enhancing energy and productivity. It also contributed significantly to migration of laborers, opening the way for the development of industry and services. The chemical revolution took off with the discovery of pesticides, fertilizers, and growth stimulants, all of which increased productivity. At almost the same time, the first genetics studies began to make their contributions--of hybrid seeds, cross-breeding, and reproduction methods of considerable consequence. Another revolution, which occurred somewhat later, involved business management; it took advantage of modern systems involving computers, communications, programming, and other technologies that make it possible to improve work systems and assign productive resources more efficiently. In recent years, modern genetics has opened the door to forces with potentials that extend beyond the limits of the imagination. Genetic engineering will change the characteristics of many species of animals and plants, and may make possible the use of salty or desert lands for agriculture; it will also improve systems for maintaining animal and plant health, and will help to bring about more efficient, highly productive methods for industrial food production.

In recent years, all these technologies seem to have exerted increasingly greater impacts on agricultural production in diverse regions of the world and under varying conditions. Increased production has not only occurred in the United States and Western Europe: in Argentina, where less than favorable economic conditions still prevail, grain production has risen spectacularly from 23 million tons in 1974-1975 to 44 million tons for the 1984-1985 agricultural year; in China, which boasts 20 percent of the world's population, the level of grain production has resulted in great increases in the quality of food available; in India, where many food problems persist, extensive growth in food production has also been achieved. Many other cases could be mentioned. Nonetheless, the recent cases of extreme food scarcity in central Africa emphasize that food production still needs attention.

In considering international trade in foods, it is of utmost importance to recognize the significant role that this commerce has played in releasing powerful, productive energies into the agricultural sector. We know that the greater freedom in world trade that prevailed after World War II facilitated the agricultural expansion that occurred in many countries. Regrettably, trade protectionism has become widespread in recent years, particularly with regard to foods, and is now interfering with productive development by causing improper resource allocations. If this continues, it will halt the expansion of production commented upon previously.

THE INTERNATIONAL FOOD TRADE: DEVELOPMENTS AND TRENDS

Over the course of the past twenty years, the international food trade has undergone considerable growth and changes in direction. To explain these with some precision, we must enter into the dry world of numbers.

The international food trade currently represents 10.2 percent of all world commerce. Its growth between 1960-1962 and 1980-1982 was calculated at 186%, as shown in Table 2. The Table also shows that exports were valued at US$47,730 million for the first two-year period, and US$136,690 million for the second two-year period. The period between 1970-1972 and 1980-1982 saw a growth rate of 57.3 percent, with the lowest figure for world exports being US$87,876 million and the highest US$138,413 million (see Table 3).

Some comments are in order about these statistics. First, there are variations between the data recorded for exports and imports; these should not be considered unusual, given the differences in statistical compilation systems used in the various countries. Table 2 is important because it contains data for a twenty year period, however, it does not include figures for the Soviet Union. The FAO did not register that data for the 1960-1962 period. Because of the important position the Soviet Union has occupied in the international commerce of agricultural products, the information presented in Table 3 is valuable. It should be noted that it is common statistical practice to use the terms "food" and "agricultural products" interchangeably.

Although world food trade has grown, its percentage of all world export products has dropped from 19.6 percent in 1960 to 10.2 percent in 1982 (see Table 4). This is in keeping with the trends of the world economy in general, and is therefore not particularly significant. Engel's law (Kapp, 1985) points out that the proportion of a family's expenditures on food diminishes as family income increases. Since the income of the world as a

TABLE 2 International Trade in Agricultural Products: Comparative Averages for 1960-1962 and 1980-1982[a]

Economic Region	Annual Trade Averages (millions of 1975 U.S. dollars)[b]					
	1960-1962			1980-1982		
	Export	Import	Balance	Export	Import	Balance
World[c]	47,730	54,462	-6,732	136,690	140,103	-3,413
Africa	3,787	1,181	2,606	7,857	9,850	-1,993
North and Central America	12,759	10,305	2,454	36,851	17,797	19,054
South America	4,981	1,082	3,899	12,093	4,294	7,799
Asia	7,250	7,532	-282	17,697	35,892	-18,195
Europe	14,292	33,810	-19,518	54,116	71,107	-16,991
Oceania	4,661	552	4,109	8,076	1,163	6,913

[a]Based on information from FAO. Data for forest products not included.
[b]Adjusted to U.S. wholesale price index.
[c]Does not include figures for the USSR for 1960-1962.

whole, especially that of the developed countries, has increased significantly over the last few decades, Engel's law has also been proven true at the level of international commerce. Hence, growth of food trade in absolute terms is consistent with a notable decline relative to trade for all products. The population in general is eating better, but expenditures for food have increased much more as a result of an increase in the variety of foods available and in the proportion of industrially processed foods and related services.

An analysis of world trade trends in food products since 1972 points to several noteworthy tendencies:

o The industrialized countries of North America and Europe have significantly increased their exports of agricultural products. Imports have risen much less. The trend is stronger among the developed countries of the Americas, than for those in Europe. Here we see the influence of the agricultural policies of the United States and of the European Common Market, as discussed below.

o There has been a marked increase in imports of agricultural products by the USSR and the Eastern European countries. It is a fact that all food exporters, including the United States, the European Common Market, Australia, and Argentina have strengthened their commercial ties with this bloc of nations (chiefly with the USSR).

o The countries of Africa have almost tripled their food imports, while their exports have remained constant. This situation reflects the difficulties being experienced by the nations of that continent. In reality, the problems are even greater, because donations of food were not included in these compilations.

o The countries of Asia have also increased their imports of agricultural products, most likely as a result of the economic growth of some nations of this region, and because of population increases in others.

o The developing countries in the Americas have increased both exports and imports in similar proportions. Argentina and Brazil have experienced the greatest growth in exports, whereas most of the other nations have increased imports.

TABLE 3 International Trade in Agricultural Products: Comparative Annual Averages 1970-1972 and 1980-1982[a]

Economic Region	Annual Trade Averages (millions of 1975 U.S. dollars)					
	1970-1972			1980-1982		
	Export	Import	Balance	Export	Import	Balance
Developed countries	51,928	69,091	-17,163	90,649	91,418	-769
Americas	16,099	12,201	3,898	30,522	13,772	16,750
Europe	28,386	48,415	-20,029	49,907	65,030	-15,123
Oceania	5,515	559	4,956	7,738	820	6,918
Others	1,928	7,916	-5,988	2,482	11,796	-9,314
Developing countries	28,435	16,105	12,330	39,179	37,446	1,733
Africa	5,964	2,672	3,292	5,767	6,463	-696
Americas	12,239	3,874	8,365	18,420	8,243	10,177
Asia	10,013	9,232	781	14,651	22,320	-7,669
Others	219	327	-108	341	420	-079
Planned economies	7,513	11,150	-3,637	8,384	23,182	-14,798
USSR and Europe	5,665	9,295	-3,630	5,865	18,019	-12,154
Others	1,848	1,855	-007	2,519	5,163	-2,644
World	87,876	96,346	-8,470	138,212	152,046	-13,834

[a]Based on information from FAO.

TABLE 4 World Food Products Exported as Percentages of World Exports of All Products, 1960-1982[a]

	World Exports (in thousands of U.S. dollars)		
Period	Exports of Food Products	Total World Exports	Percentage Food Exports
1960	25.4	129.7	19.6
1970	41.3	313.6	13.2
1971-1975[b]	75.1	611.7	12.3
1976-1980[b]	161.6	1,410.7	11.5
1981	200.4	1,972.2	10.2
1982	188.6	1,851.1	10.2

[a]Data from UN statistical yearbooks and FAO trade yearbooks.
[b]Annual Averages.

o Oceania remains a food exporter, as shown by the economies of the two largest countries in that region--Australia and New Zealand.

From these data, it is easy to see the influence of improvements in agricultural productivity of developed economies and, in contrast, of the agricultural problems of the USSR. We turn now to an analysis of the international food trade in the United States and the European Common Market, as indicated by the effects of their agricultural policies on world food prices.

Influence of Food Policy on Food Protection

At very high cost, members of the European Economic Community (EEC) established a common agricultural policy to provide strong economic support for their agricultural products. This support was supplemented with a protective buffer against agricultural products imported from outside the community. Since production exceeded the community's internal requirements in many areas, a system of export subsidies was devised in an attempt to offset the difference between extremely high internal prices and world market prices, which have been falling largely as a result of the increases in European exports. In recent years, the EEC has been the largest exporter of meat and milk products and has also gained ground in the markets for grains, sugar, and wines.

The United States has instituted agricultural policies affecting various sectors. For grains, it has developed programs to safeguard production through price supports and stockpiling, which have had a large impact on the nation's budget. In foreign trade, it has applied subsidies in the form of long-term credits, subsidized interest rates, and, in some cases, accepted soft money in payment for commodities. U.S. Public Law 480 and the credit support systems applied by the Commodity Credit Corporation (CCC) are examples of these practices. For milk products, support programs have resulted in a great deal of stockpiling. Protectionist devices are also applied against the importation of meats and other products. Recently, the U.S. government adopted a program of subsidies for agricultural exports based on payment in kind (PIK) and intended to support exports and solidify trade in specific cases. Under this system, decisions are made case by case; it was first used in a wheat sale transaction with Algeria. The total amount provided for the program is US$2 billion; the products involved are those of concern to the CCC--essentially grains and milk products. The program will not have any additional effects on the budget because these products are already in government hands and have been accounted for in previous fiscal years.

For approximately two years now, the growth of agricultural budgets in the United States and the EEC has been so great that both are trying to achieve reductions in this area. The U.S. government, which seems particularly committed to this goal, will seek a revision of the farm bill, and has implemented a program for reducing support to the dairy industry. The EEC, for its part, has implemented a system for controlling surpluses of milk products and beef production. The community is also seeking systematically to reduce guaranteed prices for agricultural products. As the United States has been pressuring the EEC to step up such policies, a trade war has broken out between these two large producers and world exporters of food. There have already been a few skirmishes, for example, as a result of the recent U.S. decision to grant specific subsidies.

Without doubt, this trade war has a great impact on international food prices and exerts a direct and considerable effect on the other countries that export these products. If the struggle is waged officially, we will be looking at several years of low agricultural prices, until new policies are adopted and stocks are eliminated. In any event, the markets would then recover, returning to an equilibrium consistent with production costs and within a framework of more appropriate allocations of resources. If agricultural policies were to change, whoever is able to produce at the lowest cost will have the best opportunities. This issue is closely tied to food protection, since it is difficult to define the proper application of standards for residue content and for the hygiene and wholesomeness of products, for example, if international prices remain at their present levels.

The Drop in Prices for Agricultural Products

As a result of the institution of the agricultural systems just described and of the international recession that has prevailed since the early 1970s (and which continues, especially in many developing nations), prices for agricultural products have fallen considerably, except in some very special cases. Table 5 shows the decline in prices since the 1970s for some actively traded products from temperate and tropical zones. The same price decline is evident for other products of lesser importance also traded in the Region. For the six basic products considered in Table 5, an average price drop of 23.6 percent occurred during the five-years between 1970-1974 and 1979-1983; quoted prices fell for all but one of the products listed as well as for corn, coffee, sugar, and many other commodities.

BASIC CONSIDERATIONS IN FOOD PROTECTION

Before examining a typical case of the effects of food protection on international commerce, we will look at the

TABLE 5 Evolution of Average Annual Prices for Food Products[a]

Product	Average Annual Prices Per Unit 1970-1974	1979-1983	Percentage Difference
	1981 (U.S. dollars/ton)		
Wheat (USA-Gulf States)	231.0	156.2	-32.4
Soya oil (FOB Rotterdam)	1,046.4	548.4	-47.6
Beef (FOB Buenos Aires)	2,111.0	1,366.0	-35.0
Fish meals (CIF Hamburg)	538.0[b]	405.0[c]	-24.7
	1981 (U.S. dollars/kilogram)		
Cocoa (International Cocoa Organization	212.8	226.6	+6.5
Bananas (FOB Central/ South America)	18.8	17.2	-8.5

[a]Data from FAO and the National Meat Board of the Argentine Republic.
[b]Prices given for 1974-1976.
[c]Prices given for 1981-1983.

seven basic factors that justify food protection standards and legislation:

1. The extraordinary progress in science and technology during the Twentieth Century has increased

knowledge of diseases, understanding of their etiology and means of transmission, and in general, knowledge about means of obtaining better health protection.

2. Our society has efficiently accepted all this information and incorporated it into cultural norms and value systems. Thus, there is now greater interest in the way food is provided and greater pressure on national political systems to enact legislation to guarantee both food quality and the proper observance of established standards.

3. The appearance of generalized environmental pollution, due in part to the unavoidable use of chemicals in agriculture and additives in food production, has justifiably caused concern among consumers.

4. The economic development achieved by a large group of countries has made it possible for them to channel a significant flow of resources toward protection of the population's health. Since it is a natural human desire to preserve health and to prolong, and improve the quality of life, it is not surprising that there is a desire to provide protective mechanisms, even though they entail large investments and costs.

5. Modern systems of industrialization and product distribution have created a greater need to protect consumers. In the past, it was not uncommon for people to consume fresh foods or minimally processed foods that were produced in close proximity to the consumers. Today, there are large food-processing centers and considerable time elapses between processing and consumption of products. Large-scale distribution is facilitated by food preservation systems that make it possible to transport products over large distances and occasionally across international borders. All these factors absolutely require close control of foods and the utilization of sophisticated techniques and other resources. These production and distribution systems, together with economic pressures and media attention, have led to the adoption of laws and regulations to protect the consumer.

6. The importance of properly identifying products and their contents and providing accurate statements about the origin of ingredients and other characteristics and attributes that affect quality.

7. The risk of transmission of pathogenic agents can cause considerable economic repercussions when animal diseases are transmitted. This requires intensification of standards and controls.

FOOD PROTECTION IN INTERNATIONAL COMMERCE: ANALYSIS OF A TYPICAL CASE

In examining the effects of food protection on world trade, we should analyze its impacts on the fluidity of trade and on the food quality requirements of countries at their respective borders. It is necessary to take into account the need to achieve international understanding and coordination and to avoid protectionist pressures, under whatever guise, that could thwart efforts to achieve established goals.

We can identify four food protection problems linked to international commerce: (1) the transmission of biological agents that endanger human health through the spread of diseases, such as trichinosis or salmonellosis, or through the formation of toxins, such as botulism, that result from defects in the industrial processing of products; (2) the increasingly frequent transmission of contaminants, such as pesticides, hormones, antibiotics, heavy metals, and inappropriate additives; (3) the transmission of biological agents that do not produce disease in humans but nevertheless present economically important hazards for animal production by causing such diseases as porcine plague, avian influenza, or foot-and-mouth disease; and (4) the need for standards of truth in commerce to protect the consumer usually by labeling the product to reflect exactly its contents, origin, composition, weight, and other characteristics.

To deepen this analysis and give it a concrete and quantifiable content, the regulations, standards, and procedures that are applied to the meat trade are examined in the following paragraphs. This example was chosen because it is probably the most important in inter-American trade, given the flow of meat exports from Brazil, Argentina, Uruguay, and Central America to the United States and Canada, and because, given the characteristics of meat products, they have attracted more attention than others and are the subject of a wide spectrum of regulations and procedures that are applied with varying degrees of strictness. This should not surprise anyone, because this trade originates in developing countries and flows toward customers in developed countries that have higher standards for food protection.

The Transmission of Biological Agents Dangerous to Humans

In view of the laws in effect in the United States and Canada, which are applied within these countries as well as in their international trade, meat products that enter these nations must qualify under the various strict standards applied to the inspection of animals before and after slaughter. The establishments in which these inspection activities are carried out as well as those in which the products are processed must meet specified standards intended to protect the hygiene and wholesomeness of food during preparation.

All industrial operations, from the place of production through packing and shipment, must also meet precise standards and criteria. Operations are checked continuously by the quality control section of the producing establishment and by the state health service responsible for inspection and supervision of hygiene and health. In the United States, an official health service representative must also be present. U.S. officials also make annual inspections in the country of origin to evaluate operations.

All these requirements are justifiable; they have technical bases and are legitimate as long as they are also required within the importing countries--the United States and Canada. Many developing countries have adopted the same standards; it is to be hoped that they will maintain them in order to benefit their own populations and to more effectively integrate their economies into the international arena.

Two points should be noted. The first concerns the need to harmonize the criteria of the sanitary inspection services among the various importing countries. Frequently, health services in the United States and in the European Common Market have posed serious obstacles to exporting nations, in some cases by making additional inspection requirements and in others, by causing conflicts. This has led to the establishment of additional criteria and to waste. Open debate on this point is probably needed, since the United States and Europe have had frequent conflicts even among themselves over the differing criteria applied within these two Regions.

The second observation concerns the need to establish reasonable limits for the application of requirements for hygiene and sanitation. In some instances, the requirements have exceeded reasonable limits. As a result, the cost to the exporting countries has been very high and discouraging.

Perhaps of only marginal concern, given the international focus of this paper, is the level of domestic observance of the standards required by some importing nations. Some EEC countries apply rigorous standards to meat from exporting nations that could not be met by many establishments within their own countries.

The Transmission of Environmental Contaminants

Legislation to control environmental contaminants is becoming ever more extensive and rigorous in developed countries as pollution intensifies. The international presence and authority of the U.S. Food and Drug Administration has had a strong influence on such legislation and represents a point of reference for all countries.

The spiraling increase in environmental pollution over the last half century has spurred research in two areas in particular. The first concerns the identification of harmful substances, the harm they can cause, determination of the dangerous dosage of each compound, and the possible limits of tolerance. The second line of research concerns development of methods and equipment to detect and quantify residues. These studies have made it possible to identify substances that should be detected and the limits of tolerance for each of them in the food under examination. In many cases it has not been possible to define the actual existence of danger, but limitations and controls exist nevertheless because of an understandable need for caution.

In the international meat trade, there are agreements and programs for the detection of residues of pesticides, hormones, heavy metals, antibiotics, and sulfonamides. Such programs have required large investments in laboratories and in the training of human resources, and have added costs to food products in general. But standards for limiting contaminants are necessary, and their incorporation into international commerce is advisable.

The question remains, however, as to whether or not the limits of tolerance established for some residues are exaggerated. Notable progress has been made in the techniques for the detection of residues, and today it is sometimes possible to determine proportions of one in a trillion. Such sensitivity has made it possible to lower tolerances, i.e., to make the system for the control of contaminants increasingly more rigorous. Rico and Burgat-Sacaze (1984) have calculated that one part per million is equivalent to one minute in two years; that one part per billion is equivalent to one drop in 50,000 liters; and that one part per trillion can be thought of as one coin lost in the city of Paris. Since current methods can detect one part in a trillion, there is the temptation and sometimes the pressure to take the tolerance requirement to extreme limits. Tolerances for many substances are set at parts per billion, and others at parts per trillion. Is this reasonable? Does it correspond to an advisable level of caution? Is a proper balance struck between the level of protection needed for a particular risk and protection against the many other risks encountered in the course of a human's lifetime?

Surely we are not the ones best suited to answer these questions, but it is well worthwhile giving them some deep thought. It should not be forgotten that in many areas related to environmental pollution and consumer protection it has come to the point where U.S. authorities have decided to halt the surge of effort for food protection and, in some cases, to reverse the trend and liberalize standards. It might be reasonable to foster an understanding among countries whereby the number of anticontaminant requirements would be reduced when an exporting nation can show that its residue levels do not present any demonstrable dangers.

The Transmission of Biological Agents that Constitute Economic Risks

In analyzing the international meat trade in light of the economic risks posed by the transmission of biological agents, we will consider the implications of foot-and-mouth disease. This disease has a particular effect on livestock markets of Brazil, Argentina, and Uruguay (among others), which provide raw materials for shipment to the United States and Canada, neither of which accepts meat from nations reporting cases of foot-and-mouth disease, unless the meat has been previously processed, e.g., canned, cooked, or frozen. The export of canned meats presents no major problems. When cooked and frozen meats enter the importing countries, however, they are subject to inspection to verify the absence of pink juices in their tissues. Prolonged cooking is necessary to meet such standards. The alternative is rejection of the product at ports of entry. It is easy to understand that extensive cooking reduces the commercial value of the meat, and this in turn affects a country's income and the economies of exporting companies. Furthermore, such standards rule out the possibility of treating the meat with salts to add color, which might adversely influence the search for the pink juices.

Other countries, such as those in continental Europe, also have rigorous provisions with respect to foot-and-mouth disease, but they allow the entry of boneless refrigerated meats that have not undergone prior processing. This provision was applied by Great Britain in 1968 and was adopted by the other European countries in 1977. The U.S. and Canadian system, which requires meats to have been cooked, has been designated the "zero risk" approach. The European system, which accepts boned refrigerated meats that have been allowed to mature to inactivate viruses present, has been referred to as the "minimum risk" approach. With the passage of time, no difference in their effects on the public health has been shown for these two systems. Great Britain has imported hundreds of thousands of tons of meat from South American countries since 1968 without any outbreak of foot-and-mouth disease.

This long experience, covering 17 years of trade in meat products without a single appearance of the virus, permits us to state that the protective mechanisms of the two systems do not result in any perceptible differences. One could say that the "minimum risk" approach has proved equal to "zero risk." However, since no country can avoid the introduction of a virus by tourists carrying food surreptitiously across borders or as a result of uncontrolled movements of peoples, it is preferable to state that there is no such thing as "zero risk" in today's world. Moreover, there are probably still other ways of introducing a virus, even in meats that have been processed according to accepted standards. The cause of a recent outbreak of avian influenza in the United States involving a virus strain not previously encountered in that country is unknown and has been attributed to wild birds.

It is not the intention of this paper to propose that uncooked boneless meats be permitted entry into the United States or Canada. Yet, such meats have been accepted by other countries, most recently by Singapore. They are likely to be accepted by Japan, whose balance of interests between its foreign trade and animal health policies is very different from those of the United States and Canada. Given the fact that risks have been minimized to imperceptible extremes, it is desirable to determine whether it is reasonable to continue the strict analyses of cooked meats exported by South American countries. Factories in these nations have sophisticated facilities for producing cooked and frozen meats; their procedures for controlling cooking temperatures and times are registered and filed; they are under the supervision of national health services; and in some countries, the staff includes a full-time veterinarian. Beyond that, quarterly periodic inspection visits are also carried out. Could these activities not also include a search for new procedures and understandings that would facilitate trade without creating hazards while avoiding exaggerated standards and analyses? The introduction into the United States and Canada of uncooked meats from Tierra del Fuego, an isolated island free of foot-and-mouth disease, should also be considered.

Standards for Consumer Protection

Standards for consumer protection vary from country to country. Cases could be cited where domestic administrative administrative standards present insurmountable hindrances to international commercial transactions. The United States is familiar with Japanese legislation that indirectly fulfills protectionist objectives, and Europeans know that intracommunity traffic is hindered by varying regulations for containers, product weight, labeling, and so on. European countries are now prepared to make a great effort to eliminate these differences. Otherwise, the dream and the advantages of the European Common Market will be realized only in part.

It has not been found that regulations in the United States or Canada particularly hinder the meat trade, although some may hinder trade in other products. In recent years, the United States has required analysis of imported meats in order to certify the identity of the species of the animal. This requirement might have resulted from a well-known case in which meat from wild animals was introduced from an exporting country. It might be to the advantage of some countries to incorporate into their exports meats from species other than the one purportedly being exported. In most exporting countries with extensive livestock production, however, the legitimately exported meats are more inexpensive. It would therefore make no economic sense to incorporate these more expensive meats into the exports.

It is recommended to the Conference that ways be sought to reconcile the diverse consumer protection standards of the countries of this hemisphere to simplify control measures and adapt them to reasonable guidelines. There will always be loopholes in regulations through which fraud or some other crime may be able to pass. It should always be remembered that production, industry, and commerce have their costs. It is not advisable to overload them with regulations, which might create problems for the consumers they are intended to protect.

EFFECTS OF FOOD PROTECTION ON THE ECONOMIES OF EXPORTING NATIONS

Intensification of requirements pertaining to food protection began in the 1960s. Increasingly strict laws were enacted, first in the United States, then in Europe and Japan. These had an impact on international commerce because of the controls that were established at the borders of the importing nations. Although some developing countries have not had the necessary means to undertake similar food protection programs, many have enacted comprehensive legislation for domestic food protection, which has been enforced with more or less rigor, depending on the case.

It is not difficult to imagine that food protection programs are very costly. Food exporting nations have had to confront these costs at the risk of being excluded from the principal world markets. Such costs result from increases in personnel expenditures for food protection inspectors; increases in expenditures for the training of human resources; investments in offices, laboratories, control equipment, transportation, and other resources; investments in factories of the food exporting companies; increases in operating costs for food production and exporting companies; and costs resulting from the rejection of products at the borders of importing countries (see Table 6).

These cost factors have not yet been quantified, but they are significant. It should be pointed out that such investments and expenditures do not bring about an increase in productivity. On the contrary, sanitary requirements normally complicate industrial processes, making it necessary to separate stages of production and back them up with others. These requirements also tend to reduce production rates in order to permit more thorough inspection and quality control by highly paid technicians.

Compensation for these additional investments and costs should be provided through higher prices, but international food prices have not risen. Instead, as we have seen, most prices have fallen noticeably as a result of international agricultural protectionism and the subsidies applied in order to sell surpluses on the world markets. Thus, the enactment of legislation to implement and intensify food protection in the developing countries,

TABLE 6 Principal Beef and Veal Import Products Refused Entry at U.S. Borders, 1984[a]

Product Entrance[b]	Quantity (in thousands of pounds) Refused	Accepted	Refused
Meat for manufacturing	5,536	970,800	0.57%
Dressed carcasses and cut meat	786	200,982	0.39%
Corned beef	850	94,789	0.89%

[a] Data from the U.S. Department of Agriculture, products refused entry, 1984.
[b] It was not possible to identify cooked and frozen meats that appear along with the other products in the statistics.

in general, and in Latin America, in particular, is hindered by a number obstacles. In addition, the dynamic effects normally resulting from growth in exports are subject to considerable disturbances, which are magnified by the deep financial indebtedness of many food producing and exporting nations.

ACTIONS NEEDED TO HELP DEVELOPING NATIONS IMPROVE FOOD PROTECTION

The expansion of food protection programs in this hemisphere's developing countries thus requires large investments by both public and private sectors. Many countries cannot provide such investments. Even if they have laws and regulations aimed at improving food protection, enforcement is not very strict. The desire of the authorities to improve this situation ends up more as a hope that may be quite removed from reality, depending on the country. Given these circumstances, a strong drive to improve food protection in the hemisphere should incorporate such supportive instruments as systems of cooperation, credit from international agencies for setting up laboratories and equipment, training programs, special technical assistance, and other elements. There is already some experience in this type of undertaking, so it should not be difficult to find paths for implementing such efforts. An evaluation of the objectives and the necessary means to attain them would make it possible to quantify needs and formulate a program.

GATT AS AN AXIS FOR THE FUTURE LIBERALIZATION OF FOOD TRADE

It is easy to appreciate the correlation between lax application of food protection standards in international commerce and low international prices for food products. Low prices on the world market are the bitter fruit of international protectionism, which affects economic growth and the progress and well-being of mankind. Protectionism also adversely influences the ability of many nations to solve their debt problems, which are linked, as is well known, to the equilibrium of the international financial system.

In recent years, the United States has proposed a new series of negotiations to revise the General Agreement on Tariffs and Trade (GATT). At a meeting held last year in Bonn with representatives of seven large countries of the free world, 1986 was proposed as the year for initiating negotiations. The proposal was accepted by all countries except France, which requested a preliminary meeting to discuss international monetary topics and demanded a commitment to protect EEC farmers. Needed at this point are the opinions of other countries on a new round of GATT negotiations and on the availability of holding a formal international meeting to plan a new conference on trade. The current consensus seems to favor such a conference, which is now expected to take place in 1986 or 1987.

Concerning GATT negotiations, the United States has shown interest in two topics: the incorporation of the service trades into the General Agreement (not envisioned originally because of the limited significance of such trades at the time) and consideration of trade in agricultural products. The General Agreement's standards for agricultural trade are extremely lax, and do not prevent subsidies and other distorting practices in international trade. Consideration of agricultural trade did not progress very far in earlier GATT negotiations. In new negotiations, the food exporting countries will probably require--as a condition for their active participation--a commitment on the part of the developed countries to achieve significant advances in the liberalization of agricultural trade. It is important for the advancement of food protection that the countries party to GATT enter into truly productive negotiations aimed at stimulating international trade. As a result, we could see an improvement in international food prices and a more reasonable relationship between prices and the costs incurred through food protection.

RECOMMENDATIONS

In light of this analysis, it is suggested that steps be taken to:

- enact or adapt, in all countries of the hemisphere, legislation on food protection that would respect applicable national conditions and considerations, and would be aimed at creating compatible standards of safety and unhindered development in trade;
- standardize international regulations on food protection, through international forums and application of the Codex Alimentarius as the basic instrument for reconciling standards;
- analyze, with the aid of technicians from various nations and inter-American institutions, issues of conflicts about the importation of food among countries of the hemisphere;
- study the possibility of obtaining credit from international agencies such as the Inter-Development Bank and the World Bank for countries that want to use it for improving their food protection programs;
- study the feasibility of establishing cooperative food protection programs among the hemisphere's developing and more developed countries;
- seek the development of cooperative programs under the sponsorship of applicable international institutions (e.g., the FAO, the Pan American Health Organization, the

Inter-American Institute of Agricultural Sciences, and others); and

o make clear to nations that a prerequisite for the vigorous development of food protection is the liberalization of international commerce, that GATT should be the focal point for planning a path along such lines, that the next GATT negotiations should include agricultural trade, and that GATT should limit protectionism in international food trade.

REFERENCES

Acha, P., and L. V. Meléndez. 1983. The role of veterinary medicine in animal production and health: Its impact on the socio-economic development of the Latin American and Caribbean countries. Rev. Sci. Tech. Off. Int. Epiz. 2:101-144.

Callis, J. 1985. Prospects for animal disease control in the Americas. Pp. 100-115 in II Meeting of the Inter-American Commission on Animal Health COINSA II. Inter-American Institute for Cooperation in Agriculture, Brasilia.

Carreras, A. E. D. C. 1978. La fiebre aftosa y el comercio mundial de carnes. Reunión hemisférica sobre fiebre aftosa y comercio internacional de animales y productos de origen animal. Organización Panamericana de la Salud, Washington, D.C.

Carreras, A. E. D. C. 1985. Participación de la carne en la alimentación de la próxima década. Pp. 55-66 in II Reunion de la Comision Interamericana de Salud Animal COINSA II. Instituto Interamericano de Cooperación para la Agricultura, Brasilia.

Crawford, L. 1985. The impact of residues on animal food products and human health. Rev. Sci. Techn. Off. Int. Epiz. 4(4):669-685.

FAO (Food and Agriculture Organization). 1981. Agricultura: Horizonte 2.000. Organización de las Naciones Unidas para la Agricultura y la Alimentación, Rome.

GATT. 1969. Instrumentos básicos y documentos diversos. Texto del Acuerdo General, Ginebra.

Kahn, H., et al. 1976. The Next Two Hundred Years. Morrow, New York.

Kapp, R. J. 1985. Increasing the intake of nutrients while reversing the Engels phenomenom. J. Am. Med. Assoc. 254:317 8-3182.
Leontief, W., et al. 1977. The Future of the World Economy: A United Nations Study. Oxford University Press, New York.
Meadows, D., et al. 1974. The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind. Universe Books, New York.
Quevedo F. 1971. Problemas de salud relacionados con la importación y exportacion de alimentos de origin animal. Pp. 111-124 en III Reunión Interamericana sobre el Control de la Fiebre Aftosa y otras Zoonosis, Buenos Aires, Argentina, 14-17 April, 1970. Publicacion Cientifica No. 218. Organización Panamericana de la Salud/Organización Munidal de la Salud, Washington, D.C.
Rico, A. G., and S. B. Burgat-Sacaze. 1984. Médicaments véterinaires et securityé alimentaire. Vol. 3, 4. Approche toxicologique. Rev. Sci. Tech. Off. Int. Epiz. 3:855-867.

DISCUSSION SUMMARY

Participants in the discussion of recurring problems in the international trade of foods agreed that international food standards can either serve to promote entry of a country into the international market or can inhibit the flow of trade. The development of the infrastructure within a developing country to meet international standards of trade is costly. Unfortunately, at the same time that these costs must be incurred in developing countries, the advanced technology of North American and European Economic Community (EEC) countries, as well as their agricultural policies, have promoted a deterioration of prices for agricultural commodities on the world market.

Because of the obvious pressing need of the developing countries to generate foreign exchange, international food protection standards are quite often applied only to export-oriented agricultural products, and are not applied to products aimed at the domestic market. The technology implicit in international food standards is not automatically extended to the domestic segment of agricultural production.

Difficulties in harmonizing international and national food standards can be illustrated by the case of beef, for which international standards are sometimes more strict than domestic ones. The regulations imposed on beef imports by Canada and the United States have been very fair. In contrast, the requirements imposed by the EEC upon such exporting countries as Argentina are more stringent than those required within EEC member nations.

The acceptable risk of foot-and-mouth disease also differs internationally. The United States bars the import of any meat from countries with foot-and-mouth disease, whereas the United Kingdom has accepted importation of frozen meat from such countries. No outbreaks of foot-and-mouth disease have occurred over an 11-year period in the United Kingdom, despite these more liberal import provisions.

International food protection standards designed to protect against food contamination sometimes call for permissible levels of a contaminant in a parts-per-trillion concentration. Considering the large spectrum of hazards to which the human being is subjected, these extremely low levels of concentration coefficients seem to be excessive in some cases. The risk-benefit ratio of such stringent standards can provide grounds for reasonable doubt. The requirements for food protection have become increasingly costly over the years, and for exporting nations there has been a need for increasing expenditures for personnel, training, and the development of a chemical and biological analytical infrastructure.

In the coming round of negotiations within the General Agreement on Tariffs and Trade (GATT) framework, the United States is willing to include as basic points for discussion both heavy construction services and agricultural products. From the Latin American standpoint, the second point is the preferred one. Quite obviously, for agricultural products, the problem of technical requirements concerning food protection will arise, and these requirements may well be treated as nontariff barriers to free trade.

In light of these considerations, discussion participants proposed seven recommendations:

1. enactment or adaptation, depending on the case, of appropriate food protection legislation by the nations of the hemisphere in an effort to create an adequate level of compatibility that will permit unhindered development in trade;

2. standardization of international regulations for food protection, through international discussions (the Codex Alimentarius should be the basic tool for reconciling standards and the GATT should help to limit protectionist attempts);

3. identification, by scientists and technologists from different nations and inter-American institutions, of areas where there are conflicts in the importation of food in countries of the Western Hemisphere;

4. study of the possibility of grants of credit assistance by international credit agencies (e.g., the Inter-American Development Bank and the World Bank) to countries that need it for the development of programs to improve food protection;

5. study of the effectiveness of cooperative programs between the hemisphere's more developed countries and those that require aid in developing food protection programs;

6. development of cooperative programs through appropriate international institutions (e.g., the Food and Agriculture Organization, the Pan American Health Organization, and the Inter-American Institute for Cooperation on Agriculture); and

7. promotion of the concept that a prerequisite for the vigorous development of food protection is the liberalization of international commerce, which is essential for the viability of the programs to be developed. The GATT should be central to the liberalization of agricultural trade as a fundamental objective in the next set of negotiations.

In discussion, the technical secretary of the coordinating committee for the Codex Alimentarius for Latin America and the Caribbean emphasized the importance for international trade of the Codex Alimentarius and the decisions made by the committee this year. International food standards have been agreed upon by participating nations, and recommendations 2 and 5 of the Committee above are already operational in the Region. Emphasis should be placed on the decisions of the Regional Codex Coordinating Committee.

Discussants stressed the need for an international reference laboratory for arbitration in cases where there might be conflict concerning a contaminant. It was also considered urgent to develop methods for measuring economic gains derived from the enforcement of food protection policies, and it was noted that international requirements for food protection, because of the very dynamics of technological progress, should be reviewed from time to time in order to maintain the validity of the standards themselves.

In disseminating information on food protection techniques, developing countries were urged to provide technical assistance and education directly to food producers, as they are in the care of agricultural services.

The problems posed to international trade when food standards are inadequate or disregarded were stressed. In this regard, it was observed that the importing country should make very clear and explicit its reasons for rejection of exports from other countries.

International Food Standards and Trade

EDDIE F. KIMBRELL

International food standards play an important role in international trade. To develop food standards that will both facilitate international trade and protect consumers, the Codex Alimentarius Commission was established as a joint effort of the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), in 1962, with a Secretariat based in Rome.

Any nation that is a member or associate member of FAO or WHO may be a member of Codex. Currently, 129 nations are members, an increase of 7 since July 1983. The seven new members are the People's Republic of China, Haiti, Lesotho, Mozambique, the Seychelles, Suriname, and Zimbabwe (FAO/WHO, 1985). All the new members are developing countries, as are about 70 percent of the commission members.

PROGRAM OBJECTIVES AND ORGANIZATION

The Codex Alimentarius Program has two major objectives: protection of the health and economic interests of consumers on a global scale, and reduction of nontariff barriers through negotiated agreements related to food labeling, food additives, pesticide residues in foods, food composition requirements, and other health provisions. To carry out its mission, the Codex Alimentarius Commission has created 29 committees and two expert groups to develop international food standards. Figure 1 illustrates the commission's organizational structure.

The subsidiary bodies of the commission can be divided into three main types: general subject matter committees, commodity committees, and regional coordinating committees. All the general subject and most of the commodity committees are chaired and hosted by member governments, which have undertaken these tasks at their own expense. The United States up to 1984 had accepted responsibility for three Codex committees: the Codex Committee on Food Hygiene, the Codex Committee on Processed Fruits and Vegetables, and the Codex Committee on Cereals, Pulses, and Legumes. As a result of the work of subsidiary bodies, the Commission has approved more than 200 finalized and draft Codex standards covering commodities in the following areas: milk and milk products, fruit juices, quick-frozen foods, cocoa products and chocolate, fats and oils, sugars, processed fruits and vegetables, meat, processed meat products, fish and fishery products, foods for special dietary uses, soups and broths, edible ices (ice cream), natural mineral waters, cereal products, and vegetable protein products (Smith, 1985).

A new committee, the Codex Committee on Residues of Veterinary Drugs in Foods, was created at the 16th session of the commission in July 1985. This committee, which will be hosted by the United States, could prove to be one of the more important committees, and indicates the commission's concern for keeping current with developing issues. Veterinary drug residues in food will thus be receiving the attention that this controversial subject deserves. The first session of the Veterinary Drug Residues Committee is tentatively scheduled for October 1986 in Washington, D.C.

THE NEED FOR INTERNATIONAL STANDARDS

The director general of WHO pointed out to the 1985 Codex Alimentarius Commission that "a report of the Joint FAO/WHO Expert Committee on Food Safety [which met] in Geneva in 1983 stated that illness due to contaminated food was perhaps the most widespread problem in the contemporary world and an important cause of reduced

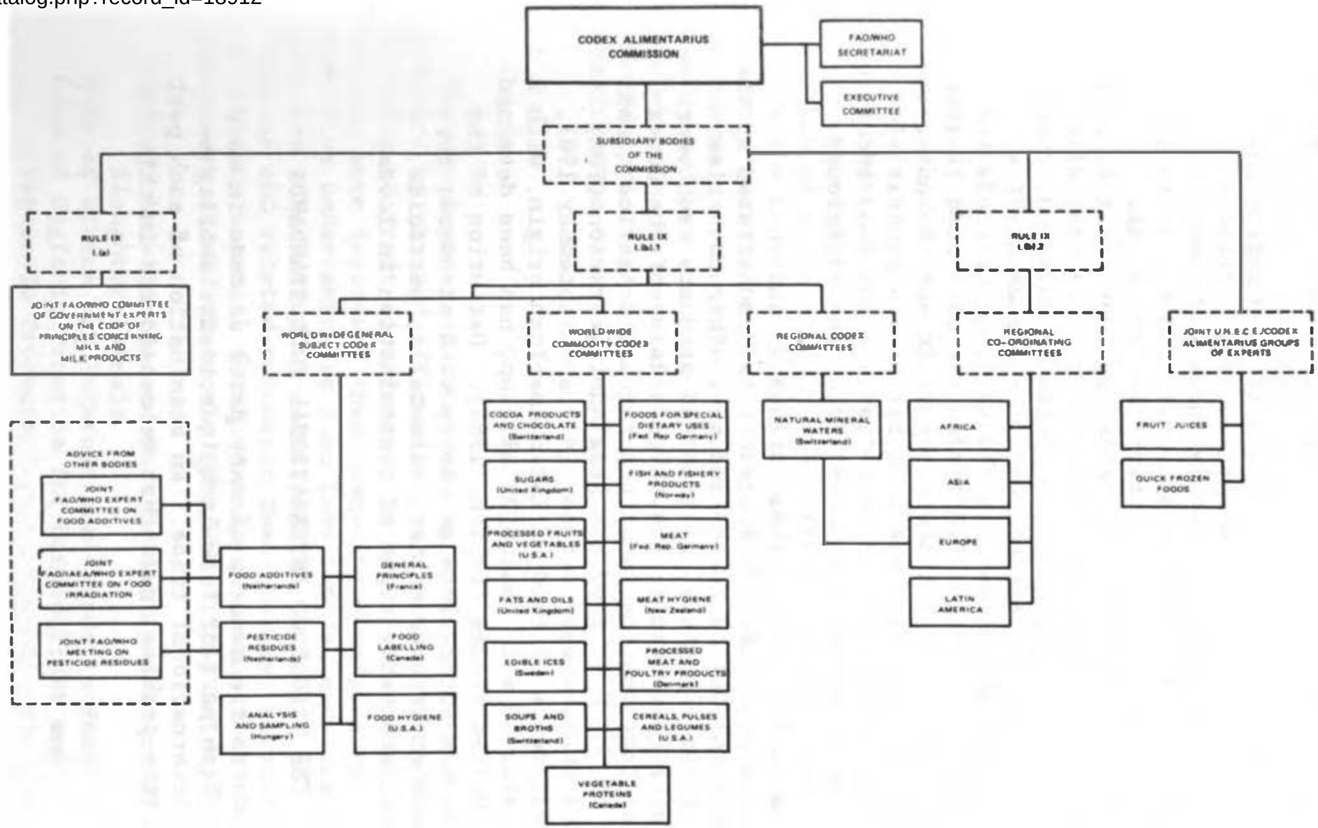


FIGURE 1 Structure of the Codex Alimentarius Commission. With permission from the Food and Agriculture Organization of the United Nations and the World Health Organization (FAO/WHO, 1981).

economic productivity." The director general went on to say that "a strategy for the prevention and control of foodborne diseases by improvement of food safety has been proposed by this Expert Committee. This strategy recognizes the need for greatly increased community participation if foodborne morbidity and mortality rates are to be reduced to more acceptable levels, and underlines the need for strengthening food control, both regulatory and voluntary." The director general also observed that "the Codex Alimentarius Commission, through its internationally agreed commodity standards, its standards and guidelines for the labeling of foods and food additives, its maximum limits for pesticide residues in foods and its many codes of hygienic and technological practice has provided, and is still in the process of providing, food control authorities and the food industry with a wealth of most valuable advice and background information" (Mahler, 1985).

The need for international standards and an understanding of their enforcement is demonstrated by the fact that the United States and many other countries reject great quantities of imported products each year. In a paper presented to the third session of the Codex Regional Coordinating Committee for Latin America, John Lupien of the U.S. Food and Drug Administration (FDA) reported that between October 1979 and September 1981, 2,252 shipments of food of Latin American origin, with a total value of more than $123 million, had been detained in the United States (Lupien, 1984). Detention of the products was for failure to comply with standards for filth and extraneous matter, salmonella, pesticide residues, and other types of contamination in foods.

THE NATURE OF INTERNATIONAL FOOD STANDARDS

Standards are made up of many parts or come in many forms. Each part or form is unique in its ability to affect international trade. An examination of each part reveals the problem areas that we considered in this report.

Commodity Standards

Setting standards for the identification of commodity ingredients and the appropriate naming of these ingredients involves much discussion, and in some cases compromise, by national bodies. Such factors as the different ingredients available in different countries and varying cultures and tastes mean that standards must be flexible enough to accommodate the differences that exist from one country to another. Yet debate over such issues as the terms "pure," "concentrated," "dehydrated," and "style" can and has resulted in international agreements that overcome unnecessary trade barriers.

The subject of commodity standards is a dynamic one. A standard that is acceptable today may have to be changed tomorrow because of technological advances, new taste patterns, or other factors. For example, the question of names of standardized products is currently before the Codex Alimentarius Commission. How can we properly qualify by name, without confusing or misleading consumers, a standard product in which a portion of the named product is a substitute product (such as vegetable protein, in the case of hamburger)? This question will receive priority at an upcoming session of the Codex Committee on General Principles.

Codes of Practice

The development of codes of hygienic and technological practice by the Codex Alimentarius Commission (CAC) is an activity of great importance. In some respects this work is even more important than commodity standards to countries undertaking to form food control services or agencies. Following is a list of the CAC Codes of Practice and related documents that are used extensively as training material for food inspectors and food processors around the world (FAO/WHO, 1985; Smith, 1985).

Code of Ante-Mortem and Post-Mortem Inspection of Slaughter Animals
Code of Ethics for International Trade in Food
Code of Hygienic Practice for Canned Fruit and Vegetable Products

Code of Hygienic Practice for Dehydrated Fruits and Vegetables including Edible Fungi
Code of Hygienic Practice for Desiccated Coconut
Code of Hygienic Practice for Dried Fruits
Code of Hygienic Practice for Egg Products
--Microbiological Specifications for Pasteurized Egg Products
Code of Hygienic Practice for Foods for Infants and Children
Code of Hygienic Practice for Fresh Meat
Code of Hygienic Practice for Frozen Fish
Code of Hygienic Practice for Low-Acid and Acidified Low-Acid Canned Foods
Code of Hygienic Practice for Molluscan Shellfish
Code of Hygienic Practice for the Operation of Radiation Facilities used for the Treatment of Foods
Code of Hygienic Practice for Peanuts (Groundnuts)
Code of Hygienic Practice for Poultry Processing
Code of Hygienic Practice for Processed Meat Products
--Preservation of Meat Product Heat Treated Prior to Packaging
Code of Hygienic Practice for the Processing and Handling of Quick Frozen Foods
--Method for Checking Product Temperature
Code of Hygienic Practice for Shrimps and Prawns
Code of Hygienic Practice for Tree Nuts
Code of Practice for Canned Fish
Code of Practice for Fresh Fish
Code of Practice for Lobsters
Code of Practice for Salted Fish
Code of Practice for Smoked Fish
General Principles of Food Hygiene
International System for the Description of Carcasses of Bovine and Porcine Species and International Description of Cutting Methods of Commercial Units of Beef, Veal, Lamb and Mutton, and Pork Moving in International Trade
Microbiological Specifications for Foods for Infants and Children and Methods of Microbiological Analysis for Foods for Infants and Children

Codes developed and being developed by the commission offer a unique challenge. How can codes be formulated to take into account both the capabilities of developing countries and the technological advances available to more developed economies? Addressing this point at the 1985 meeting of the Codex Alimentarius Commission, the director general of WHO commented, "May I propose . . . that you consider reviewing and possibly amending some of your recommendations, especially the codes of hygienic practice, which some people claim are rather rigorous and expensive in relation to the health benefits they are expected to provide. In this way, these recommendations might become even more valuable, especially for small food processors in developing countries" (Mahler, 1985).

Contaminant Standards

The presence of contaminants such as arsenic, lead, mercury, cadmium, polychlorinated biphenyls (PCBs), dioxins, mycotoxins, and drug residues in foods is of increasing concern to all countries involved in international trade. Unfortunately, many of these substances are of environmental origin and are beyond the direct control of the food producer or manufacturer. At the present time, the Codex Alimentarius Commission does not have a committee that deals exclusively with contaminants, although evaluations of some of these substances have been handled by the Committees on Food Additives and Pesticide Residues, and will be handled by the new Committee on Residues of Veterinary Drugs in Foods.

The issue of contaminants has been of great concern to member countries of the commission, and has been debated since its inception. Unfortunately, most of the debate centers on emotion and innuendo rather than on hard scientific data. Until more data and scientific knowledge are available, little genuine progress--beyond highlighting of the problem--will occur. The director general of WHO at the 1985 session of the commission asked it to consider contamination caused by packaging and packaging materials at the earliest possible time (Mahler, 1985).

Standards for Pesticide Residues and Food Additives

The issues of pesticide residues and food additives offer perhaps the greatest challenge to international harmonization efforts because of the divergence of views and regulations among countries. National differences with respect to food additives and maximum residue limits for pesticides probably represent the greatest problem in international trade in food, with the exception of labeling. In an effort to provide international guidance and leadership, the commission has done a great deal of work in attempting to harmonize provisions for both food additives and pesticide residues. Nearly 400 food additives have been evaluated for their safety and maximum levels recommended for use in specific foods. The commission has adopted pesticide residue limits for 120 different substances that are applied to nearly 2,000 different foods or food crops (FAO/WHO, 1985; Kimbrell, 1985).

Food Labeling Standards

The many concerns that play a part in the field of food labeling--such as claims, advertisements, origin, and standardization of names--make this one of the most emotionally volatile areas of food protection. In the United States and many other countries, responsibility for enforcing food labeling requirements is divided among several government departments or ministries, which adds to problems of harmonization and acceptance of international standards.

The Codex Alimentarius Commission has been very active in attempting to harmonize labeling requirements. Hosted by the government of Canada, the Codex Committee on Food Labeling has recently revised the International General Standard for the Labeling of Prepackaged Foods. The revised standard encompasses current concerns over food labeling, and includes sections on date marking and on the labeling of irradiated food (Smith, 1985). The committee has also recently finalized guidelines for adding nutritional values to labels. While the proposal on nutrition labeling has been the most complex and contentious subject ever put before the committee, it should nevertheless provide valuable guidance to those countries wishing to establish a nutrition labeling scheme. The commission has been reluctant to wade into the area of food advertising, but the subject keeps coming up, and many governments feel that the commission can play a vital role in addressing the many problems that have arisen in food advertising.

ACCEPTANCE OF CODEX STANDARDS

At the time of the 15th session of the Codex Alimentarius Commission, held in July 1983, 80 countries had indicated their acceptance, according to one of the methods of acceptance established in the general principles of the Codex Alimentarius, of a number of the recommended Codex standards and of the recommended maximum levels for pesticide residues. In the early years of the Codex program many acceptances came from developing nations. Acceptances are now being received in larger numbers from industrialized countries. In considering a number of Codex standards, the U.S. regulatory authorities have stated that products in conformity with such standards may "enter the United States or move freely in domestic commerce." While this is not a formal acceptance in procedural terms, it is certainly within the spirit of the Codex concept in that the United States will not impede the entry of conforming products.

It is important that countries give serious consideration to the Codex standards and accept them as legally binding requirements to whatever extent possible, or at least make a commitment not to impede the entry of a food that conforms with Codex requirements. It is only by such compromise that Codex standards can become internationally accepted regulatory instruments, rather than just a valuable collection of recommendations.

Clearly there is a need for uniform and internationally accepted rules to facilitate the international movement of both processed and unprocessed foodstuffs. The Codex Alimentarius Commission has provided the only forum in the world devoted to both consumer protection and facilitation of international trade of food commodities. It is unique in that it gives government representatives and their advisers the opportunity, on a continuing basis, of explaining the reasons for the different requirements of particular nations while attempting to find the compromise necessary to eliminate or minimize these differences.

ENFORCEMENT OF CODEX STANDARDS

One of the most frequently asked questions about the Codex program--usually posed by regulators or those they regulate--is this: The objectives of the Codex program are worthwhile and achievable, but what mechanism does the program have for enforcing all these standards and codes on an international level? The truthful answer is that the Codex program has no independent international enforcement capability, nor has it sought any; yet because of the foresight of the original program organizers, the acceptance procedures imposed as a condition of commission membership provide what may be an almost perfect least-cost solution to the enforcement problem. Each member country agrees to consider the acceptance of Codex standards, and when they have been accepted to allow products meeting those minimum standards "to be distributed freely . . . within its territorial jurisdiction;" conversely, that country must "also ensure that products not complying with the standard will not be permitted to be distributed under the name and description laid down in the standard" (FAO/WHO, 1981). Thus Codex standards will be enforced without the Codex program having direct control because they become part of the laws and regulations of each individual member.

A second enforcement mechanism that is significant and often overlooked is in the area of civil law. More and more frequently Codex standards and codes are incorporated into contracts between buyers and sellers (private and government) and thus become enforceable instruments in civil courts. Of course, the key to enforcement is gaining acceptance by member countries of the Codex standards. Accelerating and expanding acceptance of Codex standards are major focuses of the Codex Alimentarius Commission for the near term. The United States is among the leaders in taking action on Codex standards that have been distributed to member governments for acceptance.

DISPUTES CONCERNING INTERNATIONAL STANDARDS

When a country feels that a standard is being used as a nontariff trade barrier, the country can bring its case before an international body under the General Agreement on Tariffs and Trade (GATT). A GATT Standards Code was developed and adopted by many countries during the last round of trade negotiations, which occurred from 1975 to 1979. Under that code, the program of the Codex Alimentarius Commission was cited as an example of how nontariff issues had successfully been addressed. The structure established within the Codex Alimentarius Commission was cited as an effective one that might be applicable in areas other than food to pursue solutions to problems in nonfood product areas (Kimbrell, 1985).

Disputes arise not only as a result of the standards themselves, but also in regard to processing methods, enforcement, and other requirements. Any of these subjects may be reviewed under the GATT agreement, although many countries have not been completely satisfied with the resolution of problems through the GATT mechanism. Undoubtedly the need for a forum to consider disputes will continue.

SUMMARY

International standards for food not only assist countries in protecting the health and welfare of their consumers, but also are keys to improved trade. Such standards bring about efficiencies in production, and therefore provide economic incentive for their use. We can expect even more effort in international standardization in the years to come. The Codex Alimentarius Commission has been leading international efforts for food standardization, and will continue this thrust as the commercial interests that rely on effective standards increase their recognition of the part that international standards play in trade.

REFERENCES

FAO/WHO (Food and Agriculture Organization/World Health Organization). 1985. Report of the Sixteenth Session of the Joint FAO/WHO Codex Alimentarius Commission. ALINORM 85/47, Food and Agriculture Organization/World Health Organization, Rome. 108 pp.

FAO/WHO (Food and Agriculture Organization/World Health Organization). 1981. Codex Alimentarius Commission Procedural Manual, 5th ed. Food and Agriculture Organization/World Health Organization, Rome. 120 pp.

Kimbrell, E. F. 1985. International standards and non-tariff trade barriers. Food Technol. 39:70-71.

Lupien, J. R. 1984. Special considerations regarding food control in connection with urbanization. Presented at the Third Session of the Codex Regional Coordinating Committee for Latin America and the Caribbean, Havana, Cuba, March 27 - April 2, 1984.

Mahler, H. 1985. Opening Adress by Dr. H. Mahler Director-General of WHO. Pp. 99-101 in Report of the Sixteenth Session of the Joint FAO/WHO Codex Alimentarius Commission. ALINORM 85/47, Food and Agriculture Organization/World Health Organization, Rome.

Smith, B. 1985. Food standards and controls--a necessity for export. Food Technol. 39:72-74.

DISCUSSION SUMMARY

International standards not only assist countries in protecting the health and welfare of their consumers, but also are keys to improved trade. These standards bring about efficiencies in production, storage, and distribution, and therefore provide economic incentive for their use. Even more effort in international standardization is required, and can be anticipated in the years to come. The Codex Alimentarius Commission has been leading international efforts in food standardization, and must continue its thrust as governmental and commercial interests increase their recognition of international standards and make greater use of Codex international standards and other recommendations.

The following recommendations emerged from the discussions:

o To avoid duplication of effort, countries should increase participation in the work of the Codex Alimentarius Commission and its subsidiary bodies, particularly the technical and commodity committees and the regional coordinating committees.

o Countries should increase their acceptance of Codex standards in order to achieve the objectives of consumer protection and facilitation of trade.

o The work of the Codex Alimentarius Commission should receive much more recognition and publicity.

o In trading contracts, industry should be encouraged to use and to adhere to the standards of the Codex Alimentarius Commission.

o The role of the Codex Coordinating Committee should be reinforced, and international organizations should develop strategies to increase country participation in the Codex Alimentarius.

o There is a need for establishing the standards for food industry publicity and advertising; the Codex Alimentarius Commission might look into this matter.

o The problem of migration of chemicals through and from food packaging materials should receive priority attention.

o The setting of international standards for fresh tropical fruits and vegetables should be further explored.

o Countries should set up appropriate mechanisms to adopt and implement Codex standards and other recommendations, and the Food and Agriculture Organization (FAO) and the Pan American Health Organization (PAHO) should provide the necessary technical assistance to developing countries in this area.

The following problems of individual countries were identified by participants:

o filth and insect contamination in foods

o poor and inconsistent identification of food products

o limited ability to comply with the Codex Alimentarius because of residue problems and lack of training and capabilities for food analyses

o limited direct participation in Codex Alimentarius activities.

SESSION 3
Activities of International Agencies and of Nations

United Nations University Activities Related to Food Protection

RICARDO BRESSANI

The United Nations University (UNU) was founded by the General Assembly of the United Nations in 1975 to help solve pressing global problems of human survival and welfare through the instruments of scholarship--research, advanced training, and the dissemination of knowledge. It is governed by a board of 24 distinguished academics serving in their individual capacities, and is the only United Nations organization that works directly with universities, research institutions, and individual scholars instead of through governments. It is also the only one that operates primarily from a basis of endowed funding rather than on annual contributions from governments.

During the first 5 years of the UNU, its three priority areas were world hunger, the use and management of natural resources, and human and social development. In 1980 the range of programs was broadened, but food and nutrition remained major program priorities. Some 4 years ago the UNU began to focus on the problem of inadequate knowledge of the composition of foods, both nutrient and nonnutrient. It is indicative of the problem that in Latin America there have been few analyses of foods since the early 1950s, and that most of the data currently available were obtained more than 40 years ago, often by methods that are no longer considered suitable. The Latin American Food Composition Table, developed by the Institute of Nutrition of Central

America and Panama (INCAP) with Food and Agriculture Organization (FAO) and United States support and published in 1957, has never been updated, and food analysis activities in the hemisphere have come almost to a standstill. In the meantime, new plant varieties have been introduced, a broad range of processed foods have entered the market, new means of storing and preserving foods have been introduced, and the international exchange of foods has increased greatly. The availability of reliable food composition data is no better for the developing countries of Asia and Africa.

This lack of data not only hinders efforts to understand the effects of different diets on such conditions as hypertension, heart disease, and various types of cancer, but also handicaps efforts to achieve accurate nutrient labeling, nutrition education based on a knowledge of the nutritive value of local foods, and the prevention of nutrient losses during storage and processing.

In recognition of the widespread lack of reliable and appropriate food composition data, particularly in developing countries, the United Nations University agreed to sponsor a global effort to improve this situation by sponsoring the International Network of Food Data Systems (INFOODS). The organizational experiences of INFOODS are applicable to the concerns of the Inter-American Conference on Food Protection, and some of the technical and other problems encountered by INFOODS are similar to those encountered by Conference participants. Some of the shared problems include the need to improve and standardize methods, to enhance the training of analytical personnel, to update laboratory equipment, and to develop methods of classification, storage, retrieval, and exchange of food data.

The UNU believed that it was imperative to initiate efforts to solve these problems because the amount of readily available, good-quality food composition data has been steadily declining in relation to the number of existing foods, while at the same time there has been a gradual and steady increase in the complexity of food supplies and in the extent of the need for food data. Furthermore, it was obvious that these efforts should be undertaken on an international level, and that they should address the underlying data quality and access problems rather than only the quantitative deficiency of such information.

Accordingly, in early 1983 an international group under the aegis of the United Nations University gathered in Bellagio, Italy, to assess the status and problems of food composition data and to see what should and what could be done. This conference was supported by various U.S. government agencies, private foundations, and the food industry, with the Rockefeller Foundation providing the meeting space and housing facilities. Representatives of the National Institutes of Health (NIH), the Food and Drug Administration (FDA), and the U.S. Department of Agriculture (USDA) came from the United States. The UNU, FAO, the World Health Organization (WHO), the International Union of Nutritional Sciences (IUNS), and the International Union of Food Science and Technology (IUFoST) also sent representatives.

The meeting proposed that the INFOODS organization improve the quality and availability of food composition data and promote international participation and cooperation in the effort. Funding was obtained mainly from the National Cancer Institute but also from private foundations and industry; the UNU agreed to serve as the international sponsoring agency. Work began formally in July 1984 with the establishment of an INFOODS secretariat at the Massachusetts Institute of Technology (MIT).

The fundamental intention of INFOODS is to link the generators, compilers, and users of food composition data into a collaborative effort that will facilitate the development of channels of communication and guidelines for operation. To accomplish this, INFOODS is setting up two networks. The first is a network of people interested in food composition data, linking them together and drawing upon their expertise. The INFOODS secretariat works with regional groups that, in turn, work with individuals and groups within the countries of their regions and with other regional groups. The goals of this network are to develop a sense of unity in the field and to increase awareness of the importance and limitations of the data, as well as to keep everyone informed of what is being done.

The second is a data network, a linkage of food composition data bases around the world, designed so that anyone can determine what data exist and where they are. This network makes data from around the world accessible and enables data users to understand the nature and quality of the data they have received.

The successful establishment and operation of these networks requires completion of several essential tasks; therefore INFOODS has initiated a number of activities, described briefly below.

Development of standards and guidelines for the collection of food composition data. A committee headed by David Southgate, a British chemist who produced a brief manual on food data analysis and collection in 1974, completed the first draft of a revision and extensive expansion of this document. A meeting of IUNS held in Brighton, England, in August 1985 featured a workshop focused on a second draft, which was widely distributed for review. The final draft will be ready for review by mid-1986.

Development of a standardized terminology and nomenclature. Steward Truswell, a nutritionist at the University of Sydney, Australia, is heading a group to examine the problems of international nomenclature and classification. Several meetings have been held, leading to the initial design of a terminology that will permit international exchange of food composition data. This system is conceptually similar to the Factored Food Vocabulary of the FDA, and builds to a certain extent on the work and experiences of the International Network of Feed Information Centers (INFIC). A detailed prospectus of this group's work will be ready for review in spring 1986, and an international coding meeting will be held early in 1987 to test the system. A well-developed preliminary version of the system should be ready by summer 1987.

Development of a detailed description of users' needs. In March 1985 a users' needs meeting was held in Logan, Utah. In attendance were persons involved with the generation, compilation, and especially the use of food composition data. At this meeting, organized for INFOODS by Carol Windham and Gaurth Hansen of Utah State University, participants reviewed the initial plans of INFOODS and went on to formulate operational specifications of what was needed in terms of food composition data and how INFOODS could best accommodate these needs and desires. The proceedings of this meeting will be published in 1986.

Two important tasks for INFOODS that were identified by this group were production of (1) guidelines on how best to use existing data to fill the gaps in food composition tables and (2) guidelines on how to statistically process and present the data. These tasks are now being organized by the secretariat, which expects to report preliminary results within the next year.

Exploration of how modern information systems ideas and technology can be used in the field of food composition data. A working group in this area is being set up and chaired by John Klensin, a senior computer scientist at MIT. Initial tasks of the group include development of standards for data interchange and design of a (prototype) regional center. In addition, this group will develop computational routines that embody recommendations about terminology, data quality, and interchange, and that will facilitate electronic communication among workers in the field. This activity is central to the whole concept of a network of food composition data. One of the goals of the group is to be able to recommend and provide technical assistance for end-user systems development. By 1986 it is hoped that there will be firm versions of interchange protocols and specifications for regional centers and programs.

The production of an international directory of existing data bases. In 1975 the FAO produced an international inventory of food composition tables. Since FAO currently has no plans for updating this valuable document, INFOODS is preparing an expanded and updated version (a first edition is now available).

International Journal of Food Composition. A quarterly international journal has been established that will contain reviews, original articles, and policy guidelines related to food composition. It will be copublished by Academic Press and the UNU. Kent Stewart of the Virginia Polytechnic Institute will serve as editor. This journal, which will begin publication in

1987, is intended to give the study of food composition the coherence necessary to make it an identifiable field.

Regional INFOODS liaison groups. Within the industrialized world, some limited communication already exists among people involved with food composition data. In the developing world such communication is very limited. INFOODS is working to link, foster, and even organize, where necessary, regional groups whose responsibilities are to determine regional needs and resources, coordinate regional activities such as workshops and seminars, and in some cases establish and maintain regional computer facilities and depositories of food composition data. Links are currently being established with groups in Scandinavia (NORFOODS, centered in Uppsala, Sweden), Europe (EUROFOODS, centered in Wageningen in the Netherlands), and in the countries bordering the Mediterranean (MEDIFOODS, based in Italy). Groups are being organized in Asia (ASIAFOODS, based in Bangkok), Latin America (LATINFOODS at INCAP in Guatemala), and the United States and Canada (NOAFOODS, based in Cambridge, Massachusetts). Other regional groups are in the planning stage. By 1987 INFOODS hopes to have an AFRICAFOODS, as well as OCEANIAFOODS for the South Pacific; it also plans to have the involvement of the countries of Eastern Europe in the INFOODS network. The ultimate goal is that everyone should have easy access to at least one regional group.

Establishment of a secretariat. To keep all these activities moving along in a consistent, compatible, and timely fashion, a small secretariat has been established at MIT.[1] This group consists of Vernon Young, a nutritional biochemist, and John Klensin, a computer specialist, and is directed by William Rand, a biostatistician as executive secretary. In addition to dealing with the specific tasks already described, the secretariat is primarily involved with organizing and coordinating the task forces and serving as a general international clearinghouse and resource center. To let people know what INFOODS is doing, a newsletter is issued quarterly and is sent to those who have shown interest.

INFOODS has embarked on an ambitious program. Its activities in the hemisphere are centered around two regional groupings--NOAFOODS in the United States and

Canada and LATINFOODS in Mexico, Central and South America, and the Caribbean. Much of the work and experience of INFOODS should be applicable to food safety data. Moreover, the NOAFOODS and LATINFOODS secretariats should work closely with whatever organization is set up to promote the recommendations of the Inter-American Conference on Food Protection. Possibilities for joint activities should also be explored.

NOTE

[1] INFOODS
MIT 20A-226
Cambridge, MA 02139
TELEX: 921473 MITCAM

World Health Organization and Joint Food and Agriculture Organization/World Health Organization: Global and Interregional Food Protection Activities

F. K. KÄFERSTEIN

The World Health Organization (WHO) considers food safety as one of its priorities. Reference to food safety is made in the essential components of a primary health care program (WHO, 1978), through which WHO and its member states approach the target of Health for All by the year 2000. The components of Primary Health Care (PHC) are: (1) education concerning prevailing health problems and the methods of preventing and controlling them; (2) promotion of food supply and proper nutrition; (3) adequate supply of safe water and basic sanitation; (4) maternal and child health care, including family planning; (5) immunization against major infectious diseases; (6) prevention of locally endemic diseases; and (7) appropriate treatment of common diseases and injuries and provision of essential drugs.

Inherent in and essential to the achievement of components 1 through 4 and component 6 are the provision of adequate supplies of safe and wholesome foods to all to secure proper nutrition, and the avoidance of problems associated with poor food hygiene, such as foodborne diseases.

Primary Health Care emphasizes the need for action at the levels of the individual, the family, and the community. At the same time, it stresses the need for governmental and nongovernmental support to the community through a system of decentralization and referral. How this approach is to be implemented was set out as follows by the 1978 Alma-Ata Conference on Primary Health Care (WHO, 1978, pp. 4-5):

o PHC involves, in addition to the health sector, all sectors and aspects of national community development, in particular, agriculture, animal husbandry, food industry, housing, education, public works, communications, and other sectors, and it demands the coordinated effort of all these sectors.

o PHC requires and promotes maximum community and individual self-reliance and participation in the planning, organization, operation, and control of PHC, making full use of local, national, and other available resources. To this end, it develops through appropriate education the ability of communities to participate.

o PHC relies on a variety of health, community, and other workers, including food inspectors as applicable, suitably trained socially and technically to work as a health team and to respond to the expressed health needs of the community.

The Joint Food and Agriculture Organization/World Health Organization (FAO/WHO) Expert Committee on Food Safety, in its report on the role of food safety in health and development (WHO, 1984), drew attention to the fact that the Alma-Ata Declaration only implicitly covered food safety as an essential component of Primary Health Care. The expert committee emphasized that food safety and adequate nutrition were basic to the reduction and prevention of disease and to the promotion of health. It recommended that "food safety should be considered an integral part of the primary health care delivery system."

Activities related to food safety, food hygiene, or food protection (these terms are closely related, if not synonymous) have been carried out, frequently as joint FAO/WHO endeavors, almost since the 1948 inception of the World Health Organization. As early as 1955 there was a meeting of an expert committee on environmental sanitation, which dealt with food hygiene. In 1956 an activity now in its 30th year was started--the work of the Joint FAO/WHO Expert Committee on Food Additives. During these years, several hundreds of intentional food additives, as well as several contaminants and other compounds, have been evaluated by the committee in order to provide toxicological and technological advice to food regulating authorities in member states. In the field of pesticide residues in food, the joint FAO/WHO meetings on pesticide residues, which have taken place since 1961, have evaluated numerous pesticides and established maximum residue limits in virtually hundreds of different food commodities. Other milestones of WHO's contributions to food safety are the various meetings on specific food commodities, such as meat (1961), milk (1969), and fish and shellfish (1973), and on specific subjects such as food microbiology (1967 and 1976) and food irradiation (last meeting of expert committee, 1980).

Results of these meetings formed the basis for the work of the Joint FAO/WHO Food Standards Program, which is implemented through the Codex Alimentarius Commission (CAC). FAO and WHO sponsor the work of this commission, which was started in 1963 and whose main objectives are the protection of the consumer and the facilitation of international trade in foods. The CAC, through its many internationally agreed-upon commodity standards, its standards and guidelines for the labeling of foods and food additives, its maximum limits for pesticide residues in foods, and its many codes of hygienic and technological practice, has provided and is still providing the food regulatory and control authorities and the food industry with a wealth of valuable advice, guidance, and background information. No evidence has been found of harm to humans when foods eaten complied with Codex standards and when Codex-established limits such as those for pesticide residues were not exceeded.

In more recent years, a "new" group of residues in food--those caused by the application of veterinary drugs and other chemicals used in veterinary medicine and animal husbandry--has gained increasing attention. Following the success of interaction between CAC and FAO/WHO scientific bodies, mainly in the fields of food additives and pesticide residues, WHO and FAO stand ready to proceed jointly to furnish scientific advice and judgments for utilization by an intergovernmental Codex committee on Residues of Veterinary Drugs in Foods.

To promote the recognition, evaluation, and control of environmental conditions and hazards that may affect human health, WHO, jointly with FAO, participates in the health-related monitoring activities of the Global Environmental Monitoring Systems (GEMS). The Joint

FAO/WHO Food Contamination Monitoring Program, initiated in 1976, is one of the major GEMS activities; it has the following main objectives: (1) to collect and evaluate data on levels of certain chemicals in individual foods; (2) to obtain estimates of the intake via food of specific chemicals; (3) to provide technical cooperation to governments of countries wishing to strengthen food contamination monitoring programs; and (4) to provide relevant committees of the CAC with information on levels of contaminants in connection with the establishment of Codex standards and maximum levels of pesticide residues in food.

For many years now, WHO, jointly with the International Atomic Energy Agency (IAEA) and FAO, has been collaborating with scientists working in the field of food irradiation. As early as 1961 a meeting on the wholesomeness of irradiated foods was organized by the three agencies in Brussels. Since then, seven international meetings have been held, mainly, but not exclusively, in collaboration with FAO and IAEA.

The Joint FAO/IAEA/WHO Expert Committee on the Wholesomeness of Irradiated Food, which met in 1980, came to the conclusion that the irradiation of any commodity up to an overall average dose of 10 kGy presents no toxicological hazard; hence, toxicological testing of foods so treated was no longer required. This committee also concluded that the irradiation of food up to an overall dose of 10 kGy introduced no special nutritional or microbiological problems, but emphasized that attention should be given to the significance of any changes in relation to each particular irradiated food and to its role in the diet. With these conclusions, the wholesomeness of irradiated food up to a maximum absorbed dose of 10 kGy had been clearly established (WHO, 1981).

It is clear, however, that a good deal of advocacy work will be necessary before this technology is fully accepted. The World Health Organization is concerned that widespread rejection of the food irradiation process may severely hamper use of the technology in those countries that could benefit the most--the developing countries. Consequently, to better inform the authorities, consumer groups, and the public, the World Health Organization intends to prepare a publication on this subject in cooperation with FAO. The publication will discuss the advantages and limitations of food irradiation in comparison with those of other processes, such as drying, salting, and smoking, and will outline the benefits of food irradiation for consumers in both developing and developed countries. It is expected that the publication will be available in 1986.

Another important contribution to the prevention and control of foodborne diseases is being made by WHO's activities in the field of zoonoses control. Recent activities in this field concentrate on campylobacteriosis and salmonellosis, on histamine and paralytic shellfish poisoning, and on guidelines for small slaughterhouses and meat hygiene in developing countries.

WHO headquarters collaborates with the WHO Regional Office for Europe in a surveillance program for the control of foodborne infections and intoxications in Europe. Although this is essentially a program tailored to the needs and conditions of European countries, it can be seen as a model for other regions of the world where epidemiological studies, and in particular surveillance of foodborne diseases, are overdue.

A further contribution to food safety is WHO's involvement in the development and implementation of the International Code of Marketing of Breastmilk Substitutes, which was adopted by the 34th World Health Assembly in May 1981 in the form of a recommendation. Since then, the director-general of WHO has submitted two biennial reports to the World Health Assembly on the status of implementation of the code; these reports summarized information, provided for the most part by member states themselves, on action they were taking to give effect to the code. The third biennial report will be presented to the 39th World Health Assembly in May 1986.

In the area of strengthening national food control activities, WHO, again jointly with FAO, has been providing guidance material for the development of effective national food control systems and food contamination monitoring programs. At present the two organizations are working on guiding principles for food safety evaluation to provide program managers with a tool to ensure that activities undertaken are those that bring substantial improvements. Nowhere is this tool more needed than in situations where the food safety task at hand is diverse and where resources are limited and fragmented, or where awareness of food safety is low and responsibility may be spread over numerous ministries.

Responsibility for technical cooperation with individual member states, to strengthen their national food control capabilities and to train manpower, lies as a rule with the six regional offices of the World Health Organization. The Pan American Sanitary Bureau, which also serves as WHO Regional Office for the Americas, has a long-standing record in this area; a separate report on the bureau's activities in the region is given by Dr. Fernandes. It is hoped that this Conference and others will stimulate interest in and awareness of the importance of safe food for disease prevention and health promotion, and will lead to increased technical cooperation among member states of the Technical Cooperation Among Developing Countries (TCDC) and between member states and WHO and FAO.

Surveillance data from several industrialized countries indicate that food safety programs, as commonly carried out through official control of food production, processing, and marketing and of food establishments, have failed to reduce the incidence of foodborne disease in these countries. There is a need, therefore, for a better approach to food safety based on contemporary factors that contribute to outbreaks.

Following the views and recommendations of the Expert Committee on Food Safety, WHO will concentrate more in the future on the promotion of community participation through public information and health education. For this reason, the organization is in the process of developing Primary Health Care strategies for food safety. Pilot projects are being prepared in seven countries in Latin America, Africa, and Asia to apply the Hazard Analysis Critical Control Point (HACCP) approach to domestic food preparation and handling. On the basis of the results of these and anthropological studies, an intervention strategy focused through health education and public information is foreseen. With this approach, it is hoped that foodborne diseases and food losses will gradually be reduced to a more acceptable level than we are faced with today.

This paper has attempted to describe briefly how WHO, often jointly with FAO, is responding to the food safety problem. No claims are made to have covered all WHO and joint FAO/WHO responses, since this would not have been possible in the space available.

A list of additional publications on food safety is available from the author, whose address is in the appendix.

REFERENCES

WHO (World Health Organization). 1978. Primary Health Care. Report of the International Conference on Primary Health Care, Alma-Ata, USSR, 1978. WHO Health for All Ser. No. 1. World Health Organization, Geneva.

WHO (World Health Organization). 1981. Wholesomeness of Irradiated Food. Report of a Joint FAO/IAEA/WHO Expert Committee. WHO Technical Report Ser. No. 659. World Health Organization, Geneva.

WHO (World Health Organization). 1984. The Role of Food Safety in Health and Development. Report of a Joint FAO/WHO Expert Committee on Food Safety. WHO Technical Report Ser. No. 705. World Health Organization, Geneva.

Food Protection Activities of the Pan American Health Organization*

MÁRIO V. FERNANDES

The Pan American Health Organization (PAHO), established in 1902, is the oldest international health agency in the world. PAHO promotes and coordinates the efforts of the countries of the Western Hemisphere to combat disease, prolong life, and promote the physical and mental health of its peoples. The organization gives particular attention to technical excellence and to the effective application of existing knowledge for the solution of health problems.

The Pan American Sanitary Bureau, which performs the functions of secretariat of PAHO, is an independent inter-American organization in its own right, and also serves as the World Health Organization's (WHO) regional office for the Americas. PAHO is, therefore, a member of the system of international agencies of the United Nations and, by agreement, advisor to the Organization of American States in matters relative to health in the hemisphere.

PAHO is guided by a Plan of Action adopted by its member countries, whose purpose is to attain the goal of health for all by the year 2000. The plan emphasizes the

*Translated from the original Spanish manuscript.

expansion of preventive, curative, and rehabilitative health services so as to include the 40 percent of the population that at present lacks access to regular health care, and the training of health personnel so that they reach as many people as possible at the initial level. The plan also encompasses regional health goals to increase life expectancy, reduce infant mortality, provide immunization services to all children against the principal diseases, and provide adequate water and sanitation for all. Also incorporated in the Plan of Action--and of priority importance--are the food protection and safety activities that PAHO is committed to develop in order to fulfill the mandates of its governing bodies.

Within the organic structure of PAHO, the Veterinary Public Health Program (HPV) functions in the area of health programs development and is responsible for coordinating actions in food protection and safety. Other programs of this area, particularly those for environmental sanitation, food and nutrition, tropical diseases, maternal and child health, and epidemiology, also cooperate in food protection and safety efforts as part of PAHO's interprogrammatic work.

The Veterinary Public Health Program has two regional advisers, one stationed in Washington, D.C., who acts as focal point for food protection and safety activities, and the other in Brasilia, Brazil. HPV also has international consultants in Barbados, Colombia, Ecuador, Guatemala, Mexico, Peru, and Venezuela, all of whom have received special training in food protection and safety.

The HPV program also has three consultants in food safety attached to its Pan American Zoonosis Center (CEPANZO), which operates as the reference center for food microbiology in Latin America. One of these consultants is stationed at the center's headquarters in Buenos Aires, Argentina, and the other two are in Brazil--one in Brasilia and the other in Pedro Leopoldo in the state of Minas Gerais. In the near future a specialist in chemical analysis will be hired for the Residues Laboratory (heavy metals, drugs) of CEPANZO. PAHO also has professional staff at the United Laboratory for Control of Foods (LUCAM) in Guatemala, where work is being carried out especially on pesticide and hormone residues.

The food safety, hygiene, and protection activities developed by PAHO may be divided into two broad stages. In the first, efforts have been centered on developing training activities, in strengthening food control laboratories, in promoting studies for the preparation of programs, in carrying out and promoting research and surveys on contamination of foods, and in cooperating in the preparation of food legislation instruments.

Among the outstanding activities in this first stage have been the preparation, with the cooperation of the Adolfo Lutz Institute of São Paulo, Brazil, of the Sanitary Food Standards for Central America and Panama (also consulted by several South American countries); the establishment of the United Laboratory for Control of Foods (LUCA) in Guatemala City, with the cooperation of the government of Guatemala and the United Nations Development Program (UNDP) (this laboratory also functions actively in the control of drugs, and has changed its name to LUCAM); and, with the cooperation of the School of Public Health of the Ministry of Public Health of Venezuela, the establishment of a training center for food inspectors in Caracas (this center, after intense activity, moved its operations in the School of Public Health in Medellín, University of Antioquía, Colombia).

Also important has been the establishment of the Food Microbiology Unit in the Pan American Zoonosis Center in Buenos Aires, Argentina. During the first stage, the fundamental activities of these laboratories have included training, performing research, and giving technical cooperation to the member countries.

CEPANZO has particularly distinguished itself in providing individual and collective training in (1) microbiological analysis of foods and clinical specimens on the occasion of outbreaks, as well as of environmental samples (surfaces); (2) the methodology of research and prevention of foodborne diseases; and (3) the inspection of foods. In a report prepared on a timely basis (Quevedo, 1975), it was indicated that from 1969 to 1975 alone 63 fellows from 18 countries had received individual training in food microbiology at CEPANZO; they represented a total of 382 fellow/months, with an average of 7.2 months per fellow and an average of 8 individually trained fellows per year. During that period the center had organized or had participated in the teaching of 31 national courses and 16 international courses that were taken by more than 1,400 professionals. A report being prepared on the training given from 1976 to 1985 shows that the figures for this period amply surpass those of the previous period.

In the area of research, CEPANZO has coordinated or motivated researchers who have carried out studies and surveys on the presence of pathogenic microorganisms or indicators in various kinds of foods, on the alteration of various foods, and on the development of new analytical techniques or control methods. It has conducted research on the origin of outbreaks of foodborne diseases in humans and in animals.

CEPANZO has provided direct technical cooperation to Pan American countries for the development, organization, and quality control of food analysis laboratories; for the preparation and application of programs to improve teaching and training in food microbiology and hygiene; and for emergency situations caused by outbreaks of foodborne diseases. It has also published, in addition to the results of its research, a great quantity of manuals, guidelines for analyses, and printed reference material for courses. In addition, it has prepared and distributed biological reference material for use in national food control laboratories.

During the first stage of its food safety and protection activities, PAHO has been involved in the organization, development, and preparation of numerous seminars, meetings, and programs. These activities have included the organization of seminars on Control of Drugs and Foods for Central America and Panama; the organization and development of the Inter-American Conference on Toxi-infections of Food Origin, held in 1974 in Guatemala, and the publication of the conference proceedings; the organization and development of the technical discussions of the 28th Meeting of the Directing Council of PAHO, at which the central topic was the sanitary control of foods; and in cooperation with the Caribbean community (CARICOM) and the Food and Agriculture Organization (FAO), the organization of the Conference on Food Safety and Control in the Caribbean.

PAHO also cooperated with Colombia in the preparation of its National Food Safety Program and in the organization of its laboratory network for food control; with Argentina, Costa Rica, and El Salvador in the preparation of the documents for their national food protection programs; and with the Codex Alimentarius Commission (CAC) in its activities, and especially with the Coordinating Committee of the Codex for Latin America and the Caribbean (CCCLA). Documents on activities in food safety developed recently by PAHO were prepared for presentation at the last two meetings of CCCLA in 1984 and 1985 (PAHO, 1984, 1985).

An activity of great importance developed in 1985 by PAHO, in cooperation with FAO and with the support of the government of Peru, was the workshop on foods sold by street vendors, took place in Lima from 21 to 25 October at the Pan American Center for Sanitary Engineering and Environmental Sciences (CEPIS) headquarters.

Also important has been PAHO's cooperation in organizing the Commission on Veterinary Inspection of Meats of the Southern Zone (CINVECC), made up of representatives of Argentina, Brazil, Paraguay, and Uruguay; CEPANZO acts as the ex-officio secretariat of CINVECC.

Finally, PAHO has carried out studies on the application of the Hazard Analysis Critical Control Points (HACCP) in the domestic preparation of foods in rural and semirural homes in Peru (Lima, Puno, Loreto).

The second stage of PAHO's food safety, hygiene, and protection activities entails review of the Plan of Action to be developed in 1986. The general methods to be employed under the plan are those established by an HPV health programs development document. These methods include mobilization of national resources to guarantee that the programs have permanent effects; the establishment of networks of centers (which produce very good results, according to the experience of PAHO); the establishment of food quality standards through the formulation of guidelines; the establishment of mechanisms to evaluate new technologies; the development of indicators to follow closely the progress achieved; the dissemination of information; consultations and direct technical cooperation; training and education; and promotion of technical and economic cooperation among countries. Finally, and in accord with the policy of PAHO, the research required will be promoted.

To attain the broad objectives of food safety, the Plan of Action calls for PAHO to cooperate with each country of the region, so that by 1990 each will have a national food safety program under way. Whenever possible, these programs will function with the advisory services and participation of an interministerial committee and with representation from the industrial sector.

The broad fields of activity incorporated in the Plan of Action are the planning, formulation of policies, organization, and administration of national food safety programs (including interministerial coordination and registration of foods and food establishments); the development and strengthening of inspection services (including regional inspection networks); the development and strengthening of analytical services (including the census and evaluation of food analysis laboratories, the establishment of national networks and of a regional network of food analysis laboratories, and the quality control of laboratories); promotion of food legislation and food safety information systems; surveillance (epidemiology) of foodborne diseases; and collaboration with the Codex Alimentarius Commission and the CCCLA.

These activities are to be coordinated with those of the FAO and other international organizations, and will have the joint participation of the U.S. Food and Drug Administration (with which a special agreement is being made) and the U.S. Department of Agriculture. Naturally, these efforts will be coordinated with the Food Safety Unit of the World Health Organization. It is also hoped that backing will be obtained from the governmental agencies of Canada, as well as from the international financing agencies and the food industry.

REFERENCES

PAHO (Pan American Health Organization). 1984. Report on the activities of the Pan American Sanitary Bureau (PAHO/WHO) on Food Protection/Food Safety. Codex Alimentarius Commission. Pp. 12-15 in Report of the Third Session of the Codex Coordinating Committee for Latin America. Alinorm 85/36, Havana, Cuba, 27 March - 2 April, 1984.

PAHO (Pan American Health Organization). 1985. Report on the activities of the Pan American Sanitary Bureau/Regional Office of the World Health Organization related to the work of the Codex

Alimentarius Commission. Presented at the Fourth Session of the Codex Coordinating Committee for Latin America and the Caribbean. DOC. CX/LA 85/3 Add 1. Havana, Cuba, 17-22 April, 1985.

Quevedo, F. 1975. Teaching activities of the Pan American Zoonoses Center for the improvement of food hygiene programs in Latin America. BGA/FAO/WHO Consultation on Post-Graduate Training in Food Microbiology. Background Paper No. 9. Berlin, Federal Republic of Germany, 11-13 November, 1975.

Activities of the Food and Agriculture Organization in the Area of Food Control

R. J. DAWSON

The Food and Agriculture Organization (FAO) of the United Nations was established 40 years ago by nations determined to promote the common welfare among them by raising levels of nutrition and standards of living of their people, by securing improvements in the efficiency of production and distribution of all food and agricultural products, and by bettering the condition of rural populations.

The functions of the organization include promoting and, where appropriate, recommending specific actions directed at conservation of national resources, and the improvement of methods of agricultural production, of processing, marketing, and distribution of food and agricultural products, and of education and administration relating to nutrition, food, and agriculture. It is also the function of FAO to provide such technical assistance as governments may request.

Within FAO's overall mandate regarding production, distribution, marketing, and nutritional improvement of food, the necessity of providing a safe, wholesome, and nutritious food supply and the protection of this supply from losses, waste, deterioration, contamination, and adulteration is implicit. FAO has therefore developed programs to assist governments in orienting their national policies and programs to include nutrition improvement and food protection as specific objectives. Food control is an integrated part of these programs, and governments are becoming increasingly aware of the need to strengthen their food control, contamination monitoring, and surveillance systems; many have called upon FAO to provide technical assistance in these areas.

In FAO, the responsibility for activities to ensure quality and safety of food supplies and consumer protection is largely concentrated in the Economic and Social Department, and more specifically in the department's Food Policy and Nutrition Division. The Food Policy and Nutrition Division carries out FAO's programs in relation to the ensurance of quality and safety of foods for consumer protection. The multidisciplinary nature of the work is borne out by the fact that it is performed in a division that also deals with problems of nutrition assessment and with community nutrition programs. Work devoted to the prevention of food losses in postharvest handling and storage is carried out largely within the Agriculture and Fisheries departments of FAO. There is close liaison among departments and cooperation in the various activities.

The Food Quality and Standards Service, where FAO's activities in the field of food control are concentrated, is divided into two groups: the Food Standards Group, which provides the secretariat for the Codex Alimentarius Commission of the Joint FAO/World Health Organization (WHO) Food Standards Programs, and the Food Quality and Consumer Protection Group, which provides scientific and technical support to the Codex Alimentarius Commission and helps developing countries to establish food standards. The principal work of the Food Quality and Consumer Protection Group is to assist countries in the development of coherent national strategies for food control, including the drafting of up-to-date food laws and regulations, the strengthening of laboratories, technical facilities, and inspection and administrative services, and the creation of national action programs for the improvement of food handling practices at all levels of the food chain--even within small villages and households. In Latin America and the Caribbean special problems arising from rapid and extensive urbanization are receiving attention, and will continue to be studied within the framework of the food control and consumer protection programs.

Food control programs and projects at the country level are aimed at strengthening the ability of governments to ensure the safety and wholesomeness of the food supply, and to protect the consumer against health hazards and economic fraud. Through these programs, FAO provides technical assistance in aspects of food law and food law administration, both chemical and microbiological laboratory services, strengthening of the inspection services, and improved export inspection and quality control programs that protect national food supplies and promote trade opportunities. Considerable emphasis is placed upon training national personnel and on the preparation of training aids, as well as the publication of guidelines for food control services, laboratory and inspection manuals, and specialized documents on specific problems such as mycotoxins.

In its programs FAO has developed a special working relationship with WHO; many of the activities mentioned by the WHO report above are carried out within the framework of joint FAO/WHO programs. In special activities devoted to the protection of urban food supplies in Latin America and the Caribbean, FAO cooperates with the Pan American Health Organization (PAHO). FAO also liaises closely with many other agencies of the United Nations.

Among the highlights of FAO's activities in the Americas Region are the following:

Food Control Infrastructures: Reviews

Reviews of national food control infrastructures in the Region, entailing recommendations for improvement, have been carried out in Barbados, Bolivia, Guyana, Jamaica, Paraguay, Peru, Saint Lucia, Trinidad and Tobago, and Uruguay. A review will take place shortly in Costa Rica.

Food Control Strategy Workshops

Workshops conducted at both national and subregional levels have been held to consider, at a policy level, problems of food quality and safety and of food supplies and consumer protection. The workshops sought to determine strategies that would ensure development of better food quality control systems, voluntary or mandatory, which would cover the entire food production, processing, and distribution chain. Appropriate follow-up actions are being pursued. Workshops have so far been held in Mexico, Uruguay, Peru, and, jointly with the PAHO and the Caribbean Community (CARICOM), the Caribbean subregion.

Food Contamination Monitoring: Training

The training of personnel in proper laboratory methodology for analysis for food contaminants (pesticides, heavy metals, and mycotoxins) has been carried out at the global, regional, subregional, and national levels. At the global level participants from the Latin American and Caribbean Region have attended the FAO/United Nations Environment Program (UNEP) courses on International Training for Control of Environmental Contaminants in Food (Mysore, India; four courses), and Training Courses on Food Contamination with Special Reference to Mycotoxins (USSR; two courses).

At the regional level, FAO has sponsored the Training Course on Food Contamination Control in Latin America, held in Mexico, and the Latin American Course of Pesticide Residues Analysis in Foods, held in São Paulo, Brazil. At the subregional level, a Central American Training Course in Food Contaminants (mycotoxin analysis) was held in Guatemala from August 19 to 30, 1985. At the national level, food analysis training programs have been conducted with FAO assistance in Argentina, Dominica, and Uruguay.

Strengthening Food Control Programs at the National Level

Various FAO technical cooperation programs provide advice on drafting or updating comprehensive food laws and regulations; assistance on improvement of food inspection and analysis programs and facilities; training of functionaries engaged in food control activities; and promotion of food quality control in the food production and distribution chain. Training is a high-priority activity. Projects both ongoing or recently completed include:

o Argentina	Food contamination monitoring
o Chile	Quality control of goat cheese
o Colombia	Food control in vegetable markets
o Costa Rica	Strengthening food control and food contamination monitoring activities
o Cuba	Improving quality control of milk and food contamination monitoring
o Dominica	Strengthening of national food and water contamination monitoring program
o Ecuador	Strengthening food legislation
o Peru	Food contamination monitoring
o Uruguay	Upgrading of national meat quality control program and control of contaminants in vegetable products

Street Foods: Safety Reviews

FAO assistance projects are being conducted to review and ascertain the quality and safety of street foods in order to determine what action, if any, should be taken to improve the current situation. Reviews are being conducted in Guatemala, Honduras, and Colombia. In addition, FAO and PAHO sponsored a joint workshop on street foods, held in Lima, Peru, in October 1985; the situation was reviewed, and action was recommended to improve current practices.

Urbanization: Review of Problems of Food Control

Rapidly growing urban populations are placing new and greater demands on food transportation and distribution systems, which often lead to shipment of foods over longer distances and therefore to increased problems of food spoilage, decomposition, and both chemical and microbiological contamination. In 1984, FAO engaged a consultant who reviewed this complex situation in São

Paulo, Caracas, and Kingston, and made recommendations for improvement. This important subject was discussed at the third (1984) and fourth (1985) sessions of the Codex Committee for Latin America and the Caribbean, which has given it high priority and has asked international organizations to continue to support workshops and seminars on this subject. FAO plans to convene an expert committee in the biennium 1986-1987 to review from a global viewpoint the food control problems associated with urbanization and to make recommendations for attacking those problems.

These projects that FAO has operated over the past few years demonstrate that FAO has an active program in the Americas. However, it must be noted that the mechanism for seeking technical cooperation from international agencies includes, as the foremost criterion, the priority that a national government attaches to the particular program area. The means for assistance at the international level are limited, and are always directed toward the priority concerns of member governments, including those that are expressed before the governing bodies of the international organizations concerned. In addition, requests for assistance must come from the concerned governments.

It is hoped that the recommendations of this Conference will provide additional scope for greater cooperation between FAO and PAHO in their programs to assist member governments, while at the same time avoiding wasteful duplication.

Activities of International Agencies in Food Protection

DISCUSSION SUMMARY

Representatives from the Food and Agriculture Organization (FAO) of the United Nations and the Pan American Health Organization (PAHO) stressed the fact that their resources are limited and that governments must assign high priority to food control when making requests to the agencies for assistance.

The following informational items and recommendations emerged during the discussion that followed the presentations.

- PAHO is developing a course in food protection management. Teaching manuals should be available in 1986.

- FAO has recently initiated activities pertaining to food handling at rural and household levels. These should assist countries in providing improved protection of the food supply beyond the major urban centers.

- There is a need for continuity where food control decisions are concerned. In particular, when workshops on food control and standardization are held on a regular basis, every effort should be made to assure a continuity of approach to specific problems.

- There is a need to emphasize and coordinate educational programs within diverse food protection activities. Consumer education programs were identified as deserving particular emphasis.

- Countries are urged to implement resolutions and recommendations arising from conferences such as the Inter-American Conference on Food Protection.

Food Protection Activities of the Nations: A Summary of Country Reports

Thirty-two countries presented reports covering diverse aspects of food production and control. In their reports several countries--especially Canada and the United States--indicated that they are prepared to provide assistance to other countries in matters pertaining to food protection and control. Among the specific problems recorded in the reports, the following stand out by virtue of the frequency and intensity with which they were cited:

o All delegates noted their countries' concerns for assuring the safety of foods, both those consumed within their countries and those destined for export. Nevertheless, most countries perceive the pressing need to improve their systems for food protection and control.

o In all countries a large number of agencies are involved in food safety and control, but there are no effective internal mechanisms for coordination.

o Generally, the country delegates reported the existence of laws and standards applicable to diverse sectors and relating to food protection and control. At times, these are inconsistent and make effective application difficult.

o In the countries of Latin America and the Caribbean, the shortage of laboratory facilities, equipment, and reagents is widespread. Even where the infrastructure is good, the laboratories do not function adequately. Help is needed for planning, operating, and maintaining laboratories and for establishing international reference laboratories.

- The countries indicated that food inspection services present many difficulties, especially where there are shortages of adequately trained personnel, insufficient economic resources, shortages of needed equipment, and lack of good operating manuals.

- All countries expressed the need to strengthen the education and training of professional, technical, and auxiliary personnel in the fields of food safety and control.

- Most countries expressed the need to develop educational programs about the importance of food quality and safety for health to be directed at the general public and especially at food producers and handlers.

- In some countries food handlers, particularly street vendors, are not controlled. The majority of countries expressed a need to strengthen programs to control food handlers.

- Surveillance, recording, and control of foodborne diseases are poorly developed in all countries of the Region. The countries recognize the urgent need to strengthen these activities.

- More and better data on foods are needed on both domestic and international levels. International assistance is needed to develop a system that will permit improvement of the collection, analysis, and distribution of data for the implementation of disease surveillance and control programs.

SESSION 4
Recommendations for Improved Inter-American Food Protection

WORKING GROUP ON
Legislative and Infrastructural Needs for Food Control

REPORT AND RECOMMENDATIONS

The Working Group on Legislative and Infrastructural Needs for Food Control, considering in detail background papers, discussions at the conference, and reports from individual countries, noted widespread concern about the inadequacy of current national or local food laws, lack of sufficient trained technical and managerial personnel, the need for application of high standards for foods, and the need to develop enhanced national commitment to effective food control. The need for improved information collection and dissemination at international and national levels was discussed, as was the importance of improved monitoring programs.

The working group recommended that:

o Countries should update or unify national food laws, with assistance as needed from the Pan American Health Organization (PAHO) and the Food and Agriculture Organization (FAO). Interministerial cooperation, avoidance of duplication, and clear definition of ministerial responsibility are essential aims. The FAO/World Health Organization (WHO) model food law is a good guide to follow, with necessary adaptation being made to the needs of the country involved. Appropriate attention should be paid to complementary laws relating to labeling, food production, animal health, and so on.

o To increase national commitments to effective food control, research is required on the health impact of foodborne diseases and the economic gains from food control, including decreased food wastage, easier access to export markets, and decreased loss of export sales when foods meet required standards. The results of this research should be distributed to national governments.

o Countries should accept and apply the Codex Alimentarius standards for foods, including the Code of Hygienic Practices and other codes, as rapidly and completely as possible. In instances where international standards cannot be fully implemented at present, harmonization of food standards at the regional level may be of considerable value. The Regional Coordinating Committee of Codex for Latin America and the Caribbean should play a major role in this work, with assistance by PAHO and FAO provided to countries as required.

o Existing international systems for information exchange should be strengthened to provide a broad variety of needed information to countries of the Region. This would include, inter alia, information on legislation and regulatory changes in various countries, on Codex Alimentarius, on research findings, on product recalls and market rejections, and on analytical methods and inspection procedures.

o Information sharing systems should be strengthened to prevent duplication of efforts (such strengthened systems are being currently promoted through the Regional Codex Coordinating Committee for Latin America and the Caribbean). Interdisciplinary and interministerial national Codex committees should be established or strengthened as necessary, along with appropriate mechanisms to ensure proper dissemination of information about Codex matters among and within national agencies, industry, and consumer organizations.

o Since one obstacle to infrastructural development is the lack of trained technical, managerial, and legal personnel, international efforts should be intensified to provide training for food inspectors, analysts, and other food protection personnel, including administrators, lawyers, and policy analysts.

o National monitoring, field surveillance, and sampling programs should be strengthened as required. PAHO and FAO should sponsor research on simple, rapid screening methods for contaminants in foods. In the spirit of cooperation among countries of the Region, importing countries should promptly communicate information on product rejections to national authorities in exporting countries, and provide appropriate information to exporting countries as requested.

o Regional analytical centers should be considered when the individual needs of countries do not justify each having its own analytical facilities. The establishment and maintenance of these regional centers, which should be certified as such by PAHO, would require close intercountry cooperation. Close attention would need to be paid to the legal implications of establishing the centers.

WORKING GROUP ON

Food Inspection, Monitoring, and Enforcement

REPORT AND RECOMMENDATIONS

OBJECTIVE

The objective of the working group was to recommend actions for establishing an effective system for the implementation of national food laws and regulations, taking into account regional needs and national similarities and differences with respect to the inspection, monitoring, and enforcement of national food control and protection programs.

INSPECTION

Inspection is described as the function carried out by an individual who is considered to be the "eyes and ears" of a food control agency, with the purpose of recognizing, collecting, and transmitting evidence. An effective food control infrastructure must be provided for the sampling of food and the inspection of both the products and the premises where they are prepared, packaged, stored, or held for sale. It is the general consensus of the working group that many differences exist in the inspection systems of the countries of the Americas Region, that there is a major need for the technical training of inspectors, and that inspectors must be provided with sampling and inspection equipment, as well as with transportation. Because of the differences in inspection systems, the group felt that uniform training of staff should be provided throughout the Region.

The convenience of having uniform criteria for the standards and regulations that govern food program inspections was seen as an important concern, for international trade in food would be greatly enhanced by the existence of a single standard of inspection. Therefore the working group recommends that such a standard be developed under the aegis of the Codex Alimentarius Commission.

The working group recognized that in order to recruit and retain a competent work force of regulatory officials, including inspectors, it is essential that they be appropriately compensated, given their value to society.

During discussions of inspection, the group recognized that there is a need for the proper utilization of the food control resources that already exist within a country. As a result of petty jealousies or a lack of cooperation, or both, such resources can be wasted. The working group thus recommends that the specialized human and material resources of the public agencies and universities within a country should be fully utilized in ways that avoid unnecessary duplication of efforts. In addition, countries should strive toward subregional and regional cooperation, providing one another with advice, information, and assistance in food control matters.

It was also recognized that communication between the food inspector and the food analyst must be established and maintained in order to effectively, efficiently, and economically resolve food protection issues.

MONITORING

For a food monitoring program to be effective, the working group realized that in addition to having food inspection services it is essential to have adequate laboratory facilities staffed with competent analytical chemists, microbiologists, technicians, and support personnel. Recognizing also that uniform procedures and methods must be followed when food is analyzed, the working group recommends that such standardized methods be adopted. Following from these insights, the working group recommends as well that subregional training programs be established for food microbiologists and food chemists and that such programs include training in first-echelon repairs of equipment.

ENFORCEMENT

The working group recognized that an effective food control system must be based on adequate food laws. Most countries reported that they have adequate legal provisions to control the quality of food and to support enforcement actions when food is found not to be in compliance with the law.

Enforcement procedures, however, can be hampered by cultural practices that impede full implementation of the law. Governments should be encouraged to make visible their commitment to safe and nutritious food as a high national priority, thereby displaying their full support for appropriate food control, protection, and enforcement actions.

In discussing the application of national food laws to international shipments, the working group deplored the practice of shipping from one country to another, without proper notification, food products that are not in compliance with the laws of one of the two countries. It, therefore, recommends that a mechanism be found to alert the Region's countries to such shipments in a timely manner.

NEED FOR UNIFORM TERMINOLOGY

During the group's discussions it became apparent that there is a need to define the terms being used in food control and protection matters. As a consequence, the working group recommends that a glossary of terms be developed for acceptance and subsequent use in the Region.

ACTIONS RECOMMENDED

In summarizing its recommendations, the Working Group on Food Inspection, Monitoring, and Enforcement proposes that actions be taken in the following areas:

- Commitment: Governments should be encouraged to give full support to the establishment and enforcement of effective national food control and protection systems.

- Resources: Adequate funds, personnel, facilities, and equipment must be provided on a coordinated basis to ensure the effective implementation of national food control systems.

- Cooperation: Interregional, subregional, and internal national cooperation and coordination in food protection measures must be established.

- Training: Adequate training programs for inspectors, food analysts, and management personnel should be established on a subregional basis, and should utilize existing facilities and assistance from international agencies.

- Enforcement: Uniform laws, regulations, standards, inspection services, and analytical methods must be established.

Improved Food Handling and Good Manufacturing Practices

RUSSELL J. MARINO and PAUL E. KIFER

There is a need to improve food handling and to ensure good manufacturing practices by food processors in the Western Hemisphere to facilitate the export and import of food products. Toward that end, there must be an increased awareness of the advantages of using in-process controls to reduce the possibility of foodborne illness and related hazards.

No country has been able to eliminate either the hazard of foodborne illnesses or the practice of misrepresentation of products. However, the development and adoption of improved handling methods, the observance of Good Manufacturing Practices (GMP), and the continual improvement of in-process control systems operated by trained and conscientious employees have enhanced the general perception by consumers in many countries of the quality and safety of the food supply.

If food products are to move freely in commerce among the nations of the Western Hemisphere, producing and consuming nations must be aware of, promote the use of, and provide systems for the monitoring and inspection of food handling and processing systems. A succint summary of the goals and the needs is given in Table 1.

Table 1 Summary of Improved Food Handling and Good Manufacturing Practices

Goal	Objectives	Identifiable Hazards	Baseline Information Required	Subsequent Action Needed
Adoption of improved food handling and manufacturing practices to facilitate export-import of food products	Increase awareness of food-oriented hazards	Foodborne illness	Identify extent of hazard	Review of food processing industry's "state of the art" by expert teams
	Increase awareness of advantages of appropriate in-process control systems	Environmental contamination	Qualify circumstances relating to occurrence	Development of recommendations for industry actions
	Describe appropriate educational programs	Food chemicals	Quantify data collected	Obtaining government assistance and approval
	Enhance industry-government cooperation	Natural toxicants	Summarize information	Development and application of appropriate educational programs programs
		Improper nutrition	Publicize with industry and government where appropriate	Adoption of appropriate quality assurance systems
				Adoption of good manufacturing practices

HEALTH HAZARDS IN PERSPECTIVE

Considerations for strengthening and expanding food protection systems in the Western Hemisphere require coordinated efforts on an international scale. Such efforts rely heavily on optimal communications among participating nations in matters relating to the critical issues of food safety. Unfortunately, there is a paucity of the necessary communication systems in existence; the more critical hazards associated with foods internationally are therefore difficult to place in proper perspective.

In the United States, for example, surveillance and reporting systems for foodborne disease outbreaks are less than adequate, and serious shortcomings exist (APHA, 1972; Bryan, 1980; Hauschild and Bryan, 1980; NRC, 1964, 1969). Although the United States might be considered one of the leaders in this regard, health hazards associated with the U.S. food supply in all probability are consistent with those in other Western Hemisphere countries. Such hazards in the United States have been categorized as foodborne illnesses, environmental contaminants, food chemicals, and natural toxicants; these are discussed in detail below.

Foodborne Illness

Foodborne illness results from contamination of food with bacteria, chemicals, parasites, and viruses. The statistics available for the United States indicate that bacterial contamination is the most common, and that known and reported outbreaks account for 2 to 3 times as many incidents as chemicals, parasites, and viruses combined. Surveillance systems in the United States are generally conceded to be incomplete, and only a small proportion of the incidences are reported. Estimates of the actual number of cases of foodborne illness of microbial origin in the United States in an average year vary from 2 million to 10 million. A more complete review of foodborne infections and intoxications can be found in the literature (NRC, 1975; Riemann and Bryan, 1979).

Needed to confront problems of foodborne illness are appropriate education and training of management, employees, and consumers regarding food preparation and handling; meaningful and realistic microbiological criteria; meaningful surveillance, reporting, and food protection systems; procedures for early and rapid identification of foodborne pathogens and spoilage organisms; and effective and reliable methods for the safe disposition or salvage of contaminated foods.

Environmental Contaminants

Environmental contaminants become a potential risk in foods when they are introduced--usually through contaminated ingredients or as a result of accidental contamination--during food processing, storage, distribution, and retailing. Generally speaking, in the United States these contaminants are chemicals, foreign materials (e.g., glass, metal, stones), and biological agents. Environmental contaminants represent a special problem in that many of the health hazards in this category (cadmium, DDT) become persistent contaminants once they are introduced into the food supply.

Pesticides and herbicides, in particular, differ widely in their persistence in the environment and in their potential toxicity to humans. Because of these factors, and because even under the best agricultural practices some residues persist on the crops treated, the use of pesticides and herbicides in countries such as the United States is carefully regulated, and tolerances are established for the presence of residues.

Of greater concern is contamination of the food chain with an industrial chemical that is both persistent and toxic. Examples include repeated incidents of contamination by polychlorinated biphenyls, and widespread contamination in Michigan as a result of the accidental inclusion of polybrominated biphenyls in animal feeds. The concern that such contaminants may introduce persistent carcinogens or mutagens into the food chain is valid. In most instances, industrial chemicals, because they are not expected to enter the food chain, have not been thoroughly tested for potential hazards to humans.

Needed are extensive educational efforts to ensure that hazards resulting from the misuse of agricultural chemicals (pesticides and herbicides) in food crop production are recognized; educational efforts to ensure that hazards resulting from the misuse of sanitation and pest control compounds in food processing operations are recognized; educational efforts to ensure that users of industrial chemicals recognize the potential for introducing a human health hazard into the environment; and systems for monitoring the disposal or disappearance of industrial chemicals.

Food Chemicals

Food chemicals continue to be regarded as potential threats, in spite of rigorous testing and approval procedures required by most food control authorities. Regulations for use of these food additives provide a high degree of protection against misuse when based on testing with laboratory animals or, in some instances, on a long history of safe use. On the other hand, individual responses vary, and as a result, exceptional cases are often cited to question the overall safety of some compounds approved for food use.

Needed are appropriate research before approval of new food chemicals; reevaluation, as new research develops, of existing approved food chemicals; a recognized agency, competently staffed, with responsibility for approving and monitoring the use of food chemicals; and systematic monitoring of human exposure to food chemicals and resulting health consequences.

Natural Toxicants

Natural toxicants are considered to be potential hazards of natural origin, and may also be biological or chemical in origin. Examples of the former would include mycotoxins or estrogen-like compounds produced in moldy corn. Those of chemical origin include glycoalkaloids and goitrogens that occur naturally, generally in foods of vegetable origin and rarely in foods of animal origin.

Needed are more information on the role and significance of natural toxicants in food safety; methods for the detection and identification of natural toxicants; more effective educational programs for consumers; better understanding of the effects of food processing systems, storage, and distribution on nutrient retention; and better understanding of the importance of maintaining the nutritional value of foods.

Product Quality and Safety Assurance: In-Process Controls

Food manufacturing, handling, and distributing systems, as well as food products, were not very complex in the past, and the acceptable approach to assure safety and quality was to sample only the finished product. The effects that other factors (e.g., the environment, ingredients, manufacturing processes, sanitation, personnel hygienic practices) may have upon product safety and quality generally were given scant attention. In most instances, it was difficult to use these early methods to address the issue of cause and effect, and as a consequence, there was a high probability that identical product problems would occur on a continuing basis.

As newer approaches to food safety and quality were investigated, inspection of facilities and operations, as well as finished-product testing, became routine control efforts in industry and regulatory agencies. U. S. regulatory agencies, in particular, have relied heavily on these approaches to assess adherence to good manufacturing practices. However, when used alone, whether for industrial or regulatory purposes, each of these control options has serious shortcomings, and as a result the desirable level of product quality and safety control can be difficult to achieve.

In today's food business environment, the approaches just named cannot be relied upon to assure, with a reasonable degree of confidence, the safety and quality of the food supply. Systems for manufacturing, handling, and distributing food products have become increasingly larger, more sophisticated, and complex. Transportation systems are much faster. Product distributions are made to much greater geographic areas than in previous decades. Even food products themselves have become more complex; for example, product formulations have been modified in order to reduce preparation time for the homemaker, and food additives are routinely used to improve product functionality and product shelf life, among other things. As a result of these factors, should problems arise, greater quantities of food products and wider geographic areas can be affected than in the past.

As product and process complexity increases, safety hazards and quality problems also tend to increase. Concurrent with increasing complexity have been rapid advances in technology utilized for the detection and identification of undesirable elements in the food supply. Consequently, the food quality and safety control systems employed must be expanded in order to keep abreast of these newer challenges. However, finished product examinations continue to serve limited useful purposes, such as detection of *Salmonella* in certain high-risk foods, assuring adherence to purchase specifications, product salvage, and determining acceptability of imported products.

To meet newer demands, the concept of total quality assurance has emerged (Juran et al., 1979). In the food industry this concept places major emphasis on the critical factors within the manufacturing, handling, and distributing systems that have the greatest influence on the quality and safety of products. On-site, in-process controls are emphasized and considered, such as on-line analytical observations, adherence to process specifications and procedures, ingredient selection, equipment sanitation and cleanliness, and package integrity. These controls are important vehicles that not only identify changes beyond those that would normally be expected but also pinpoint when and where changes occur, thereby assisting in the determination of cause and effect.

More important, such controls generally uncover undesirable trends before an unacceptable product is encountered. In-process controls can provide immediate information for prompt action: corrective measures can be initiated within the shortest time possible in order to prevent the continuing manufacture of a defective product. Provided is a greater degree of confidence that desirable quality and safety attributes are being attained on a consistent and continuing basis.

Meaningful and realistic in-process controls, when effectively applied, will assist in:

o assuring product and process specification compliance

- identifying substandard ingredients
- identifying troublesome suppliers
- process evaluation, particularly for the establishment and monitoring of critical control points and the identification of operational problem areas
- product evaluation (i.e., in-process materials and finished products)
- identifying environmental problem areas (e.g., unsanitary equipment, adverse product flows, adverse ventilation)
- determining analytical trends in ingredients, processes, and finished products
- assessing regulatory compliance (when applied to inspectional findings)
- identifying storage and distribution problem areas

Critical to the success of an in-process control program is the development and establishment of uniform product guidelines for quality. Such guidelines are not to be confused with food quality standards, which generally are dictated by governmental agencies. Guidelines should be brought into line with standards so that the final product conforms to the national requirement.

Hazard Analysis and Critical Control Points

Within recent years a modified approach to assuring food safety through in-process controls has been developed and accepted. In 1971, at the National Conference on Food Protection sponsored by the American Public Health Association (APHA), the Hazard Analysis and Critical Control Point (HACCP) system was presented as a concept "to describe the location(s) or point(s) in a food processing operation at which failure to prevent contamination can be detected by laboratory tests with maximum assurance and efficiency" (APHA, 1972). The conference reported further that "it is more efficient to concentrate attention on the most vulnerable or critical steps rather than expend resources in making tests at noncritical points."

HACCP is more specific and critical in its approach to controlling hazards in foods than traditional quality control procedures, and as a consequence provides a greater degree of confidence that food safety and wholesomeness are achieved. HACCP, which is oriented primarily to the prevention of problems, abides by the premise that safe and acceptable food products will result from the systematic, rigid control of defined and established critical process parameters. Basically, the HACCP system identifies food hazards and their potential to enter the food chain, pinpoints where in the food chain hazards may enter or originate, sets up appropriate control procedures to prevent the entrance of hazards, and provides a continuous monitoring program to ensure that the controls function as anticipated. More comprehensive reviews of the general principles and elements of the HACCP system, as well as its applications, may be found in the literature (APHA, 1972; Bauman, 1974; ICMSF, 1981; Pillsbury Co., 1973).

HACCP systems for the control of food hazards have gained great popularity within the U.S. food industry, as evidenced by the many processors who have incorporated the elements of HACCP into their ongoing quality assurance programs. The success of these programs affirms that the HACCP approach to food safety can be effectively utilized in various sectors of the food industry--e.g., for frozen foods (Peterson and Gunnerson, 1974), canned foods (Ito, 1974), and food service operations (Bryan, 1981a,b). Although the HACCP Working Group on Improved Food Handling and Good Manufacturing Practices did not discuss the food service industry, food service operations are essentially food processing operations and major sources of foodborne illness. The HACCP principles discussed here are applicable (Bryan, 1979).

The World Health Organization (WHO) requested that the International Commission on Microbiological Specifications for Foods (ICMSF) investigate the feasibility of utilizing the HACCP concept for the control of microbiological hazards in foods in both developed and developing countries. An ICMSF committee appointed for this task subsequently reported that the HACCP concept is an effective and economical approach to food safety and quality in developing as well as developed countries. The committee concluded that "the HACCP concept is a desirable alternative to more traditional control options"; that "in comparison with other approaches," the HACCP "application will result in a better cost/benefit ratio"; and that HACCP "is a more systematic and logical approach to avoiding food hazards" (WHO/ICMSF, 1981).

EDUCATION AND TRAINING

Effective control of hazards in the food supply cannot be achieved without the total involvement and commitment of all people in the food industry. All individuals--management, professionals, employees, and the general public as well--can contribute significantly to programs or activities designed to control hazards.

To effectively achieve the desired level of control, appropriate education, training, and information systems must be made available to all involved. In addition, it is essential that management comprehend the need to assure the safety of the food supply, and that it has a complete commitment to this effort and to providing the necessary funds, facilities, and personnel to achieve the objective. The professionals who administer and execute the control programs must not only have technical competence in the appropriate scientific disciplines, but must also possess the ability to apply that knowledge in a meaningful and realistic manner, whether for regulatory or for industrial purposes. All employees who process, handle, store, distribute, and prepare foods, as well as their supervisors, must not only be knowledgeable about the potential hazards associated with their products and activities, but must also have a thorough understanding of the measures that can be taken to prevent those hazards from occurring (Bryan, 1978, 1981c).

Equally important is the continual updating of personnel education, training, and information systems, in order that ongoing food safety control programs may keep pace with changing technology, products, processes, and socioeconomic patterns. For example, the HACCP system requires implementation by knowledgeable people who have been adequately trained in this newer approach. The discovery of new hazards, including detection and control measures, as well as the knowledge gained from food safety research, must also be communicated through ongoing education and training programs. These programs should have at least a fourfold purpose: training of new employees, including on-the-job exposure; maintenance of professional competence; updating of technological knowledge; and development of personnel backstops for key positions.

Personnel training and education must be dynamic to effectively meet ever-changing needs. Most education and training efforts relating to food protection have been directed primarily to professional people. There is a need to provide all employees within the food industry with practical information that can be easily understood and applied to their areas of responsibility. Such training should also provide the understanding necessary for handling foods in a safe and sanitary manner (Bryan, 1980).

The general public should also be made aware that foods can be important sources of foodborne illnesses. Information relating to foodborne illnesses, to their prevention and control, and to good food hygiene practices must be communicated to the general public (Bryan, 1980).

GOOD MANUFACTURING PRACTICES

Good Manufacturing Practices (GMP) are accepted courses of action taken by responsible food processors during the preparing, processing, packing, or holding of foods. In some instances, GMPs are required by regulation (CFR, 1985, EMS, 1980). GMPs have been designed to assure that food for human consumption is safe and has been prepared, packed, and held under sanitary conditions. Effective quality assurance systems are an integral part of the GMP effort.

The generally accepted criteria for GMP cover, but are not necessarily limited to, the areas of personnel, plant grounds, plant construction and design, equipment, sanitary operations, process and controls, and water. These are discussed below.

Personnel

Certain standards and codes of hygienic practice should be established in order to prevent the spread of diseases not only among workers, but also from workers to the food processing area and the food itself. Certain personal grooming practices, if not effected properly, can contribute to the contamination of foods by undesirable agents (e.g., hair, bits of clothing, jewelry, and other foreign materials).

Plant Grounds

The design and construction of plant facilities, as well as the proper maintenance of surrounding ground areas, are important considerations in preventing the contamination of food through unsanitary conditions and through cross contamination during processing. Consideration should be given to storage of equipment, disposal of waste and refuse, grounds maintenance (weed control, lawn maintenance), appropriate and adequate drainage, and appropriate and adequate paving of grounds or roads.

Plant Construction and Design

The design and construction of plant facilities should take into consideration the appropriate size of facilities and work areas in order to prevent employee and equipment congestion. Appropriate construction materials should be used so that facilities may be adequately cleaned and maintained, and the layout of facilities should enhance process flow and prevent cross contamination of in-process materials and finished products. Lighting (light fixtures, bulbs, skylights) should be adequate and of the safety type to prevent contamination of food products with glass in case of breakage. There should be appropriate protection against animal and insect pests and adequate ventilation to minimize or eliminate odors and to prevent condensation.

Equipment

Criteria must be established for the design and installation of equipment to prevent the adulteration of foods with contaminants such as lubricants, fuel, material fragments, and impure water. Equipment should be fabricated from appropriate materials to facilitate cleaning and maintain sanitary conditions. Food contact surfaces must be constructed of materials that assure that deleterious agents do not leach into foods.

Sanitary Operations

General criteria should be established for building and equipment maintenance to assure appropriate control of animals and vermin. The sanitation of equipment and utensils is also an important consideration. In this regard, established cleaning and sanitation programs should be in effect and executed on a daily basis, or more often if needed.

Also important for sanitary operations is the use of an acceptable water supply (see "Water", below). Adequate and readily accessible hand-washing facilities must be provided in the plant for all employees who handle unprotected packing materials and food contact surfaces. Such facilities should be equipped with control valves that are activated other than by hand to minimize or prevent recontamination of employees' hands. Appropriate and timely waste and rubbish control are essential at all times.

Process and Controls

All operations in the manufacturing process should be conducted in a manner consistent with recognized sanitary practices. Adherence to strict time and temperature standards is mandatory. Abuses of these standards must not be permitted.

Meaningful and effective quality control and food protection systems, staffed by qualified and competent people, should be in effect at all times to assure that all reasonable precautions have been taken to protect all food from being contaminated with harmful agents. These systems should assure that the handling and use of raw materials, in-process materials, packaging, and other items along the production line shall be effected in such a manner as to prevent contamination or other adulteration.

As part of an effective process control system, all finished products should be coded with permanently legible marks. Such codes permit use of an effective product recovery system and identification of unacceptable products.

Finished products should be stored and distributed in a manner that will prevent their contamination with undesirable agents. Storage conditions must not permit the deterioration of food and its container.

Water

All food processing facilities need an adequate supply of potable water. GMP requires that water used in processing or on food contact surfaces shall be safe and of adequate sanitary quality.

Once used, water must be safely returned to the environment. A major concern throughout the world is the contamination of underground, potable water supplies. Where practical, consideration should be given to clean-up, recycling, or re-use of water for irrigation.

Technically Oriented Food Industry Trade Association

To develop uniform product guidelines across many companies, it will be necessary for the food processing industry sector in each country to become self-sufficient in technical areas. For this reason, assistance in developing a voluntary, functional, technically oriented trade association could be useful in helping the food industry establish specifications for products for the export market, as well as for domestic consumption. An example of such an association is the National Food Processors Association of the United States.

REFERENCES

APHA (American Public Health Association). 1972. Proceedings of the 1971 National Conference on Food Protection. U.S. Government Printing Office, Washington, D.C.

Bauman, H. E. 1974. The HACCP concept and microbiological hazards categories. Food Technol. 38:30-34,74.

Bryan, F. L. 1978. Factors that contribute to outbreaks of foodborne disease. J. Food Protect. 41:815-827.

Bryan, F. L. 1979. Prevention of foodborne diseases in food service establishments. J. Environ. Health 41(4):198-206.

Bryan, F. L. 1980. Foodborne diseases and their control. U.S. Department of Health and Human Services, Public Health Service, Atlanta.

Bryan, F. L. 1981a. Hazard analysis of food service operations. Food Technol. 35:78-87.

Bryan, F. L. 1981b. Hazard analysis critical control point approach: Epidemiologic rationale and application to foodservice operations. J. Environ. Health 44:7-14.

Bryan, F. L. 1981c. The impact of training veterinarians, sanitarians, and food establishment managers in the prevention of foodborne diseases. Paper presented at the 8th International Symposium of the World Association of Veterinary Food Hygienists in Ireland.

CFR (Code of Federal Regulations). 1985. Human foods. Title 21, part 128. Current good manufacturing practices (sanitation) in manufacture, processing, packing, or holding. U.S. Government Printing Office, Washington, D.C.

EMS (Environmental Management Services). 1980. G. M. P. rules for food plant employees. Environmental Management Services, Peoria, Ill.

Hauschild, A. H. W., and F. L. Bryan. 1980. Estimate of cases of food-and-waterborne illness in Canada and the United States. J. Food Protect. 43(6):435-440.

Ito, K. 1974. Microbiological critical control points in canned foods. Food Technol. 28:46-48.

Juran, J. W., F. M. Gryna, and R. S. Bingham. 1979. Quality Control Handbook. 3d ed. McGraw-Hill, New York.

NRC (National Research Council). 1964. An evaluation of public health hazards from microbiological contamination of foods. Subcommittee on Microbiology, Committee on Food Protection. National Academy of Sciences, Washington, D.C.

NRC (National Research Council). 1969. An evaluation of the Salmonella problem. Committee on Salmonella. National Academy of Sciences, Washington, D.C.

NRC (National Research Council). 1975. Prevention of microbial and parasitic hazards associated with processed foods. National Academy of Sciences, Washington, D.C.

Peterson, A. C., and R. E. Gunnerson. 1974. Microbiological critical control points in frozen foods. Food Technol. 28:37-44.

Pillsbury Company. 1973. Food safety through the hazard analyses and critical control point systems. The Pillsbury Company, Minneapolis.

Riemann, H., and F. L. Bryan. 1979. Foodborne Infections and Intoxications. 2d ed. Academic Press, New York.

WHO/ICMSF (World Health Organization and International Commission on Microbiological Specifications for Foods). 1981. Hazard analysis and critical control point. Application to food safety and quality assurance in developed and developing countries. A Special Committee report at a Meeting on Hazard Analysis: Critical Control Point System in Food Hygiene, held in Geneva, June, 1980.

WORKING GROUP ON

Improved Food Handling and Good Manufacturing Practices

REPORT AND RECOMMENDATIONS

A factor that significantly affects the incidence of foodborne illness, observed in all Western Hemisphere countries, is the prevalence of inadequate food handling practices--a result of a lack of sufficient training in the operation and management of facilities for production, processing, and handling of food, especially in medium-sized and small concerns.

Governments have an essential role in setting the framework for food control by legislation and regulation, and in ensuring the effectiveness of control by monitoring and enforcement. But all such activity can touch directly only a very small portion of the food supply. Effective implementation depends virtually entirely on the full participation of an educated and motivated industry.

Thus the success of the three recommendations that follow will be fully dependent on the commitment of all those involved: industry, government, and the academic community. All must recognize that significant health, economic, and social benefits will result from adoption and implementation of these action recommendations.

1. A major coordinated effort should be instituted to develop and implement appropriate educational programs in good manufacturing practice, to be directed at managers

and key employees of food processing and food handling establishments.

The working group recognizes that these programs, to be effective, must be designed to be country-specific and industry-specific. In application they must be accurate, but must be nontechnical in nature to ensure understanding and acceptance. The programs must include simple, dramatic demonstrations of good food manufacturing practices (showing, for instance, the importance of time, temperature, sanitation, etc., on foods).

Success will require cooperative effort by industry, government, and university personnel. The potential economic impact of these programs (reduction of postharvest food losses, improved marketability, etc.) will need to be emphasized. The resulting health improvement benefits must also be stressed.

It should always be kept in mind that although their primary target is the small industry with limited or no technical personnel, these programs need to be utilized by all food processing industries for training employees.

The handling of food by street vendors in the Americas deserves special attention and must be addressed. However, the working group makes no specific recommendation at this time to deal with the problem, in view of the meeting on this subject organized by FAO and PAHO, which took place in Lima, Peru.

2. An international, multidisciplinary task force should be created, under the aegis of the Pan American Health Organization (PAHO) and Food and Agriculture Organization (FAO), to become the focus and coordinator of these programs, and to marshal the resources to support them.

The task force should be a technical group, not an economic or policy one. Food technologists, microbiologists, and experts in food safety and food control should be prominent in its membership. It is critically important that the task force receive both participation and financial support from industry (see recommendation 3). It is important that, whenever possible, existing educational and training materials be adapted and simplified rather than developed de novo.

The first responsibility of the task force should be to assess the availability of relevant expertise, existing documents, and other useful resources (university departments, research institutes, Codex Alimentarius, etc.). The task force must establish for each program, at the time of implementation, a method and criteria for periodic evaluation of the progress of the program. Examples of such criteria in relation to the dairy industry would be explicit goals for reduced plate count, longer shelf life, or reduction of existing losses in milk and other dairy products.

3. Funding for the programs should be obtained from a combination of sources, with emphasis on those that will benefit.

These activities will obviously require the commitment of funds from several sources to ensure implementation. Sources of support should include health organizations that represent the individual consumer; governments that will have improved trade and/or tourist business as a result of the programs; larger food companies interested in improving the status of the industry; importers/exporters of raw and finished materials whose available resources will be improved; and concerned government agencies, such as the Agency for International Development (AID), the International Development Research Center (IDRC), the Organization of American States (OAS), the Andean Pact, the Caribbean Community (CARICOM), and the Asociación Latinoamericana de Integración (ALADI).

Intercountry and Regional Cooperation*

ANTONIO BACIGALUPO

It has not always been possible for Latin American and Caribbean countries to follow the classical patterns of progress traced by countries that today have developed the area of food control. Modern interactions with technological, economic, social, and political factors, at the national and international levels, impose different, more realistic approaches to food control in order to meet the permanent human need for sufficient quantities of good-quality and safe foods.

The countries of the Latin American and Caribbean region have been facing the formidable task of food protection with varying degrees of success. No simple solutions have evolved where at the national level there have been limited economic resources, unemployment, malnutrition,and poor health, and society has felt the fair pressure of those who want a better standard of living. Under these circumstances and in the presence of vast potential resources for food production, it seems that the best possible approach to the complicated

*This paper constitutes the opinion of the author and does not necessarily reflect the opinions of the Food and Agriculture Organization of the United Nations.

problem of food protection in modern underdeveloped societies is for countries to learn from one another. It should then be possible to elaborate viable solutions, with the complementary support of appropriate technologies from developed countries; these solutions should be relentlessly applied in a continuously evolving but firm manner in order to develop a self-sustaining food system that will ensure a supply of safe and wholesome food.

Most individual countries in the Americas Region do not have the experience required to synthesize a complete and viable integrated solution to food problems. However, by working together through regional cooperation, or better still through hemispheric cooperation, they may successfully attain food system development in the Region. Recommendations for the organization of a regional cooperative network for integrated development of food control are proposed at the conclusion of this paper. They are based on the experiences accumulated by the Food and Agriculture Organization (FAO) Regional Office for Latin America and the Caribbean.

FACETS OF FOOD SYSTEM DEVELOPMENT

In both developed and underdeveloped societies we cannot help but observe a continuous interaction of many factors that are linked in a stable balance by strong forces that bind malnutrition and poor health; good nutrition and good health; poor education and poor jobs; good education and better jobs, etc. It is easier to make progress, in almost any direction, when one lives in a developed society. In an underdeveloped country or sector of society it is difficult to get out of the situation of "poverty" because the improvement of one parameter is not sufficient, since the other parameters with which it is strongly bound slow down progress. Thus, it is not easy to have a good job, eat well, produce food, have good health, have education, and live tranquilly.

These forces are present everywhere, in every society and at all levels of development, regardless of their nature and size--just as nuclear forces act in every atom of any substance. When dealing with problems of food and nutrition in developing societies, it is therefore difficult to isolate the influence of each factor, be it food production, food processing, nutrition, or food safety. In turn, all these are influenced by biochemical, biological, economic, and social forces, which are permanently acting within the food cycle. Thus, food safety and food quality cannot be treated independently of related and interacting factors; all factors are universally connected by complex cause-effect relations. It is for this reason that problems of food quality and safety, and their management through food control measures, have to be viewed within the overall context of a food system.

The Role of Food Quality Control

It would seem safe to assume that for countries having limited technical and economic resources a sufficient volume of food production constitutes the most important goal and is the cornerstone of national food system development. Only after food is produced in sufficient quantities and kinds is it possible to take the next step in the food system--essentially, the preserving of food and the food's integrity until it reaches the consumer.

In all the steps in a food system there exists an interplay of technological, economic, and sociological factors. It is within the interplay of these factors that food quality control plays a significant role in protecting human health, promoting higher levels of economic income for all involved in agriculture and the food industry, lowering the price of good-quality foods, and encouraging the utilization of better technologies.

It is evident that the best results of food quality control measures are obtained when the full potential of a national food system is applied. The utilization of food control merely to protect human health, although unquestionably fulfilling an essential need, is not totally satisfactory, especially in underdeveloped societies where food production is insufficient to meet national demands. Similarly, the threat of hunger, unemployment, food shortage, malnutrition, sociopolitical unrest, and other negative forces cannot be defeated or controlled by the exclusive use of sanitary measures.

Under any circumstances, but particularly where there is an unfavorable environment for food and agricultural development, there is a need for integral solutions, such as the utilization of food quality control measures to promote larger and better food production and strengthen the food distribution system (WHO, 1982). Such solutions are common practice in more advanced societies, where within the food industry, food quality control shares with economic analysis and the control of technical efficiency a responsibility for the continuous flow of information, advice, and actions that facilitate timely adjustments and corrections. Assisted by these guiding procedures, technical personnel, farmers, entrepreneurs, and the public in general have a better chance to produce a larger volume of healthy and accessible foods of high commercial quality, while reducing waste and improving human nutrition--in other words, to promote the essential ingredients of a developed food system.

Obviously, a country cannot be satisfied with raising production while disregarding human health and accessible food prices, or with lowering production while improving food quality--or with any other unbalanced improvements. The prime need is for the development of the entire food system to meet the requirements of both the producer and the consumer of food.

Difficulties of Maintaining Food System Development

It is clear that accelerated growth and development in food and agriculture require the solution of a large number of problems almost simultaneously. Listed below are some of the problems commonly encountered by countries attempting to upgrade food control activities in the Americas Region:

- insufficient quantities of food (caused in part by a poorly designed distribution system), and fear that rigorous food control measures will result in a reduction of food supplies;
- underdeveloped food distribution systems in which a large number of middlemen increase the potential for food contamination and adulteration;
- environmental conditions in the humid tropics that make food handling more difficult and increase the likelihood of food deterioration;

- o farmer's lack of education about, and uncontrolled use of, pesticides and veterinary drugs, resulting in the potential for excessive residues in foods;
- o lack of potable water;
- o failure to give national priority to food control services, thereby severely limiting funds available for necessary food protection activities;
- o inadequate food control infrastructures (including laws and regulations);
- o lack of cooperation and coordination among governmental sectors concerned with food inspection and analysis;
- o inadequate food inspection activities, as a result of poorly defined food distribution systems;
- o ill-trained and underpaid food inspectors and chemists;
- o lack of attention to consumer complaints about food safety and quality;
- o poor education of the general public regarding food quality and food handling;
- o inadequately handled and controlled street-vended foods;
- o poor consumer habits that inhibit the control of food contamination; and
- o application of different food standards for export markets and for in-country consumption, resulting in products of lower quality and safety for local consumption, particularly by the poorer segments of populations.

At first, finding solutions to such problems may seem to be impossible. How can there be success where so many well-intended national campaigns and education and training schemes have failed? What kind of actions, strategies, budgets, and infrastructures are required? How should we deal with food plants in cities whose facilities are overburdened--cities that are not able to supply good water, sewage, living accommodations, and food markets? How can we improve food quality while governments are economically broken, have heavy foreign debts, and are experiencing social unrest? How should we act where marginal sectors of the human population have been consuming chicken feed?

These and other problems are present in our societies just at a time when the rate of crime and terrorism is rising. Nonetheless, these difficult food safety situations must be improved at all costs before they reach catastrophic dimensions (Herrera et al., 1977). This can best be done by strengthening the vital food development triad of agriculture-nutrition-health.

COOPERATIVE APPROACHES TO FOOD SYSTEM DEVELOPMENT

Fortunately for the Americas Region, there is much that can be done to improve food problems that exist in the presence of vast natural resources (Castells, 1981). It is reassuring to know that governments, private industry, and international agencies in the Region have been seeking better approaches to food system development and to the solution of food problems. Although a complete list of promising solutions is not available, each organization involved has discovered partial solutions, which have been tentatively applied and which are still waiting to be fully utilized. Many are still valid today. International organizations like the Food and Agriculture Organization (FAO), the Pan American Health Organization (PAHO), the Inter-American Institute for Cooperation on Agriculture (IICA), the Agency for International Development (AID), the International Development Research Center (IDRC), the Canadian International Development Administration (CIDA), and others constantly have the opportunity to observe developments and gather reports on food protection work carried out in the world, in the Region, and in each country of the hemisphere. Much of this information could have a significant and lasting value for food system development in the Americas.

But the information is scattered. Needed is an appropriate collection and analysis mechanism for assembling viable answers and proven solutions for similar environments. It is quite possible that Latin America already has accumulated sufficient knowledge and experience to provide appropriate technologies for food system development (Mittendorf, 1978). It is certain that developed countries of the Western Hemisphere and other parts of the world have a wealth of information that can be adapted to the conditions of the Region for the improvement of food systems.

With this purpose in mind, several international agencies already have given support to cooperative programs in the Region. In 1979, the Food and Agriculture Organization, through its Regional Office for Latin America and the Caribbean (RLAC), started a series of intercountry and intracountry technical cooperation networks, whose main purpose is to induce the development of specific food products and agricultural areas. This type of cooperation, which involves the exchange of specific technical information through personal contacts, workshops, videos, and publications, has already produced substantial results.

Different approachs have been used by RLAC's sponsored networks, depending on the products or areas involved. In the case of oil palm and tropical fruit development, the network's method involves a systematic sequence of activities oriented toward formulating and using solutions that expand in a spiral of development (FAO, 1984). The sequence involves selection and definition of the most pressing problems: presentation and discussion, by country delegates and consultants, of successful approaches to problems (workshops); recommending approaches for the Region; transfer of applied technology, at pilot-project scale, by interested national companies or institutions; consultations and adjustments; if required, research on unsolved matters; promotion of solutions at the training and investment levels; selection and definition of new problems; new workshops; new recommendations; new technological transfers; and so on. See Figure 1.

Each RLAC network operates according to the scheme shown in Figure 2. A network's activities are organized by a coordinator and a technical secretary. The former is elected by the delegates of the countries involved, and the latter, who is usually the corresponding regional officer, is sponsored by RLAC. Actions are taken with the participation of a country's delegates, and with the cooperation of the FAO country representatives. Funds coming from the countries themselves, from FAO headquarters, and from RLAC contribute to the development of network activities, which are planned at technical workshops.

When RLAC networks were first started, a network's activities within a country were initiated through the country's Ministry of Agriculture. Later, with the

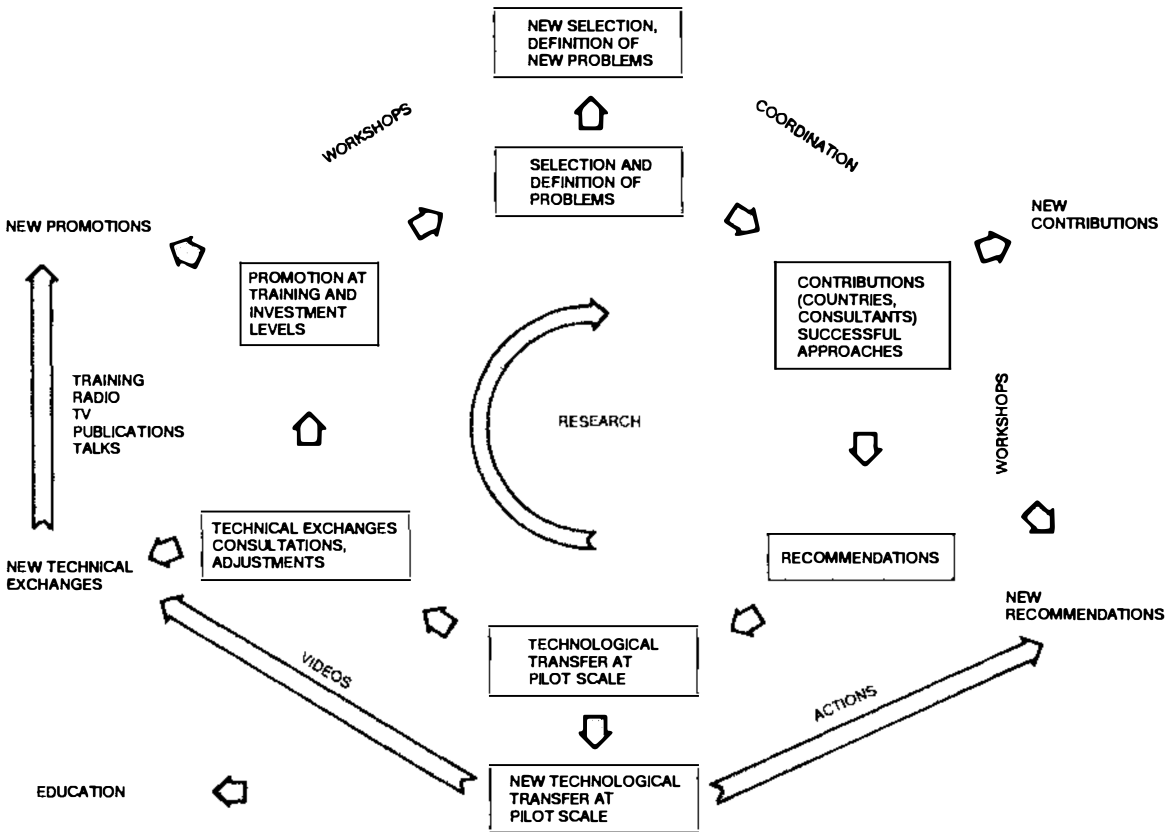


FIGURE 1 Activities of the oil palm network sponsored by FAO-RLAC.

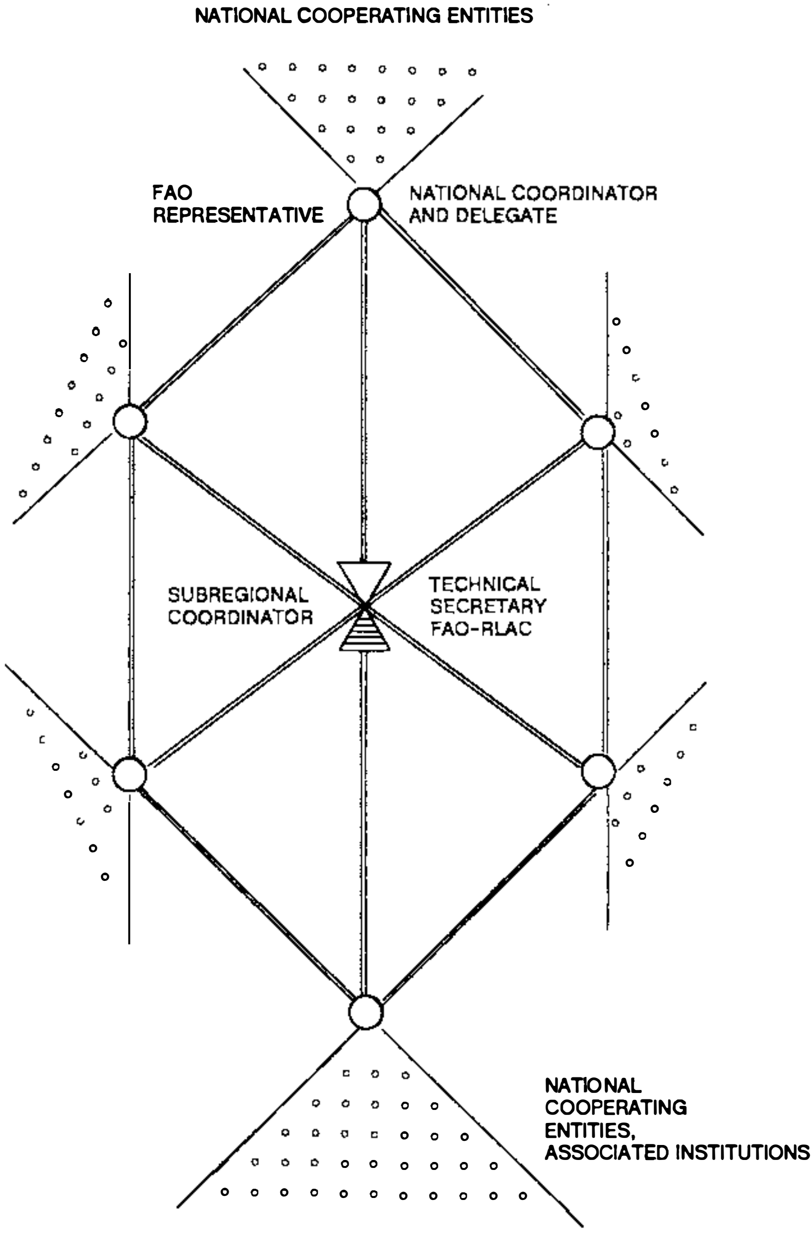


FIGURE 2 Structure of a cooperating network at the subregional level.

establishment of more regional cooperative networks, it was necessary to organize a national network coordinating unit within the Ministry of Foreign Affairs. This induced national programs to provide more support for the network.

ADVANTAGES OF TECHNICAL COOPERATION IN LATIN AMERICA

RLAC experience with technical cooperation carried out at the regional level indicates that beyond the benefits of exchanging specific technical information necessary for the development of products or industries, there are a number of benefits of international cooperation that could play a significant role in Latin American food development. Among these are stimulation of a solidarity among countries and institutions, which greatly facilitates technological transfer between donor and recipient countries; wider and better use of highly qualified human resources, and encouragement of faster development and specialized training; and greater contact and mutual awareness among people working in related fields--factors that favor the forming of international technical teams with either multidisciplinary or undisciplinary purposes.

International cooperation also facilitates crossing of the barriers that often separate different but related public sectors, fosters more objective analyses of common problems, permits easier identification of national problems and country needs, and promotes contacts between developed and underdeveloped countries that make it possible to identify areas of cooperation where common interest exists. A wider and more complete view of the significant factors intervening in the development process can be obtained from the international perspective, in which different national developments are contrasted. The processes of making and implementing decisions on food development are furthered by international cooperation, which makes available concrete information from neighboring countries with similar ecologies. Finally, international cooperation gives high status to technical personnel and to institutions--status that is important in mobilizing national resources for food development--and favors the participation of newspapers, television, and radio in the process of development.

International technical cooperation is already promoting economic cooperation among the countries of the Americas Region, whose leaders and financial institutions are interested in sound investments, the development of natural resources, and solutions to the vital problems concerning nutrition and health. It has been found easier to transfer technology among similarly developed countries than among those that have disparate levels of development.

RLAC technical cooperation at the regional level started with the concept of technical development of one product or area, but it was soon found that the social, economic, and legislative implications of such development had to be taken into account. In dealing with a single product, a world of problems and opportunities was discovered, which gave everyone the opportunity of seeing, appreciating, and participating in a concerted and integral approach to development. Perhaps when enough experience has been accumulated, RLAC will be in a position to provide systematic solutions to the problems entailed in developing a particular product or group of products. And perhaps in time such solutions could lead to adequate answers to some of the pressing demands of our present society.

SHORTCOMINGS OF PRESENT PROGRAMS

The fact that there have been some successful developments does not imply that everything has been done or done well. There are limits to the availability of human resources and of funds for coordination and implementation of activities. There are projects, questions, and needs that have not yet been treated adequately. In our RLAC activities, the first emphasis has been placed on the food and agricultural development; but the area of food quality control--an essential adjunct to food and agricultural development as well as to the strengthening of the food system--has still to be adequately tackled.

Considerable internal problems prevail in the countries of the Region because of serious mismatches between agricultural production, food needs of the vulnerable sectors of the population, and consumer protection needs of the general population. These problems also derive from the fact that a large modern commercial production sector is willing to comply with the food quality control measures required for exports, but not with those required for domestic consumption, as the national consumer by and large does not have sufficient resources to pay for better-quality foods. This is a situation calling for a strategic set of compatible answers involving adequate legislation, financing, and technology that will result in both better income for food producers and the provision of good-quality food for local consumption.

In practice, the lack of harmony between producers and consumers presents a real challenge to everyone in food development--a challenge that deserves careful consideration, since it is evident that accelerated progress could be achieved through cooperation among programs and through the networks of institutes that cover all the aspects of food system development in a harmonious way.

INTERCOUNTRY COOPERATION FOR EFFECTIVE FOOD CONTROL

As a result of the present economic and social crises involving many countries of Latin America and the Caribbean, it may not be easy for a government to finance new national developments in food safety and quality. As an alternative, the comparative economic advantages that regional cooperation offers in our hemisphere are worth considering, since sound regional cooperative programs are capable of providing important assistance to governments interested in strengthening their national programs. It might also be possible to realize cooperative projects that have been floating around as ideas for years.

In addition, the experience and wealth of information that has been accumulated on agriculture, health, and nutrition through the cooperative efforts of FAO, PAHO/WHO, IICA, AID, CIDA, the U.S. National Academy of Sciences, and other international agencies and scientific organizations constitutes a formidable body of knowledge. See, for example, Canada Ministry of National Health and Welfare, 1975; Bourne, 1978; Bryan, 1983; FAO, 1979, 1984, 1985; FAO/UNEP, 1976; FAO/WHO, 1975, 1976, 1978, 1979, 1981; Herman, 1963; Hernández Pérez, 1980;

JUNAC, 1982; WHO, 1982. The Codex Alimentarius alone provides detailed recommendations on food regulations and standards, specifications for foods and additives, analytical methodologies, and codes of practice; all of these are valuable to industrial and marketing enterprises interested in food production and trade. Abundant and detailed information exists on the nutritional needs of every human group (including the vulnerable sector within our society), and on the formulation and preparation of food supplements for temporarily meeting the nutritional requirements of the neediest populations. Many processes, plans, projects, and strategies have been tested; toward the goal of improved food hygiene and control, workshops, studies of policies, legislative measures, and coordinating schemes for national institutions have been proposed (Monti, 1979; IFAP, 1981; Cabal de Olivera, 1982). Both the food industry and the farming community have a great deal of information on food production and food distribution, including the supplying of fresh products for national markets and the production of high-quality foods for developed countries. Most of these data are available in national or regional institutions and libraries, as well as at other private or governmental sources.

A well-established and well-managed regional cooperative program could provide a flow of technical information required by national food control programs; direct support of national and foreign experts to promote, implement, supervise, evaluate, and adjust relevant programs and activities; assistance for training courses aimed at professionals, technicians, and personnel working in the food industry or food services; and assistance in teaching school and university students about food safety and quality, by providing educational materials, publications, and other teaching aids. Such a program could also furnish quick and practical assistance from countries of the hemisphere when it is necessary to solve specific and difficult administrative, legislative, and technical problems related to food production, processing, and marketing at the internal and external levels (Monti, 1979). It would render economic assistance to national programs in critical areas, and assist in the strenthening of human and physical resources.

To ensure successful cooperation among the Region's countries, it would be necessary for each country to be willing to receive and to give the kind of support it needs and is able to provide. In addition, the present Conference might consider a tenative plan to improve cooperation within the hemisphere in the area of food control. Such a plan should incorporate the following steps: establishment of a tentative Regional Cooperative Network for the Integrated Development of Food Control; submission of a proposed program for the network to the national governments of the hemisphere for their consideration and approval; communication (by letter of intent) of interested governments with an ad hoc Organizing Mechanism, to be composed of representatives from FAO/RLAC, WHO/PAHO, and selected country delegates from the present Conference (a letter of intent should specify the kind of support that a government would be willing to offer, and the type of assistance that it might need); and formal organization of the Regional Cooperative Network for the Integrated Development of Food Control by the ad hoc Organizing Mechanism, with the support of national and international organizations working in the hemisphere. To explore the possibility of establishing a wider integrated program involving all the phases of food development, the ad hoc Organizing Mechanism should also contact other regional programs, institutions, networks, and organizations working in Latin America in the areas of food production, processing, marketing, and nutrition.

Recommendations for a Regional Cooperative Network for Integrated Development of Food Control

The recommendations below concerning the purpose, activities, and organization of such a cooperative regional network are offered as a basis for discussion.

Purpose. The fundamental objectives of the Regional Cooperative Network would be to improve the safety and quality of food in all Latin American and Caribbean countries through technical cooperation within the hemisphere, to improve food production, processing, and nutrition, and to make basic foods more accessible to entire populations.

Activities. To reach its objectives, the Regional Cooperative Network should carry out the following activities: (1) exchange, among members, of technical, legislative, and policy information on food control and related plans and projects; (2) promotion of cooperation among national institutions and between these and regional organizations in the areas of education, training, research, development, and financing of joint projects; (3) maintenance of good working relations with cooperating governments; and (4) strengthening of food control systems and food safety and quality in the Region.

Organization. The organizational structure outlined in Figure 3 should be adopted. It calls for a general assembly of regional cooperators, in which would reside the maximum authority of the network, and a coordinating committee representing the cooperating countries, FAO/RLAC, and WHO/PAHO. The committee would be in charge of gathering studies and information from specialized working groups, the secretariats (see below), and the cooperating networks. The committee would also propose plans of action, strategies, and budgets to the assembly for approval.

A general coordinator would have executive responsibility, and would be assisted by an administrative secretariat, which would be in charge of financial matters and relations with country delegates, regional institutes, and organizations; and by a technical secretariat, which would be in charge of communications, data banks, computer services, and assistance to specialized working groups. The general coordinator should be elected by the general assembly from among the delegates of cooperating countries, and should serve for a period of three years. Specialized working groups of representatives from cooperating countries would work on topics selected by the coordinating committee.

The activities of this program should be carried out by existing facilities in the cooperating countries, through their own national programs, and with the economic support of international agencies and organizations. The main job of such agencies and organizations should be to facilitate communications among countries, and to assist in establishing the

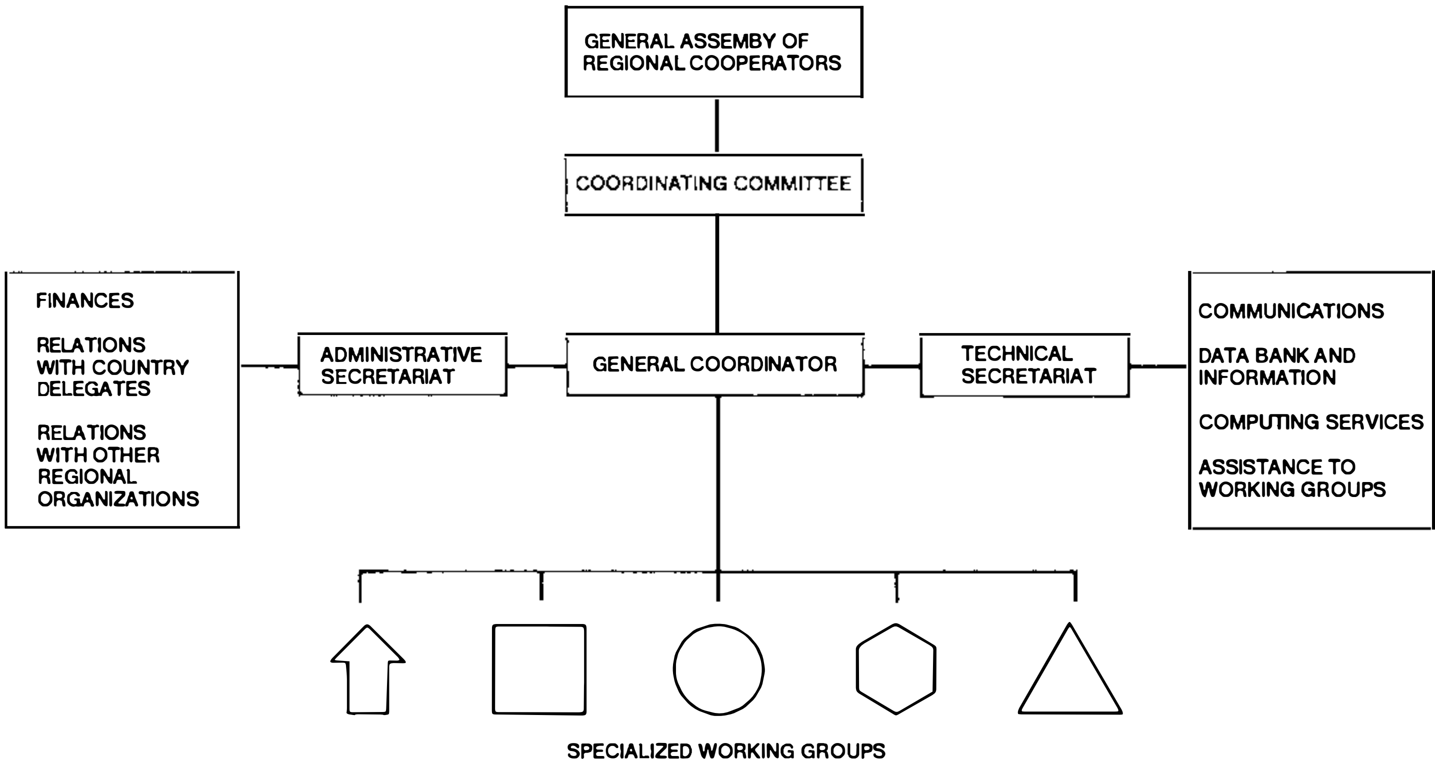


FIGURE 3 Proposed organization of a Regional Cooperative Network for integrated development of food control.

facilities needed to improve, demonstrate, test, and apply better technologies and methods for the development of integrated food control systems, the improvement of food quality and safety, and the upgrading of food systems performance in the interests of human health and economy.

REFERENCES

Bourne, M. C. 1978. The significance of food losses and the need to minimize them. International experience. Pp. 45 in Anales del Tercer Seminario Avanzado de Tecnología de Alimentos. COLCIENCIAS, Bogotá, Colombia.

Bryan, F. L. 1983. Food safety strategy for countries of the Caribbean Community. Review of food control services and recommendations for program priorities and for activities to assure food safety. Report of Temporary Advisor to PAHO. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Atlanta, Georgia.

Cabal de Olivera, M. P. 1982. Bases técnicas de un sistema integral de control de calidad de alimentos para Colombia. Ciencia y tecnología de alimentos 3(1-2):165-177.

Canada Ministry of National Health and Welfare. 1975. Report of the Advisory Committee on Food Safety Assessment. Ottawa.

Castells, J. 1981. La crisis de alimentos en América Latina. Investigación presentada a la Asociación Latinoamericana de Industriales y Cámaras de Comercio, ALADI-ALICA. Asociación Latinoamericana de Industriales y Cámaras de Comercio, Montevideo, Uruguay.

FAO (Food and Agriculture Organization). 1979. Informe del Proyecto sobre Estrategia para Alimentos, Perú. Fondos Fiduciarios Suecos. FAO/SWE/TF ESN: TF/SWE/79. Organización de las Naciones Unidas para la Agricultura y la Alimentacion, Roma.

FAO (Food and Agriculture Organization). 1984. Informe de la Mesa Redonda sobre Redes de Cooperación Técnica, su funcionamiento y vinculación con los organismos nacionales de cooperación técnica international.

Oficina Regional de la FAO para América Latina y el Caribe, RECO 5, Santiago de Chile. FAO (Food and Agriculture Organization). 1985. Sistemas de redes de cooperación técnica. Oficina Regional de la FAO para América Latina y el Caribe, RECO 6, Santiago de Chile.

FAO/UNEP (Food and Agriculture Organization and U.N. Environment Programme). 1976. Orientaciones para el establecimiento de un eficaz sistema nacional de inspección de los alimentos.

FAO/WHO (Food and Agriculture Organization and World Health Organization). 1975. Specifications for identity and purity of some food additives including food colours, flavor enhancers, thickening agents and others. FAO Nutrition Meetings Report, Series No. 54 B. Food and Agriculture Organization/World Health Organization, Rome.

FAO/WHO (Food and Agriculture Organization and World Health Organization). 1976. Evaluación de ciertos aditivos alimentarios. Algunos colorantes alimentarios, espesantes, condensados de humo y otras sustancias. Decimonoveno informe del Comité Mixto FAO/OMS de Expertos en Aditivos Alimentarios. Informe No. 55, Serie de Informes Técnicos No. 576. FAO Reuniones sobre Nutrición, Roma.

FAO/WHO (Food and Agriculture Organization and World Health Organization). 1978. Report of the Joint FAO/WHO Food Standards Regional Conference for Latin America. Codex Alimentarius Commission. Food and Agriculture Organization, Rome; World Health Organization, Geneva.

FAO/WHO (Food and Agriculture Organization and World Health Organization). 1979. Manuals of food quality control: Food for export. Food and Nutrition Paper No. 14/5. Food and Agriculture Organization, Rome.

FAO/WHO (Food and Agriculture Organization and World Health Organization). 1981. Manuals of food quality control: Food inspection. Food and Nutrition Paper No. 14/6. Food and Agriculture Organization, Rome.

Hernández Pérez, V. M. 1980. Control de la contaminacion de los alimentos. Informe de la Misión Preparatoria Realizada en 11 Países. Organización de las Naciones Unidas para la Agricultura y la Alimentación, Roma.

Herman, V. 1963. La inspección y vigilancia de aditivos alimentarios en la República Federal de Alemania. Inspección y vigilancia de aditivos alimentarios No. 7. Organización de la Agricultura y la Alimentación, Roma.

Herrera, A. O., H. D. Scolnik, G. Chichilnisky, G. C. Gallopén, J. E. Hardoy, D. Mosovich, E. Oteiza, G. L. de Romero Brest, C. E. Suárez, y L. Talavera. 1977. Catástrofe o nueva sociedad. Modelo Mundial Latinoamericano. Fundación Bariloche, Bogotá, Colombia.

IFAP (International Federation of Agricultural Producers). 1981. Developing countries' food policies. IFAP's Secretariat for the 24th General Conference. IFAP Liaison Bulletin 27. International Federation of Agricultural Producers, Paris.

JUNAC (Junta del Acuerdo de Cartagena Grupo de Politica Technologica). 1982. Análisis y Recomendaciones de Politica: Proyecto III "Tecnología, Producción y Comercialización de Alimentos Infantiles y Dietéticos Formulados en la Subregión" y Proyecto IV "Estudio de Cinco Casos de Oportunidades de Innovación Tecnológica en el Subsector Industrial Alimentario en la Subregión." Convenio BID-JUNAC ATN/SF-1817 RE. JUNAC, Lima, Perú.

Mittendorf, R. I. 1978. Cómo organizar sistemas urbanos en mercadeo de alimentos para el desarrollo rural. Dirección de Servicios Agricolas. Organización de las Naciones Unidas para la Agricultura y la Alimentación, Santiago, Chile.

Monti, A. 1979. Las exportaciones agroindustriales. Cooperación y promoción latinoamericana. Consulta de Expertos sobre Cooperación e Integración Agrícolas en América Latina, Asunción, Paraguay. Oficina Regional de la FAO para América Latina y el Caribe, Santiago de Chile.

WHO (World Health Organization). 1982. Control sanitario de los alimentos. Discusiones Técnicas de la XXVII Reunión del Consejo Directivo de la OPS. Publicación Científica No. 421. Organización Panamericana de la Salud, Washington, D.C.

WORKING GROUP ON

Intercountry and Regional Cooperation in Food Protection

REPORT AND RECOMMENDATIONS

Discussions during the plenary sessions of the Conference brought to light some fundamental needs for the improvement of food protection in the Western Hemisphere that require immediate attention. The Working Group on Intercountry and Regional Cooperation explored whether and how intercountry and regional cooperation in food protection could remove barriers to trade and reduce differences in levels of development among the nations of the hemisphere.

This working group views intercountry and regional cooperation primarily as a means of accelerating and reinforcing the development of effective, integrated systems of food protection within each nation. The holding of this international conference indicates to the group that the urgency is great and the opportunity right for strengthening international cooperation now, especially in the areas of manpower training and development, public education, research and investigation, exchange of information, and technical assistance. Given the scarcity of resources, the working group does not advocate the establishment of a new institution. The conclusions reached and recommendations made are outlined below.

o Food protection in the Americas must be viewed against a backdrop of an abundant food supply on the one hand and of hunger and malnutrition on the other. Food scarcity affects a majority of the population of most developing countries in Latin America and the Caribbean, largely because of widespread poverty. Improper food handling practices exacerbate the problem.

o In many countries of Latin America and the Caribbean, population is growing at a faster pace than food production. Rapid and disorganized urban growth is common. The result is a growing dependence on imported foods, causing undue strains on foreign currency reserves and exacerbating the problem of external debts. Solutions to food protection problems in the Americas must take into account the needs of national food industries, local consumers, and international trade. This background of growing dependence on imported foods has increased the importance of establishing and harmonizing standards for the production, processing, storing, and distribution of foods, as well as the need for implementation of these standards through effective national food control systems.

o The working group acknowledged that most countries in the Region do have some food protection services. However, outside the United States and Canada, in nearly every country such services are severely constrained in carrying out their tasks. The most apparent reason for their ineffectiveness is the fragmentation of efforts among various ministries and sectors of the national government, accentuated by the lack of coordination among the different agencies and the competition for staff, funds, and prestige. These problems at the national level are magnified at the state, or provincial, and municipal levels. Effective coordination of the different sectors and levels of governments must be addressed with a sense of urgency.

o Since food protection activities, to be effective, involve a continuum of interrelated functions and different disciplines, the working group agreed that national programs should be conceived and organized within a coherent and integrated strategy.

o In addressing its specific task, the working group recognized that many countries in the Western Hemisphere do not have sufficient experience or resources to embark on comprehensive solutions to their food protection problems. Because of different levels of national development, local capacities in technology, infrastructure, and manpower vary widely. No single country can by itself provide all the resources to assure adequate food protection systems throughout the hemisphere. To achieve meaningful, sustained, and long-term solutions to the current problems, the use of existing resources must be optimized through intercountry and regional cooperation.

o The working group therefore agreed that intercountry and regional cooperation is the only means for accelerating and reenforcing the development of effective, integrated systems of food protection within each nation and the hemisphere as a whole. The very holding of this international conference indicates that the urgency is great and the opportunity right for strengthening international cooperation.

o The working group considered various means for promoting and achieving intercountry and regional cooperation in food protection activities and reviewed some of the networks currently operating in related fields. It was agreed that a networking approach, suitably adapted to the broad issues of food protection, could maximize the use of available facilities in the Region, promote international trade, and strengthen development of national food industries. An important feature of this network should be a mechanism for quality control.

o To promote intercountry and regional cooperation in food protection requires a conscious, systematic, deliberate, and voluntary sharing and exchange of technical resources, skills, and capabilities between and among developing countries. It also requires creation of a framework of multiple relationships, which are interdependent and mutually supportive. The working group agreed that the concept of Technical Cooperation among Developing Countries (TCDC) could provide a suitable framework for enhancing the capacity for food protection in developing countries, while advancing collective self-reliance.

o Other mechanisms considered and endorsed were the identification and designation of collaborating centers, using the existing procedures of the Pan American Health Organization (PAHO), the World Health Organization (WHO), and the Food and Agriculture Organization (FAO); bilateral and multilateral cooperation; international and regional technical cooperation; and systems for information exchange and sharing.

o The working group recognized that a good deal of cooperation is already occurring among countries, and between countries and international organizations, industries, laboratories, and other institutions. What is most needed at this point is to build upon accomplishments to date and to devise a flexible mechanism that can help to rationalize institutional cooperation for a hemispheric system, making more efficient use of the strengths of some institutions (beginning in the developing countries themselves). While recognizing that this must be a long-term project, the working group believes that it is urgent to give it impetus immediately.

o In order to assure adequate food control in the Western Hemisphere, the working group strongly recommends that within the next year PAHO and FAO jointly develop a plan for creating a cooperative network for advancing the development of food protection and safety. Although the group envisions the network as being composed in the first instance by the countries of the hemisphere, it would expect the network also to take account of other international initiatives, including the action plan adopted by the Regional Committee of Codex Alimentarius at its meeting in Havana in 1985, and the work of multilateral and bilateral assistance agencies, industrial associations, etc.

o The working group expects that planning by PAHO and FAO would include surveying of current institutional resources and needs in the field, and devising specific ways in which such needs could be met with the help of international cooperation through the network. In addition, PAHO and FAO should begin as soon as possible to develop and maintain a directory of all senior food control officials and institutions in the hemisphere. This directory should include telephone, telex, and cable information. Given the economic and health imperatives and the opportunity at hand, it is hoped that in the case of some pressing problems PAHO and FAO might raise the needed financial resources and foster cooperation now, before the formal creation of the network.

o The working group identified five broad generic areas for intercountry and regional cooperation in food protection: (1) manpower training and development, (2) consumer education, (3) technical cooperation and assistance, (4) information exchange, and (5) research and development.

o Underscoring the sense of urgency, the working group strongly recommends that on behalf of the participating governments, PAHO/WHO and FAO set in motion the mechanisms to develop the plan of action and mobilize sufficient resources to ensure intercountry and regional cooperation in food protection. The plan of action should be in place within one year.

o While not specifying the precise nature of the action plan, the working group did establish the following frames of reference:

-- The plan must be designed to utilize all the skills and available resources existing in all countries of the Western Hemisphere.

-- The plan must incorporate the concept of a single focus to assure coordination, efficient planning, and proper control of these efforts.

-- The plan must be designed to utilize and integrate existing instruments of cooperation, such as the collaborative centers program of FAO and PAHO, bilateral agreements between countries, and the regional Codex Alimentarius Coordinating Committee.

-- The plan must include built-in evaluative components that regularly analyze the progress of each part of the plan and its programs; these evaluations should be used to modify existing plans and programs as well as to prepare future activities.

o Building on the momentum of this Conference, each delegation, upon return to its country, must brief its respective national authorities and urge its government's unequivocal support for the above recommendations. Appropriate instruments, including these recommendations, should be sent to both the director-general of FAO and the director of PAHO/WHO. In addition, copies of these instruments should be sent at once to the principal national authorities, stressing the importance and urgency of their support for the recommendations made in this Conference.

Problems and Needs in Training and Education in Food Protection in Latin America and the Caribbean*

FERNANDO QUEVEDO

No food protection program will be successful unless it is staffed by well-trained, properly motivated administrative, professional, and technical personnel, and has the necessary facilities for the performance of its functions. The same may be said with respect to quality assurance or control efforts put forth by the food processing and food service industries. Similarly, foodborne disease (FBD) prevention activities will fall short of their goal if food handlers, cooks, housewives, and consumers are not motivated or correctly informed about the principles of food hygiene (Allen and Käferstein, 1983; OMS, 1968; Quevedo, 1970).

As was rightly pointed out at the time of the 1971 National U.S. Conference on Food Protection, the prevention of contamination during the production, processing, distribution, and serving of food is essentially a "people problem" (FDA, 1972).

*Translated from the original Spanish manuscript.

STATUS OF TRAINING OF PROFESSIONALS AND TECHNICIANS

Undergraduate training: In general, professional training schools in Latin America and the Caribbean are not teaching food protection in a comprehensive manner to undergraduates. In many training schools instruction on specific food control subjects is out of date and lacks depth.

Postgraduate group training: Some universities and scientific centers in Latin America and the Caribbean offer specialized postgraduate courses in particular aspects of food protection. These are regular courses scheduled over an entire academic year or offered intensively over a period of a few weeks. In addition, a number of international organizations sponsor intensive courses for professionals from the various countries, and intensive courses have also been organized and conducted with the cooperation of industrially developed countries of the Western Hemisphere or other continents (Quevedo, 1975b).

In the absence of adequate coordination of the training offered by this wide variety of organizers, not all of the benefits that should be attained are realized. Careful study of the problems that arise from this situation is required if efforts are to be fully effective and adequate financial resources allocated (Ministerio de Salud y Acción Social y OPS, 1985).

Among the problems most often encountered are those resulting from different and (at times) conflicting approaches to the subjects taught. Legitimate differences, of course, may derive from respectable but differing scientific criteria; however, such divergence generates confusion and makes it difficult to standardize techniques, analytical methods (ICMSF, 1978), specifications, and legislation among all the countries in the Region.

Some programs include the teaching of highly sophisticated techniques that are neither advisable nor appropriate for countries at certain stages of development. Such programs lead to the generation of nonessential or excessive requirements that cannot be met and that only lead to frustration on the part of course participants.

Something similar occurs with the selection of analytical programs for courses. Entire course days may be given over to the discussion of problems of no relevance to local reality (Mossel, 1975); or, inadequate solutions to local problems (Abdussalam and Käferstein, 1975) may be proposed because of a lack of knowledge of the environment or particular circumstances of the local area (Quevedo, 1975a).

The central subject of some courses is not always responsive to a country's priorities and needs or to preestablished programming. Courses on particular subjects are often organized and offered to suit an individual's enthusiasm or influence rather than because they meet a country's real training needs.

The selection of training participants presents another problem. People who are regularly engaged in activities completely unrelated to the training being offered often participate in that training, occupying places that ought to be taken by those for whom the training is relevant. In other instances, because of inadequate advance information on courses, not all available places in a course are filled; as a result, efforts and money are wasted by teaching the course to fewer participants than planned.

Also to be considered is the lack of support sometimes encountered by training participants after returning to their normal workplaces. Upon completing a course, participants are frequently assigned to activities completely different from those in which they were trained. Others do not receive the minimum facilities, supplies, and equipment they need to apply the knowledge acquired.

Postgraduate individual training: Some scientific centers, national laboratories, and universities offer training for the individual. The duration of such training varies. The program may consist of in-service training, inclusion in an ongoing research activity, or special studies developed on the basis of the trainee's future needs, background, and previous professional training (Ratto, 1971).

The problems associated with group training, described above, also affect individual training. But a problem specific to individual training is insufficient training time. Some fellowship recipients have to return to their places of origin just when they are becoming acquainted with work procedures at the training site.

Professional and technician training: In Latin America and the Caribbean, training should be provided for professionals and technicians in the following areas of food protection: planning and administration of food protection programs; food legislation (particularly important for lawyers and other professionals); food protection information systems; inspection of slaughterhouses and meat and poultry processing plants (important for veterinarians, inspectors, and technicians); inspection of other food processing plants; and inspection of food-dispensing and food-serving establishments (including markets, stores, restaurants, and catering kitchens). Training of both professionals and technicians is also needed in the areas of microbiological, parasitological, physical (including food microscopy), and chemical analyses of food, including analyses for determinations of pesticides, mycotoxins, heavy metals, anabolics, veterinary drugs, antibiotics, and food additives (Mendoza, 1971).

The epidemiology, investigation, control, and prevention of foodborne diseases, the educational methodology in food hygiene ("training of trainers," "teaching how to teach") (Austin, 1983), and food protection during disasters are other areas in which professionals and technicians need training. (See the following for a tabulation of the information, skills and attitudes that need to be acquired by more specific professional and technical groups).

In the years ahead, training of the kinds listed above should be provided to food protection professionals in virtually all countries of Latin America and the Caribbean. In reports submitted by a Pan American Health Organization (PAHO) consultant in 1981 (OPS, 1982), it was estimated that at least 3,000 trained food protection professionals would be needed in the following 10 years and that 23,000 professional and nonprofessional inspectors should be trained between 1982 and 1984 alone. It was also reported in 1981 (OPS, 1982) that 200,000 key food-handling personnel working in Latin America's food industry would have to be trained during the following 10 years. Even today that demand for professionals and inspectors is far from having been met. In fact, there is now a need for refresher training for many professionals because of the speedy and constant advances of food science.

PAHO's Regional Veterinary Public Health Program, which is charged with coordinating the organization's food protection and safety activities, has begun to update these data with the cooperation of the PAHO country representatives and appropriate national authorities. Upon completion of data collection, the information will be tabulated and distributed to the Region's countries. It will serve also as the basis for developing the PAHO training program in food protection for the period 1986 to 1991. PAHO will make a strong effort to disseminate information on food protection courses offered by other institutions (although PAHO's publicizing of those courses will be contingent on their meeting basic requirements concerning study programs, hours, techniques to be taught, instructional staff, physical facilities, and bibliographies).

STATUS OF EDUCATION IN HYGIENIC FOOD-HANDLING PRACTICES

Despite the fact that national and international meetings have recognized the importance of hygienic food handling for the prevention of foodborne disease and premature food spoilage, and have noted the urgent need to establish continuing programs of education in food hygiene for handlers and the public at large, it has not been possible to achieve this goal in Latin America and the Caribbean. There are scattered efforts in some countries--for example, educational campaigns of a short duration, the printing of a limited number of educational pamphlets or other educational material, the teaching of a few short courses--but these are not sufficient for reaching the objective. A profound, continuing, nationwide effort has not been made in any of the countries of the Region. The principal obstacles to the fulfillment of educational objectives have been financial problems and failure of decisionmaking (OPS, 1983).

Problems that have been detected in countries with health education activities should be kept in mind if their recurrence is to be avoided (Gravani, 1982, 1984). In certain environmental sanitation projects designed to bring about broader community participation, both intrainstitutional and extrainstitutional constraints have been found to impede a successful outcome. Intrainstitutional constraints have included failure to include representatives of the community in the program development process, insufficient sociocultural information, lack of coordination among services, belated response and lack of institutional coordination, lack of coordination between specialists and agents of change, insufficient training of trainers, insufficient time spent by trainers in communities, inadequate dissemination of promotional information, and inadequate training material. Extrainstitutional constraints have included dispersion of the population, high illiteracy rates, and language barriers (Alvarez Vigil, 1983).

Education Needed in Hygienic Food Handling

Except for a very small segment of the population that knows and practices the necessary precautions for the hygienic handling of food, everyone in Latin America and the Caribbean needs to participate in educational programs or campaigns (since we are all daily food handlers). Groups for whom special food education and hygiene courses or activities should be organized can be identified. For example, some programs on food hygiene should be provided for food handlers in group kitchens (services), hospital kitchens, food processing establishments, slaughterhouses and packinghouses, and food-dispensing establishments, as well as for street vendors of foods (OMS, 1976). Other food hygiene programs should be developed for housewives (Elmendorf, 1983), primary school teachers, primary and secondary school students, and university students (Bryan, 1974b).

Simple food technologies should be taught to cottage industry workers, open market vendors, and other food handlers.

RECOMMENDATIONS

In view of the problems and needs in training and education in food protection discussed above, the Inter-American Conference on Food Protection should consider issuing the following recommendations:

o that the Food and Agriculture Organization (FAO) and PAHO coordinate their efforts to collect and disseminate to the Region's countries information on educational and training activities whose soundness of purpose and organization makes them worthy of support;

o that FAO, PAHO, and agencies organizing educational and training activities cooperate to avert duplication of efforts and to foster such activities on a priority basis;

o that appropriate authorities in each country select participants for training activities in an appropriate way, giving preference to personnel working in food protection;

o that appropriate authorities assign recently trained employees to activities relevant to the training received and endeavor to provide them with the material and ancillary resources required for the application of the knowledge acquired;

o that organizers of courses base course content on subjects that are relevant to the solution of existing problems or potential problems in the participants' country or countries;

o that instructors of courses teach whatever analytical methodology and legal provisions may be recommended or required by recognized international standards or by the most prestigious agencies, e.g., the Codex Alimentarius Commission (CAC), the International Standards Organization (ISO), the International Commission on Microbiological Specifications for Food (ICMSF), the Association of Official Analytical Chemists (AOAC), the U.S. Food and Drug Administration (FDA), and the U.S. Department of Agriculture (USDA);

o that educational activities concerning hygienic food handling be organized with the participation of health educators, community education specialists, and anthropologists;

o that food hygiene education activities for the public at large include specially prepared materials written in the language of the target population and drawing on situations, illustrations, and examples relevant to the applicable country or locale;

o that use be made of the INTELSAT "Share" project to disseminate educational advice on hygienic food handling to all countries of the hemisphere;

o that Food Hygiene Week be celebrated simultaneously each year in all countries of the hemisphere, that PAHO and FAO coordinate the organization of this event, and that advertising agencies and mass media be asked to provide financial and logistical support to ensure its successful outcome;

o that all countries of the hemisphere include the teaching of food hygiene at an appropriate level in their official primary education programs; and

o that the countries of the Region request the Inter-American Development Bank (IDB), the United Nations Development Program (UNDP), the U.S. Agency for International Development (AID), and other international funding agencies to furnish the necessary financial support for carrying out a Regional Food Protection Training Program (PRAPAL). Such a program should be similar to the Regional Animal Health Training Program for Latin America (PROASA) financed by IDB, and to the Regional Animal Health and Veterinary Public Health Assistants Training Program (REPAHA) for the Caribbean financed by UNDP. Both programs were organized by PAHO some years ago and both have been completed successfully.

INFORMATION, SKILLS, AND ATTITUDES NEEDED FOR FOOD PROTECTION

The lists that follow indicate the information, skills, and attitudes that should be acquired by various professional, technical, and administrative groups through education or training in order to ensure food safety and protection. These lists have been adapted from materials in a book to be published by the International Commission on Microbiological Specifications for Food (ICMSF). The kindness of the ICMSF Secretariat in authorizing the use of the materials in these lists is acknowledged.

Information, Skills, and Attitudes Needed by Hygienists

o Knowledge of the ecology of foodborne disease (FBD), pathogens, and food spoilage organisms, including frequency of their occurrence in different foods

- Understanding of the degree of the risk of transmission of pathogens, chemicals, and natural toxins responsible for FBDs in different foods
- Knowledge of the epidemiology of FBDs, including sources, vectors, and vehicles that contribute to the spread of the various microorganisms and toxic agents that cause FBDs
- Knowledge of clinical signs and symptoms of FBDs
- Understanding of the principles and methods of epidemiology
- Skill in applying appropriate procedures to investigate outbreaks of FBDs
- Understanding of principles of microbiological and chemical examination of foods, and of examination of clinical specimens from humans and animals
- Skill in applying appropriate procedures in collecting food samples, and understanding of the reasons why particular microorganisms or substances should be sought or enumerated in the samples and specimens
- Knowledge and understanding of microbiological and physicochemical criteria to be applied to each category of foods
- Ability to assess the need for chemical and microbiological analysis of particular foods, and to determine through such analysis food safety, hygienic quality, and suitability for human nutrition
- Ability to determine what should be done with foods that do not comply with physicochemical or microbiological criteria
- Knowledge of the technology of food processing and of technology's influence on increasing or decreasing contamination, on the survival and growth of microorganisms, and on toxin production in foods
- Understanding of the principles underlying the prevention of contamination; the destruction, inhibition, and multiplication of microorganisms; and the applications of principles to food processing and service operations
- Knowledge of hygienic design of food processing equipment and plants, and of the importance of such design in the prevention of contamination
- Knowledge of the best procedures for cleaning and disinfecting plants and equipment

- Knowledge of the application of Hazard Analysis Critical Control Points (HACCP) in food processing, food service, and homes, and practical ways to monitor them
- Knowledge of educational technology for training food industry personnel
- Knowledge of sanitary food handling techniques
- Knowledge of food inspection techniques

Information, Skills, and Attitudes Needed by Health Administrators

- Understanding of the economics (risk-benefit ratios) of food control options
- Understanding of the relative importance of the FBD problem or the risk of FBD in relation to other environmental or health problems within the administrator's community
- Knowledge and understanding of the adverse economic impact of FBDs, of the spoilage of foods, and of the rejection of spoiled foods by importing countries
- Understanding of the need for training professional staff and food industry personnel
- Understanding of the principles of FBD prevention and control
- Skill in the application of procedures for evaluating health risks (especially FBD risks) in a community
- Understanding of the need for, and knowledge of procedures for, epidemiological surveillance of FBDs
- Knowledge of the epidemiology of FBDs
- Understanding of the critical importance of inspectional and analytical services in ensuring the supply of safe foods to the population
- Understanding of the importance of an adequately operated national food protection program for the health, economy, and development of the country

Information, Skills, and Attitudes Needed by Food Microbiologists

- Skills in performing food examination procedures for the purpose of detecting and quantifying indicator organisms o Skills in examining samples of foods and clinical specimens from humans or animals to detect microorganisms that are FBD pathogens, and skill in identifying these agents

o Skills in collecting food samples and clinical specimens

o Knowledge of diagnostic procedures for detecting food spoilage problems

o Ability to perform biological tests for microbial toxins and to determine the pathogenicity or diarrheogenicity of microorganisms isolated from food samples or clinical specimens

o Knowledge of biological safety measures to be observed in the laboratory, and the ability to apply them and to teach them to technicians

o Knowledge of and ability to perform the basic quality control procedures of a food analysis laboratory

o Skill in performing procedures to check the potency of antiseptics, preservatives, and detergents, and their applicability within the food industry

o Ability to determine and monitor critical control points

o Ability to interpret results of microbiological tests of food, and to explain them to medical, veterinary, and environmental health personnel and industrial managers

o Knowledge of the ecology of microorganisms that cause food spoilage and FBDs, and of the changes in microbial flora during the processing of foods

o Knowledge of the epidemiology of FBDs

o Understanding and use of biostatistics in analyzing and tabulating results for microbiological specifications

o Knowledge of survey techniques for gathering information on or monitoring the presence of contaminants in foods produced, processed, imported, or exported within the jurisdiction of the microbiologist's laboratory

o Skills in marking microbial strains (e.g., phage-type Staphylococcus aureus or serotype Salmonella) and tracing them during epidemiologic investigations

o Ability and willingness to train inspectors in appropriate techniques for the collection, labeling, preservation, and transportation of food samples for microbiological analysis

- Ability and willingness to teach good hygienic food-handling practices to food handlers through talks and practical laboratory demonstrations

Information, Skills, and Attitudes Needed by Medical Personnel

- Knowledge of clinical syndromes and diagnosis of FBDs
- Willingness to request laboratory assistance with food samples and clinical specimens when the presence of a foodborne disease is suspected
- Ability to treat persons who have an FBD
- Understanding of the significance of raw food as a source of cross contamination to cooked foods, and as a source of infection of food handlers
- Understanding of the epidemiology and surveillance of FBDs
- Understanding of the role of carriers and excreters of pathogens in the transmission and spread of FBDs
- Knowledge of the origin and source of pathogens in food processing, preparation, and serving establishments
- Understanding of the need to report any known FBD cases to health authorities
- Knowledge of procedures for safeguarding the health of workers against the risk of contracting an FBD in food processing and food serving establishments
- Knowledge of action to be taken when a food handler is found to be infected by, or to be a carrier or excreter of, microorganisms that are FBD pathogens

Information, Skills, and Attitudes Needed by Inspectors and Field Personnel

- Understanding of the significance of the presence of indicator microorganisms, foodborne pathogens, and food spoiling microorganisms in various foods
- Understanding of the degree of risk of transmission of pathogenic microorganisms through different foods
- Understanding of the principles of the epidemiology of FBDs, and of epidemiological investigation

- Knowledge of the technology of food processing and of food preparation techniques in various types of establishments
- Understanding of the principles of cleaning and disinfecting equipment and surfaces
- Skills in procedures for collecting, labeling, preserving, and transporting food and for swabbing working surfaces
- Understanding of the principles of food storage
- Skills in assessing the level of hygiene in food processing, retailing, storage, transportation, preparation, and serving establishments
- Knowledge of the relevant laws and regulations, and the ability to interpret them
- Knowledge of the application of the HACCP system to food processing, preparation, and service, and the ability to apply it or monitor its use
- Thorough knowledge of the letter and spirit of the General Principles of Food Hygiene and of the Codes of Hygienic Practice approved by the Codex Alimentarius
- Skills in using thermometers, potentiometers, cameras, magnifying glasses, and other equipment and tools used by food inspectors
- Willingness to respond to inquiries from industrialists and managers of food-selling and food-serving establishments, and to educate food handlers and the public at large

Information, Skills, and Attitudes Needed by Farmers and Breeders of Animals

- Awareness that food hygiene starts while animals are being bred
- Knowledge of and application of sanitary practices on farms and breeding premises
- Awareness of the importance of vaccinating animals, sanitary practices for preventing diseases, and problems that arise when antibiotics, hormones, and similar growth promoters are misused
- Understanding of cleaning and disinfecting practices, and motivation to use them routinely
- Understanding of the need to feed and water animals with clean, uncontaminated (e.g., Salmonella-free) products

- Knowledge of the dangers of the accumulation of manure, and of the means for its use or disposal
- Knowledge of when to stop the treatment of animals with antibiotics or other drugs before transporting them to market
- Knowledge of the safe application of pesticides and parasiticides
- Knowledge of the proper methods for transporting animals to the market or slaughterhouse

Information, Skills, and Attitudes Needed by Crop and Truck Farmers

- Understanding that only potable water should be used to wash and freshen vegetables
- Awareness that fertilizers may contain anthrax spores (from bone meal) and salmonellae, and that it is important to use products free of these pathogens
- Awareness that harvested grains and other foods should be stored in a manner that will protect them from rats and birds
- Understanding that human sewage and animal manure can contaminate crops grown in soil polluted by them
- Understanding that fungus may grow and mycotoxins may form if grains are not properly stored, and that grains in storage should be protected from rain, flooding, or condensation
- Understanding that excessive use of pesticides on fruits and vegetables, particularly at a time too close to harvesting, can result in poisoning of consumers

Information, Skills, and Attitudes Needed by Slaughterhouse and Meat Industry Workers

- Understanding that work must be accomplished under adequate sanitary conditions in order to obtain meat and meat products that are safe for the consumer
- Increase awareness that they are working with food products and the health implications of food handling
- Understanding of the consequences of possible mistakes in the preparation or dressing of carcasses (e.g., that accidental intestinal rupture may lead to

dangerous contamination of a carcass by intestinal contents)

- Understanding and acceptance of the importance of personal hygiene and frequent handwashing
- Knowledge of, understanding of the reasons for practicing procedures for decontamination of knives, other utensils, and work surfaces
- Understanding of the importance of low temperatures in preserving the quality of meat and keeping it safe
- Motivation to cooperate with inspectors and technicians in maintaining the cleanliness of operations and workplaces
- Recognition of the critical control points in the line of processing
- Understanding and acceptance of the need to inform supervisors of any symptoms of disease developed by fellow workers or themselves
- Understanding that they themselves can become infected while working on slaughtering operations or handling meat and viscera, or as a result of close association with animals, and knowledge of ways of avoiding such infection

Information, Skills, and Attitudes Needed by Fisherman and Shellfish Harvesters

- Awareness of the necessity for cold storage of the catch
- Understanding of the need to use containers constructed of materials that can be readily cleaned and disinfected
- Understanding of the need to use potable water for cleaning, conveying, or flushing fish, and the need to cool fish in ice made from potable water
- Understanding that fish for processing must be treated with the same or greater care than fish sold fresh to the public
- Understanding of the hazards associated with harvesting shellfish from closed areas, or any area known to be subject to sewage pollution or sewer outflows
- Ability to identify fish known to be toxic when they are caught in certain geographic areas

- o Knowledge of the hazards associated with harvesting shellfish from waters in which red tides have recently occurred

Information, Skills, and Attitudes Needed by Managers of Food Processing Operations

- o Ability to identify critical control points in operations
- o Skill in monitoring critical control points
- o Understanding of the value of a quality assurance program that includes an HACCP component
- o Knowledge of epidemiologic information about the frequency with which the products being processed become vehicles of FBDs
- o Understanding of the necessity to train and adequately supervise staff
- o Knowledge of processes that enhance hazards of the foods being processed, and of means by which processes can be made safe
- o Concern about the safety of workers, procedures to reduce stress, and the need to provide rest areas, showers, and lockers to enhance morale
- o Understanding of the economic advantage of a food safety and quality control program

Information, Skills, and Attitudes Needed by Workers in Food Processing Plants

- o Habitual practice of good personal hygiene and hygienic food handling techniques
- o Proficiency in performing tasks that ensure the proper processing of foods and that can be used to monitor the effectiveness of the process
- o Awareness of hazards (foodborne disease and spoilage) associated with the foods being processed, and of plant operations that affect these hazards
- o Skill in proper procedures for cleaning equipment
- o Understanding of the procedures, and their necessity, for properly processing foods that are heated, dried, cured, frozen, or fermented, so that safe products result

o Understanding of the need to report to supervisors upon the appearance of diarrhea, infected lesions, a sore throat, jaundice, or other signs or symptoms of illnesses that might be foodborne
o Skills in monitoring appropriate critical control points of operations

Information, Skills, and Attitudes Needed by Personnel Responsible for Transportation of Food

o Awareness of the catastrophes that may occur if adequate safeguards are not taken
o Knowledge of correct practices for cleaning and disinfecting vehicles, especially those parts that come into contact with the products transported
o Awareness of the need to avoid cross contamination between raw and processed foods, and of the danger to foods from toxic materials (e.g., pesticides) that may have been transported previously in the same vehicle
o Knowledge of the time and temperatures necessary to conserve the foods being transported

Information, Skills, and Attitudes Needed by Managers of Food Service Operations

o Knowledge of critical control points for potentially hazardous foods being prepared and stored
o Awareness that health authorities can assist in reducing some health-related hazards and in solving sanitation problems
o Knowledge of the time and temperature exposures of foods that will kill vegetative forms of foodborne pathogens in the food preparations being supervised
o Knowledge of procedures for effectively holding foods to prevent multiplication of foodborne pathogens or spoilage organisms to the point where they cause illness or spoilage
o Understanding of the need to train and adequately supervise staff
o Knowledge of procedures for properly cleaning food service equipment and maintaining cleaning schedules
o Awareness of the dangers of cross contamination from raw to cooked foods.

Information, Skills, and Attitudes Needed by Food Service Workers

- Understanding of the danger of cross contamination from raw to cooked foods, of the need to wash hands after touching raw food, and of the need to thoroughly clean equipment surfaces that have touched raw foods
- Understanding of the principles of heat treatment, hot-holding, rapid cooling, and cold storage as they apply to the destruction of microorganisms and the inhibition to microbial growth
- Understanding of the basic concepts of microbiology, and of how pathogens and spoilage organisms spread and multiply
- Understanding of the need to report to supervisors the appearance of diarrhea, infected lesions, a sore throat, jaundice, or other signs and symptoms of illness that might be foodborne
- Knowledge of procedures for properly cleaning and disinfecting utensils and equipment in order to remove food residues that may contaminate the next batch of food processed
- Understanding of the necessity of and procedures for cleaning and sanitizing cleaning cloths, mops, and buckets
- Skill in applying appropriate and practical procedures for monitoring the safety of foods being prepared, cooked, or stored

Information, Skills, and Attitudes Needed by the General Public

- Awareness that raw foods (e.g., meat, poultry, fish, eggshells, rice) carry pathogens when they enter kitchens
- Awareness that by handling foods that are contaminated, organisms can pass to hands and then to other foods that are subsequently touched
- Awareness that some organisms can be transmitted from raw foods of animal origin to knives, cutting boards, bowls, and pans as well as to other foods
- Awareness that cloths, sponges, and brushes used to clean food-preparation surfaces can transfer organisms

from raw foods to equipment and surfaces that will be needed for cooked foods

o Awareness that everyone can contaminate foods (particularly cooked foods) when the foods are handled during slicing, grating, cutting, or mixing

o Awareness that raw foods of animal origin and leftover chilled foods must be heated to sufficiently high temperatures for sufficiently long periods to kill vegetative forms of pathogens

o Awareness that leaving foods in ovens at low temperatures, at room temperature, or in large containers in refrigerators will allow bacteria to multiply to large numbers

o Awareness that improper processing (e.g., heating) of canned foods, improper fermentation, inadequate concentration of curing salts, or inadequate time for curing have resulted in outbreaks of botulism, and knowledge of procedures to prevent these problems

o Skill in the practical monitoring of the safety of foods being prepared, processed, or stored

REFERENCES

Abdussalam, M., and F. K. Käferstein. 1975. Course in Food Microbiology-Proposed Curriculum. Background paper No. 3 in the BGA/FAO/WHO Informal Consultation on Postgraduate Training in Food Microbiology. BGA (Bundesgesundheitsamt), Berlin. 2 pp.

Allen, R. J. L. and F. K. Käferstein. 1983. Foodborne Disease, Food Hygiene and Consumer Education. Arch. Lebensmittelhyg. 34(4):86-89.

Alvarez Vigil, J. 1983. Principales Problemas Que Limitan la Comunitaria en los Proyectas de Agua y Saneamiento. Pp. 142-152 in Publicación Científica No. 437. Organización Panamericana de la Salud/Organización Mundial de la Salud, Washington, D.C.

Austin, J. H. 1983. Training of trainers. Pp. 88-98 in Scientific Publication No. 437. Pan American Health Organization/World Health Organization, Washington, D.C.

Bryan, F. L. 1974. Training public health workers and food service managers. Pp 405-415 in B. C. Hobbs and

J. G. B. Christian, eds. The Microbiological Safety of Foods. Academic Press, New York.

Elmendorf, M. L. 1983. Women--the underused human resource: Education and training of women for community participation. Pp 174-191 in Scientific Publication No. 437. Pan American Health Organization/World Health Organization, Washington, D.C.

FAO/WHO (Food and Agriculture Organization and World Health Organization). 1976. Guidelines for Developing an Effective Food Control System. Prepared in collaboration with the United Nations Environment Programme Food Control Series No. 1. Food and Agriculture Organization/World Health Organization, Rome. 169 pp.

FDA (Food and Drug Administration). 1972. Proceedings of the 1971 National Conference for Food Protection, Denver, Colo. U.S. Department of Health, Education, and Welfare, Food and Drug Administration, Public Health Service, Washington, D.C. 242 pp.

FDA (Food and Drug Administration). 1984. Proceedings of the Second National Conference for Food Protection, May 9-11, 1984, Washington, D.C. Food and Drug Administration, Washington, D.C. 383 pp.

Gravani, R. B. 1982. Training programs: They need not be boring. Dairy and Food Sanitation. 2:96-99.

Gravani, R. B. 1984. Can video be used as an effective training tool in food protection? Pp. 281-291 in the U.S. FDA Proceedings of the Second National Conference for Food Protection. Food and Drug Administration, Washington, D.C.

ICMSF (International Commission on Microbiological Specifications for Foods). 1978. Microorganisms in Foods 1. Their Significance and Methods of Enumeration. 2nd ed. University of Toronto Press, Toronto. 434 pp.

Mendoza, S. 1971. Colaboración de la Universidad con la industria para el mejoramiento del control higiénico de los alimentos. Pp. 133-136 in J. C. Bacigalupo y E. R. Castro, eds. Conferencias, Simposios y Plenarios del V Congreso Lationamericano de Microbiología. Sociedad Uruguaya de Microbiología, Montevideo.

Ministerio de Salud y Acción Social de Argentina y OPS. 1985. Programa Nacional de Protección de Alimentos (PRONAPAL) Diagnóstico de Situación. Documento de Discusión, Ministerio de Salud y Acción Social, Buenos Aires. 244 pp.

Mossel, D. A. A. 1975. Postgraduate courses in food microbiology. Background paper No. 1 in the BGA/FAO/WHO Informal Consultation on Postgraduate Training in Food Microbiology, BGA, Berlin. 2 pp. with 3 annexes.

OMS (Organización Mundial de la Salud). 1968. Aspectos microbiológicos de la higiene de los alimentos. Ser. Inf. Técn. 399. Organización Mundial de la Salud, Ginebra. 71 pp.

OMS (Organización Mundial de la Salud). 1976. Aspectos Microbiológicos de la Higiene de los Alimentos. Ser. Inf. Técn. 598. Organización Mundial de la Salud, Ginebra. 114 pp.

OMS (Organización Mundial de la Salud). 1984. Importancia de lainocuidad de los alimentos para la salud y el desarrollo. Ser. Inf. Técn. 705. Organización Mundial de la Salud, Ginebra. 86 pp.

OPS (Organización Panamericana de la Salud). 1982. Control Sanitario de los Alimentos. Publicacion Cientifica 421. Organización Panamericana de la Salud, Washington, D.C. 57 pp.

OPS (Organización Panamericana de la Salud). 1983. Simposio regional sobre recursos humanos para el decenio internacional del agua potable y del saneamiento ambiental. Publicación Científica 437. Organización Panamericana de la Salud, Washington, D.C. 268 pp.

Quevedo, F. 1970. Importancia de los programas de higiene de los alimentos en los países latinoamericanos. Pp. 113-121 in IV Seminario de Veterinaria de Salud Pública para Centroamerica y Panamá, Ciudad de Guatemala, 15-19 junio 1970. Organización Panamericana de la Salud, Guatemala.

Quevedo, F. 1975a. Postgraduate training in Food Microbiology in Latin America. Background paper No. 8 in the BGA/FAO/WHO Informal Consultation on Postgraduate Training in Food Microbiology, BGA, Berlin. 5 pp.

Quevedo, F. 1975b. Teaching Activities of the Pan American Zoonoses Center for the Improvement of Food

Hygiene Programs in Latin America. Background paper No. 9 in the BGA/FAO/WHO Informal Consultation on Postgraduate Training in Food Microbiology, BGA, Berlin. 7 pp, with one annex.

Ratto, M. A. 1971. Función de la Universidad en la Formación y Perfeccionamiento de Especialistas en Microbiología Alimentaria. Pp. 141-142 in J. C. Bacigalupo y E. R. Castro, eds. Conferencias, simposios y plenarios del V Congreso Lationamericano de Microbiología. Sociedad Uruguaya de Microbiología, Montevideo.

WHO (World Health Organization). 1976. Final Report of the BGA/FAO/WHO (Bundesgesundheitsamt) Federal Health Office of the Federal Republic of Germany. Informal Consultation on Postgraduate Training in Food Microbiology, Berlin (West), 11-13 November, 1975, Documento WHO VPH/76.1. World Health Organization, Geneva.

TASK FORCE ON
Education and Training

REPORT AND RECOMMENDATIONS

The Conference paper "Problems and Needs in Training and Education in Food Protection in Latin America and the Caribbean" by Fernando Quevedo contains a series of excellent specific observations and recommendations. The Task Force on Education and Training fully endorses these recommendations and urges their implementation. However, specific mechanisms need to be developed for this purpose.

An integrated program in food protection and safety requires in turn a very strong and active program of education and training. Although education and training activities are ongoing at the present time in almost all countries in Latin America and the Caribbean, their frequency, intensity, and focus vary among countries. No food protection initiatives can be successful unless the commitment to education and training is effective and sustained.

Education and training programs in food protection and safety must be designed to increase knowledge and competence in several areas. These are food microbiology and hygiene, the prevention of foodborne disease (microbial, parasitic, chemical, and viral), good food manufacturing practices, and good food handling techniques.

TARGET GROUPS

Education and training programs in food protection and safety must be directed to various target groups involved with foods within the specific activities in the food system. These groups include those associated with plant and animal food production, including basic staples; those whose responsibility is the storage, transportation, and marketing of foods; those involved in processing and packaging; those whose interest is in legislation, surveillance, and quality control; and other government officials concerned with food protection and safety. But target groups also include the public at large and consumers in particular--i.e., all individuals involved in every aspect of the food system from production to consumption. The education and training task is obviously very large and difficult, and will require an aggressive and continued program of specific actions supported by adequate economic and human resources.

A more detailed list of target groups would include:

- food policymakers: government officials, food legislators, lawyers, customs officials, other administrative professionals
- farmers and agronomists
- food inspectors: inspectors of slaughterhouses and meat and poultry processing plants (veterinarians, technicians), inspectors of other food processing plants (professionals, technicians), inspectors of food-dispensing and serving establishments (markets, stores, restaurants, group kitchens, and street vendors)
- food industry workers in large firms, small and medium-sized firms, retail stores, transportation companies, restaurants and institutional food services, food equipment manufacturing, street vending
- laboratory analysts: microbiological and parasitological analysts (professionals, technicians); specialists in analyzing pesticides, mycotoxins, heavy metals, anabolics and other hormones, medication for animals, antibiotics, and additives; food microscopists; instrument repair technicians
- epidemiologists: professional persons in epidemiologic investigations and in the control, surveillance, and prevention of foodborne disease

- teachers: primary and secondary school teachers, university lecturers and instructors
- media professionals: television, radio, and newspaper professionals (writers, directors, producers, reporters)
- consumers: the general public--children and adults.

Other important groups that should receive training and continuing education are those that deal with food protection in disasters and emergencies and those involved with teaching the trainers.

Education and training programs adapted to the subject area of interest and to the specific target group can not only be effective in improving the knowledge and competence in the field but also can be a significant factor in reducing the prevalence of foodborne diseases. They can also be a strong force for sustained implementation of legislation, food laws, and quality control programs.

PURPOSE AND REQUIREMENTS

The task force recognizes that before meaningful education and training programs are designed, developed, and implemented, a thorough audience analysis and needs assessment must be undertaken. Careful consideration must be given to many factors, including the purpose and specific objectives of the training activity (behavior that needs to be modified, motivation techniques to be used), and the nature of the audience (educational background, previous training, experience, cultural orientation, and interest and motivation concerning the subject). Further factors to be considered include the nature of the material being taught (whether it is scientific, technical, nontechnical, or consumer-oriented), the training methods to be used (lectures, group discussions, case studies, role-playing situations, self-instruction, including programmed instruction and home study, computer-assisted instruction, and mass media, such as radio, newspapers, books, and magazines), and the availability of audiovisual aids (slides, filmstrips, films, videotapes, broadcast and satellite television).

The time and frequency of training activity, and the length of training sessions, are also important considerations, as are the availability of training facilities, the availability of financial resources, and the interest, enthusiasm, and abilities of the trainers. There is also a need to evaluate training programs to determine their effectiveness, to determine future training needs, and to assess the requirements for continuing education efforts.

The task force recognizes that in order to improve the chances of dealing successfully with the complex constraints on the development of food protection training programs in the region, there is a need for a monetary commitment by international agencies, and for commitment and strong support by the government and food professionals in each country in the Region. A final requirement is that all channels of communication be used to provide information to facilitate the development of good-quality and effective food protection education and training programs. With the above target groups and requirements in mind, the task force has drawn up a list of proposed actions that embody its recommendations.

PROPOSED ACTIONS

The great need in Latin American and Caribbean countries for food protection and safety, and the lack of communication among interested groups in the various countries facing similar problems, suggest that education and training efforts in food protection and safety should incorporate the following ten actions:

1. convening of a yearly or biannual conference at the hemisphere level for the purposes of presenting research reports and information to promote and develop human resources and disseminate knowledge, conducting symposia on specific areas of food protection and safety, and offering short and specific courses for continued education in food protection and safety;

2. establishing cooperative clearinghouses for the collection and exchange of all kinds of educational and training materials;

3. publishing research reports pertinent to food protection and safety in journals that are recognized and widely distributed in Latin American and Caribbean countries, and when appropriate, adapting such reports and other relevant materials for use in the different national education and training programs;

4. distributing more widely to national laboratories and institutions, and using in training and education programs, the many research reports, laboratory findings, publications of international agencies and organizations, and other information on food protection and safety that are not generally available in the Americas;

5. publishing a food protection and safety training newsletter at the technical level as a means of developing links among groups interested in the problem;

6. utilizing the Society of Food Microbiology Specialists (SELMA) of the Latin American Association of Food Microbiologists to disseminate information on necessary measures for protecting food against microbial contamination, and calling upon SELMA to develop specific training materials for use in the hemisphere;

7. exploring and evaluating, by training professionals, the use of modern communication technologies in food protection and safety training programs;

8. in order to assure that every country has a nucleus of expertise, urging the World Health Organization, the Food and Agriculture Organization, and United Nations University to coordinate their activities and include within their programs support for regional courses and other training opportunities in different aspects of food protection and safety (such support should include assistance with fellowships, training materials, and trainers, and it should be noted that the contributions of the International Trade Center would also be valuable in this regard, as would bilateral assistance in training);

9. urging the United Nations University to give priority to interdisciplinary food protection and safety

students from Latin America and the Caribbean in its program of fellowships for advanced training; and

10. strongly promoting adequate compensation and attractive work conditions for food protection and safety professionals in order to avoid the loss of expertise to other activities.

Computer Possibilities in Food Protection and Nutrient Composition: Similarities and Contrasts

JOHN C. KLENSIN

SYSTEM STATUS OF NUTRIENT COMPOSITION DATA

Many computer systems have now been written to store, retrieve, and manipulate data about the nutrient composition of foods. Few of them are able to deal effectively with the interchange of data between regions or countries with radically different eating styles. But the most serious problems encountered in using these systems concern overspecialization to meet the needs of particular installations. In some institutions, food composition and dietary analysis systems are being redeveloped and reimplemented for the second and third time. In a few cases, these changes are occurring because of perceived inadequacies in older versions. In most, the stimulus is a desire to make more use of desktop computers, rather than the larger, shared machines for which previous systems were developed.

Whatever the impulse for second and third generation implementations, one of the effects is that the newer systems reflect--and respond to--the perceived inadequacies of their predecessors. If the earlier system was seen as having a particular problem, the successor usually has that problem fixed. However, many perceived inadequacies are very local and specific to the institutions developing or using the programs: difficulties with particular data being considered, particular questions being asked, particular habits of programmers or users. Another set of institutions, with different idiosyncracies, might not perceive the same problems. This can result in highly developed systems becoming very specific to the needs of a single institution. Since a given food composition or nutrient analysis system is typically used only by a single installation or small number of installations, however, such local adaptation is appropriate, even though it makes the programs less useful for other installations.

These programs obviously do not operate completely in isolation. While the capabilities that they make available, and the way in which those capabilities are made available (the user interfaces), differ from program to program, the data being used tend to be quite similar from institution to institution. At least within a given small part of the world, the foods are much the same, the compositions of those foods are broadly much the same, and most systems contain the same values from the same published tables. One result of all of this is that the issues of national and international interest arising out of these data systems have to do primarily with data interchange--how data should be organized in national or regional repositories and made available to distributed and individualized systems.

Even data interchange is likely to be an infrequent event as far as any given system is concerned. Since new food tables are not often issued, the data do not change frequently. Even when new data must be obtained and integrated into an existing system--whether those data originate from new measurements in a country of long-term interest or from a new set of interests--there are likely to be periods of many weeks or months in which to obtain and convert the data for the local system. With so much time available, data communications technologies are not important, since the use of cards or tapes and the postal system is usually quite practical.

The data themselves are usually fairly long term. They are chosen, and put into food composition tables, to be representative values for the foods encountered in a particular country or other area over some time. There is rarely, if ever, a need to understand or tabulate the composition of the grain aboard a particular ship, or the watermelons from a particular state in a particular year. Indeed, one of the more important efforts now under way in the use of nutrient composition data is the refinement of sampling procedures--refinements designed to eliminate sensitivities in the data that result from exactly such specific measurements.

THE JOINT PROBLEM

The apparent information systems needs in the fields of food protection and nutrient composition do overlap in several significant ways. Perhaps the most important of these has to do with what we have come to call "terminology." Terminology involves the whole series of questions that, in combination, determine how we should name or classify foods so that people from separate countries (or different groups within a country), when carrying on a discussion, can know that they are talking about the same products. In discussions of nutrient composition data and, I presume, food safety data, terminological difficulties become especially acute when a given name is used to describe quite different foods or recipes in different places.

So far, the International Network of Food Data Systems (INFOODS) investigations as well as one interpretation of the longer experience with animal feeds in the International Feed Composition (INFIC) system, indicate that there are no easy solutions to the terminology problem. It is probably impossible to reach agreement on a naming scheme that will uniquely identify particular foods for all purposes, if for no other reason than that specific purposes determine when two samples are, or are not, the same food. It appears that a standardized system of classification and description is the most that is both possible and worthwhile.

SPECIAL PROBLEMS IN APPLYING COMPUTERS TO FOOD PROTECTION

Computer systems design for food protection, if computers are needed in this area at all, depends critically on what experts in the field conclude is needed. It is not only premature to discuss computers and computing before those needs and the associated priorities are decided upon, it is dangerous. (See discussion under "Systems Considerations in the Design of INFOODS" later in this chapter.) The development of computer-based systems, once started, tends to acquire a momentum of its own that dominates considerations of both requirements and users unless those requirements are well established before the computer development begins. No computer or data base expert--even one having extensive experience with nutrient composition data bases--understands nearly as much about the requirements for food protection information as people whose major professional involvement has been in the food protection area. Unlike the situation a dozen or more years ago, computer and communications technology today exists for doing almost anything that would make scientific or administrative sense. Even though some technological options may be much more expensive than others, the best strategy is almost certainly to determine what is required, without making assumptions about feasibility or costs, then to bring in the technical people and make adjustments as needed.

At the same time, it seems fairly obvious to someone not familiar with the food safety field that there are some issues that should be studied very carefully in determining what the needs are. For example, if there are concerns about keeping track of contaminated foods moving between countries, agreements about how to identify ships and airplanes may be as important as agreements about how to identify foods. Even more important is the question of how the required information should get from one country to another, for in this case (unlike that involving nutrient composition systems) there is not the luxury of being able to wait several weeks for information to arrive.

Electronic communications tend to pose more difficult problems, and problems that take longer to solve, than computers and data bases. Whatever the problems with electrical power, air conditioning, operations, and so forth, a computer ultimately needs only to be placed in an appropriate location, plugged in, and turned on. Electronic communications--whether by telephone or Telex between people or by network or dedicated line or channel between computers--require that the needed lines, cables, or satellite channels be laid or arranged for, and that they operate with an adequate degree of reliability. Meeting these requirements can take a great deal of time. Consequently, it is important that communication needs be assessed in some detail, that adequate technical advice be obtained, and that efforts are made to ensure that arrangements are made in a timely fashion.

Similarly, while it is possible to maintain multiple copies of a data base on foods--for use in different countries, for example-- and to keep those copies simultaneously updated every time a ship leaves port (using technology developed for, e.g., airline reservation systems), to do so is a very complex and usually costly undertaking. Such a system should be designed and built only if it is really needed, and should not be considered if an alternative, such as a reliable Telex network for broadcasting specific warnings, would suffice. In this regard it is worth stressing that until there is the best possible understanding of what is needed from a public health standpoint, there are advantages to avoiding computer vendors and experts who, out of self-interest and artistic preference, very much like to sell or build complex and distributed computer systems and networks.

SUMMARY OF GENERAL CONSIDERATIONS

At this time it is premature to discuss details, or even broad outlines, of computer systems for food protection within the Pan American health community. Such discussions tend to divert attention from important issues, such as what is really required, by whom, and how rapidly, in order to maximize public health benefits. The information system questions that are likely to be most important in the medium term are associated not with data storage and processing, but with the adequate, reliable, and smooth communication of information and warnings between countries. While the need to determine actual requirements is the same in the data communications area as in data storage and computation, the lead times and range of available alternatives of the former argue strongly for early decisionmaking and the early involvement of experts from that field.

SYSTEMS CONSIDERATIONS IN THE DESIGN OF INFOODS

The International Network of Food Data Systems (INFOODS) was organized in 1982 as a global collaborative of people and organizations interested in working toward improving the amount, quality, and availability of food composition data. Currently it is focusing on the development of standards and guidelines for (1) the terminologies and nomenclatures used in describing foods and food components, (2) the gathering of food composition data, including sampling, assaying, and reporting procedures, and (3) the storage and interchange of food composition data.

INFOODS is coordinated by a small secretariat, based at the Massachusetts Institute of Technology, which has responsibility for initiation, coordination, and administration of international task forces to work on specific problems. In addition, this secretariat serves as a resource for, and clearing house for information about, food composition activities around the world. INFOODS works with, and is organizing where necessary, regional groups throughout the world. These provide information and assistance for food composition work in their geographic areas. INFOODS presently is funded primarily by the U.S. Government and is administratively supported by the United Nations University. Following is a discussion of the special systems considerations that have arisen during the design and development of INFOODS.

It is generally assumed that the major product of INFOODS will be one or two integrated computer systems for nutrient and nutritional data. In terms of both technical problems and the requirements of different groups of users, that goal presents serious challenges. It is useful to review those challenges and the reasons why a different strategy may be in order.

Technical problems and user requirements may be seen as challenges because they involve questions for which we don't know the answers, as well as several for which, at this point, we probably do. The validity of our belief in the answers we have depends on whether certain analogies hold between systems for management, recording, and analysis of nutrition data and those for other types of data--especially statistical and social measurement data--and the scientific application of them. In addition, a recurring theme in systems design is that large systems usually involve complex choices for which there are few "correct" answers. Instead, there are many trade-offs in which the needs and preferences of one group are optimized at the expense of others. Making these choices explicitly and with an understanding of their implications, and remembering far into the future the reasons for the options chosen, tends to promote better systems--systems that are both more internally consistent and consistent with their avowed goals. The inevitable other side of making explicit choices that are remembered is that as time passes, some of the decisions will turn out to have been wrong. As a result, one of the major challenges--almost a metachallenge--is designing for damage containment to ensure that a few wrong decisions do not result in the total uselessness of the system or the need to rebuild it from scratch. An understanding of how the wrong decisions were reached contributes to containment of damage.

One of the questions that is not important is that of "personal" versus "large" computers as ends in themselves. There can be specific reasons for choosing smallish machines--cost, space, even the psychological advantage of being able to pull the thing's plug if it behaves offensively; and there are also some reasons for choosing large ones (or complexes of small ones)--economies of scale, the ability to retain large data bases of foods or consumption histories, convenient sharing of information among scientists. But in discussing the reasons for choosing a machine, we should not get involved in debate about the relative merits of small and large computers. It is especially important to avoid that debate because the use of some mixed strategies, in which different equipment is used for different operations, may be the best overall strategy given the present state of the art.

Before discussing the issues, challenges, and problems involved in trying to construct integrated systems, the question of why such systems should interest anyone should be considered. Small nonintegrated systems have several advantages. They are typically cheaper to build and easier to maintain, and they do not require large team efforts over a long period. Perhaps as important is one of the major discoveries of the microcomputer revolution--that considerable "friendliness" is a characteristic of machines that are not very capable.

When capability is limited, it becomes possible to list all the commands, to list all the options, and to provide clear error messages that identify all choices. In other words, a message such as "No, you cannot type that answer, you must use one of the following three" is a reasonable and possible option. It is neither reasonable nor possible if there are tens of options to a particular command. Nor is it feasible to respond to an inquiry about what a command is called by listing all commands when there are several hundred from which to choose. The limited environments of small and unintegrated systems also tend to make them comparatively easy to document.

In this paper, large-scale systems are assumed to be groups of programs that provide a more-or-less common face to users, that permit free movement of data and intermediate results between different commands or other program components and analyses, and that let the user determine the order and content of both analyses and display formats. Such assumptions make the large-scale system a different type of object, rather than just a larger one, from most traditional program packages or packaged programs.

If one can figure out what is to be done with the data and what analytic and accessing capabilities are needed, it is often easily possible to design a collection of separate programs--several medium-sized programs or small-scale systems--for quite different purposes and users, and with different interfaces, to operate from a single data base. In terms of the complexities of getting the data base design right, that type of arrangement raises the same issues as the large-scale system, but is much easier from a software design standpoint. And the individual programs may be much easier to get onto a small machine than a complete large-scale system would be. So that is one of the alternatives to be considered.

A potential advantage of large systems is that they should be able to provide a user more flexibility. At their best, they contain a wider resource base--more tools that can be applied--for most situations. If designed well, they should have a longer life expectancy than smaller systems because they can be extended more and can be used in more innovative and creative ways, including ways not anticipated by their designers. Larger systems can support a wider variety of models and analyses and, consequently, permit comparisons among techniques. Such additional analytic capabilities are usually supplemented by facilities for handling large or complex data sets that are beyond the capabilities of a smaller system.

Most of the issues raised in this paper apply to smaller systems as well as larger ones, but become much more important as systems become larger. The would-be developers of a large system must consider these issues in the early design stages to avoid severe problems later on. The major challenges are easily stated: planning and designing what the system is to do and how to implement it and then testing those ideas. Also essential, although seemingly obvious, is that resources adequate to the task be available not only at the beginning but also over a long enough span to do the entire job. The best long-term strategies, which tend to focus on the building of tools and prototypes and the conduct of experiments before a final commitment is made to a strategy, tend to be poor short-term ones from the standpoint of sponsors or agencies looking for results. The fear of ending up with only a prototype when the resources run out has prevented many prototypes from being built, and as a result, many problems have occurred in production that would have been easily identified and eliminated in prototype experiments. The resource issue will not be addressed here, except to note that tasks usually take much longer and cost much more than expected.

It is also worth noting that a very large fraction of the time and cost overruns in computer-system building and programming can be attributed to lack of clarity about what the goals are, what users are to be served, and what facilities are to be incorporated. Clear thinking, careful analysis of user requirements and constraints imposed by the users (as distinct from ones imposed by real or imagined technical considerations) and careful design consistent with that thinking and analysis are usually richly rewarded, and the failure to perform such thinking and analysis is equally richly punished.

Staff Turnover and System Growth

The planning of large systems requires consideration of a future in which most of the members of the development group will change by the time the system is in active and productive use. By the time the system is ready for demonstration, much of the development staff will have departed, although the designers may well still be around. This implies that careful attention must be paid to how additions and modifications to the system will be made and how the system will be extended in the future either by the users or the design group. For the typical system design, there are benefits from building special tools to aid in system construction, integration, and testing. It is often useful to expend some effort to define and delimit the framework of the proposed system--its boundaries, fundamental structure, and relationship to the outside world. How much time and effort can and should be spent in these areas becomes another critical choice. This choice is complicated by the knowledge that what is appropriate for a central staff to do in developing a system may not be appropriate for a staff later on (especially one that is administratively or geographically disbursed) and may not be appropriate when users try to create their own extensions.

Documentation

The question of how to document a large system is a key one that should be addressed early and as part of the planning of the code and user interfaces. One approach is to provide comprehensive documentation; but comprehensive documentation may run into thousands of pages as the system grows (NAG, 1983). Such volume will almost certainly lead to complaints about size and bulk, comments about needing wagons rather than binders, and requests that everything be distilled onto cards that can be put into pockets and purses. Standards about information to be included in documentation--algorithms (Berk and Francis, 1978; Muller, 1978; Francis et al., 1975), error messages, and the like as well as sampling information and methods of analysis--make such volume inevitable; a mere 4 pages of description on each of 500 commands leads to 2,000 pages of documentation. On the other hand, documenting a large system as if it were a small one, adopting pocket cards or brief on-line files as the only form of documentation, or in some other way trying to keep the total under 100 pages will cause user frustration or worse. These are questions that do not have clear answers, but making choices early and clearly and remembering the reasons for the decisions that are made can help. At the same time, these decisions, like others discussed throughout this paper, should be made in a way that minimizes the damage if the world appears differently at some time in the future.

Selection of Environmental and Basic Tools

Almost any applications system that one might build today will exist in some environment over which the system developers do not have complete control. The days of writing codes in absolute binary and keying them in from the front panels of machines have departed, some recent excesses in the microcomputer community notwithstanding. Potentially, this means that choices must be made about what environment will be established to develop and operate the system--choices about hardware, operating systems, and languages. In many cases, the possible choices are so constrained by circumstances as to be trivial or nonexistent. Worse, the constraints often arise from circumstances that have nothing to do with the requirements or the intentions of the new integrated system, and will often lead to choices that prove grossly unacceptable. The two sections that follow are provided for the reader who has the luxury of making choices; for the reader who does not, these sections may be helpful in anticipating problems where choices are more constrained.

Selection of Operating Systems

In an ideal world, the operating system chosen for any applications system is one that is smart, flexible, and state-of-the-art, and that operates on powerful, inexpensive, widely available hardware. In addition, the operating system must be utterly stable, so that applications development does not involve aiming at a moving target. These attributes almost never exist in combination. Advanced and state-of-the-art systems are typically kept that way by continual revision or frequent releases. Each revision will "improve" the environment in ways that more or less significantly undermine existing work. Applications system developers can gain control over such changes by developing and maintaining their own operating systems, but the price for doing so is usually too high. Systems should be selected to reach a reasonable balance between sophistication and modernity on the one hand and stability on the other. Once the selections are made, software design criteria should include the ability to keep the stable interface that end-users will insist upon; for once they get used to a system that is even moderately satisfactory, they are likely to strongly prefer it to any other, even those that are objectively better (whatever is meant by "objectively"). It will be expected that stability will be preserved even when the supporting operating system is changed.

Selection of Programming Language

The selection of a programming language (or a set of languages) usually follows that of an operating system. While there have been cases in which an operating system was chosen because it supported a particular language, such cases are rare. All things being equal, systems that can be built entirely in a single language are much easier to cope with than those that require two or three. If nothing else, use of a single language makes the management task easier, since few programmers are equally comfortable and efficient in several languages at the same time; just as with natural languages, it is difficult to "think" in more than one language concurrently, regardless of what one can manage at separate times or in different places.

Unfortunately, from the language standpoint, operating system requirements involve procedures for data entry and recording, for locating and aggregating data, and for doing statistical computations on surveys and constructing food tables. Historically, almost all good software for screen management and data entry support has been created in or for COBOL or PL/I. By contrast, almost all the research and development work in numerical algorithms has been done in FORTRAN and ALGOL-60. While FORTRAN and ALGOL are quite suitable for computational codes, they are not suitable for systems work unless machine dependencies, assembly language subroutines, and other forms of idiosyncratic and incomprehensible code are introduced. COBOL is terrible for systems work and not much better for numerical computation. The languages that are very good for systems work tend to be poor or untested, or both, for serious computational work. While there are two possible exceptions, both are very large and complex as languages go, and there are allegations that they are very clumsy and hard to learn; furthermore, they tend not to appear very often (at least in complete form) in microcomputer implementations.[1] The alternative--writing in assembly languages rather than relatively high-level ones--leads to nothing but trouble, and should not be seriously considered in building a large system with a long life expectancy.[2]

User Interface

The user interface for a system includes not only how users will communicate with the system but also how the system will communicate with users in normal and error situations and how output will be formatted and presented. There are many opinions about each of these issues, and none is completely correct for all audiences. Every user interface decision is problematic. This paper cannot hope to provide a complete discussion of the issues; the examples that follow are intended to convey the flavor and difficulty of the challenge.

If a single user-level language is chosen and imbedded in the system, the choice must be correct for all present and--as important--future audiences. Interfaces that adapt automatically to the characteristics of individual users and their growing knowledge of the system are a major research area today. Where such adaptation is possible, it complicates documentation in two ways: for the users themselves and for those who are expected to understand the processing and analysis activities of others. If one can design language for the system around the particular needs of the users to be served, be they the builders of food tables, epidemiologists, or hospital dietitians, much convenience may be gained for the users, and their learning and use of the system may be expedited.

At the same time, such language design may require a great deal of learning on the part of users with other backgrounds or interests.

If, instead, the needs of several different types of users are to be supported, the system will end up with multiple languages and interfaces and all of the inconsistency and unpredictability to which that leads. Since large, diverse systems attract people with diverse needs and backgrounds, there are no easy solutions--but this may be another argument for not building such systems at all.

One popular solution, at least hypothetically, is to try to use a natural language, such as English, as the means of instructing the system. Because of advances in the technology in the last few years, this is probably a feasible option, although it entails considerable difficulty in design and implementation. Significant difficulties are presented by the degree to which natural languages lack compactness of form and absolute clarity, which is why mathematical and other symbolic notation is used in statistical work. One of the greatest difficulties in using natural languages is getting people to understand them unambiguously.

All the preceding comments on user interface apply to picture languages, pointing languages, and even shouting-at-the-computer languages just as much as they apply to typed commands. One can either optimize for a particular group of users and leave everyone else somewhat inconvenienced and unhappy, or one can try to find compromises somewhere.

The actual mode of communication between user and system is almost a separate issue from that of the language used in the communication process, although some choices in this area can constrain, or remove constraints from, language choices. User-oriented menus, help systems, command completion systems, and question-answering are good choices for the novice; it has been argued elsewhere (Klensin, 1981) that they have a tendency to become seriously defective for regular and experienced users. Many of the most interesting and sophisticated of the less traditional approaches to human-computer interfaces rely on specialized hardware that may prevent their application in many specific implementations.

One useful alternative to a single, firm choice of interface is to design "agent" facilities so that the system can easily support programs--both system- and user-provided--that run other programs on behalf of the user. Agents may be useful for supporting alternative command formats and presentations, default arrangements, and a choice of interfaces such as menus or question-asking. They are also a convenient framework for system extension facilities for use by the relatively casual user (Dawson and Klensin, 1980), and they appear to be well suited for building systems analogous to expert or assistant ones. By contrast, while they can be used to provide conversational or menu-driven environments, or those that require screen inputs, they tend not to work well or to be difficult to support when the underlying environment has any of those characteristics. These drawbacks impose some major constraints on system organization.

The difficulties and choices found in user communication with the system are paralleled in system communication with the user and with output presentation. The design of all formats around a 24 x 80 character display can be a severe limitation, especially for plots and graphics. Worse yet in this day of stress on interaction is the design of output for the line printer, with its headers and footers and its long and wide pages at low resolution. At the same time, there are still many analysts who prefer working with piles of paper to sitting at terminals; articles and food tables will probably be published and used on paper for a long time to come. Designs that depend on high-resolution graphics devices will exclude the many users who will be unable to pay the price of entry to the system. Almost any solution will either make some class of potential users very unhappy or will limit the groups and types of users who can be served. Thus it is very important to make decisions early and explicitly and with an understanding of whose happiness is being considered and whose is being sacrificed.

Data Representations

Most integrated environments make use of some kind of file system to retain information--a worksheet, a special system file, or even a full data base management system. In addition to providing a compact way to save information during and between sessions, these files can be used as the mechanism by which all commands for users, other than those intended to read raw data into files and display the contents of files, communicate with each other and with the users. In other words, computational commands do not read, clean, or process raw files, nor do they print results. Having commands work this way ensures (given adequate data representations) that any command can use the outputs of any other appropriate commands as inputs. That level of compatability will apply to commands written in the future, as the system is extended, as well as to those designed initially. This type of strategy is also complementary to agent strategies and to primitive tool-based systems (discussed below).[3]

As a system-building approach, such strategy has a long tradition in statistical and social science computing (Buhler and Buhler, 1979; Culler and Fried, 1965). At the same time, many users find it inconvenient (unless it is hidden) for trivial sets of operations. It also leads to inconvenience and unpredictability when one discovers, late in the life of a system, that the data representation forms are inadequate, that there is no mechanism for cleanly extending them, and that the only practical solution is to have some commands that simply print results. In the recent past, for example, some statistical systems have run into major difficulties as the requirements of new or proposed procedures forced a choice between moving from columns and data matrices to symmetric matrices and multidimensional arrays on the one hand and, on the other, deciding that some routines should display results that could not be captured in the file system.[4] To a degree, the more heavily the system relies on a single fixed set of data structures, the more dependent it becomes on the correctness of those data structures and file representations; such dependence amounts to a negative technical aspect of the approach. So once again there is a challenge in trying to make the right decision--in balancing the compatability advantages against convenience for trivial tasks and against the risks of having to use a mixed strategy or make a major redesign if the data representations are not adequate to future developments. There are some alternative methods for data conversion, such as globally changing all files, for data conversion, that would not exist in an integrated environment. However, the risks of making a conversion of broad scope would be a threat to the integrity of multiple independent programs operating off a common data base or data representation as well as to a more structured system.

System Architecture and Linkages

As systems become large, basic issues of organization assume an importance of their own. As long as the total size of the system is much smaller than the effective size of the machine, one can be fairly cavalier about simply putting things together and running them. But with very large systems, new issues arise as to how the codes are to be accommodated on the machine. Depending on the size and characteristics of both the system and the machine, the consequences of trying to ignore the impact of size may be as gross as vastly increased costs or inability to run at all, or as subtle as slightly reduced performance or response. Independent of what the host machine or operating system look like, it is generally desirable to keep as low as possible the host system's perception of how large the applications system is in operation (the working set). At the same time, the user's perception of application system size should be one of a vast and growing collection of capabilities and functions. While the user will be happy to see more facilities in the system, that happiness will disappear quickly if the presence of additional facilities causes last year's task to operate more slowly or at higher cost. A system may be thought of as having two separate "sizes"--one determined by the machine resources required to execute its individual programs and the other determined by its total extent when stored. If a system has many and diverse capabilities, no single user is going to use more than a small fraction of the system on any given day or even in one lifetime. As a result, the first of these measurements (the machine resources) must depend on what the user is doing in a particular session--the programs being run--rather than on the total system size (the second type of measurement). Very few operating systems provide facilities that make this easy, and simulating it in an application is quite difficult. An application can simulate it, however, and a few existing systems and packages have managed to do so, but it is not to be taken lightly and requires an intimate understanding of the operating environment that must be tricked.

An application that provides linkage facilities that depend only on what programs the user asks for, as they are asked for, has several advantages in addition to keeping the bills down, the performance up, and the machine requirements at a minimum for the user's application. Among the most important of these is the ability to employ user-supplied codes to supplement system facilities without having to create private copies of the system or major components of it. Such copies are a liability, not merely because of the costs or inefficiency they entail and the burdens they place on the user, but because they promote retention of ancient versions of systems and codes and subsequent conversion problems.

Very large virtual memories may provide some of the facilities that will help to trick an operating system into behaving well when confronted with large systems, but they are not in themselves a solution. Misuse of such memories can introduce severe performance degradation. The major benefit of large virtual memories, in addition to programming convenience, is that as application size limits are reached the system degrades more or less gracefully; in the absence of virtual memories, the same situation leads to catastrophic system collapse. The goal and the challenge should be to avoid both alternatives, especially when the amounts of software and data actually being used fall well within the host system's natural limits for application sizes.

Stability

Stability is very important if the system is to be large and to have a long life expectancy. The problem is similar to that of advanced operating systems: the developers and their staff want things to be better, current, and as sophisticated and clever as possible; programmers want a completely stable interface (this is especially true of those amateur users who write a little code to add one small facility to the system to make it perfect for their purposes). Users also believe that they want commands and results that are predictable: what worked last year should work today in exactly the same way. On the other hand, they also want the programs, algorithms, functional capabilities, and data to reflect last month's journal article. Of course, only the developers see incompatabilities among these objectives.

An obvious possibility is to make it a rule that a routine, once installed under a particular name, has the same behavior forever and that new things or new versions of things must have new names. This is an easier approach to apply to a subroutine library--especially a subroutine library from which users are permitted to copy and imbed "obsolete" routines that have been replaced by newer ones with different names[5]--than to a major integrated collection, where such an approach requires a great deal of discipline on the part of the maintainers and tolerance on the part of the users. Unless the architectural and linkage problems have been solved exceptionally well, the accumulation of semi-obsolete codes will also cause degradation and high disk costs much sooner than if the growth of the system resulted from an extension and replacement strategy alone.

While the stress here has been on programs rather than on data, the problems with data are quite similar. The ability to reproduce an old result may require that the associated data be retained forever (or nearly so), even when it has been found to be out of date or substandard. There have been a few cases in which users have rather carefully built procedures to compensate for data inadequacies that they were aware of, only to have their procedures produce seriously incorrect answers when the original data values were replaced with "corrected" ones. There are strong arguments for being able to associate particular vintages of data with particular analyses or studies, but such requirements impose great difficulties on the system's design and its human managers. So the data and program problems are not very much different after all.

Primitive Tool-Based Systems

Many of the problems--with programs if not with data--that have been discussed here can be avoided by designing a system around primitive tools that provide no more facility than what is necessary for a user to put things together to produce the computations needed. Such a system provides adequate facilities for the right user, tends to be very extensible, and can typically be kept very small in spite of being integrated and powerful. Most important, such systems are conceptually very simple. However, they do tend to be disastrous for unsophisticated users, and even sophisticated users spend too much time fussing around with the tools themselves. In a rich environment, that fussing often has more to do with the process of moving objects back and forth--looking for tools to make square pegs fit round holes--than with anything substantively interesting. Furthermore, all other things being equal, systems of primitives tend to be slower in operation than higher-level integrated systems and are sometimes so slow that they result in poor response rather than merely poor resource consumption. Nonetheless, such an architecture may be a reasonable choice for some audiences.

Summary of Large Integrated Systems

The critical challenge in developing a large integrated system is the same as the critical challenge in developing any system: figuring out what the real goals and requirements are and what is to be sacrificed in order to get there. The costs, complexities, and additional problems that arise when systems become very large, or when the integration requirements become more stringent, are sufficiently major that the decision to build such a system should be justified on the basis of real requirements.

Once the decision to build a large and integrated system has been made, and the necessary resources for planning, building prototypes and tools, examining design issues, and actually building the system have been secured, the short-term implications of a variety of questions that really make sense only in the long term must be considered. Each of these questions and issues poses a significant challenge for which there are no clear answers that are right for all cases. Those discussed in this paper that directly affect the development process itself include the choice of the operating base and language of implementation, organization of the system, and the management and accommodation of stability and growth over time. More user-related issues include documentation, command languages, presentation and output, and extention of the system when needed. A final design concern is how to contain damage resulting from incorrect decisions, which are inevitable no matter how much care is taken. The challenges are nearly overwhelming, but can and must be met.

NOTES

[1] The two languages are PL/I and the U.S. Department of Defense's new high-level language, Ada (Ada is a registered trademark of the U.S. Department of Defense). The pros and cons of each are highly controversial in the computer science community and are beyond the scope of this paper. The claim that they might be useful for both machine-independent systems work and for computation is based on the explicit design criteria for both languages, which include that type of mixed application use. PL/I is much more widely implemented than most people realize, but while data base and screen (forms) management programs have been developed for it, few statistical or numerical algorithms have been (algorithms from ALGOL-60 translate rather easily). Complete implementations of Ada have not yet, as of this writing, been tested in serious production computational use, regardless of the impressions that the popular computer press may have created.

[2] There is a third alternative in languages like BCPL, BLISS, and C, which are really medium-level, nearly machine-independent assembly languages. For serious applications, as distinct from systems work, they can be nearly as bad as assembly languages and for much the same reasons.

[3] The "pipe" approach used in the UNIX system is an alternative, but a less desirable one. Using the notion of files described here permits "strongly typed" and complex representations; pipes do not.

[4] There have been several situations in which systems have been reorganized in major ways internally--thereby requiring users to convert data sets--in order to try to cope with these problems as they unfold. Naturally enough, the problems tend to be buried as much as possible rather than being cited explicitly in the literature.

[5] Giving improved routines names that differ from those of the incompatible routines they replace has been a long-term IMSL strategy (IMSL, 1975).

REFERENCES

ANSI X3.23-1974. American National Standards Institute. American National Standard Programming Language COBOL, ANSI X3.23-1974. Revision (ANSI BSR X3.23-198X, June 1983; ISO DP 1989.2) undergoing public review, fall 1983.

ANSI X3.53-1976. American National Standards Institute. American National Standard Programming Language PL/I, ANSI X3.53-1976. Equivalent document approved by ISO, as ISO 6160-1979.

ANSI X3.60-1978. American National Standards Institute. American National Standard for Minimal BASIC, ANSI X3.60-1978.

ANSI X3.9-1978. American National Standards Institute. American National Standard Programming Language FORTRAN, ANSI X3.9-1978. Equivalent document approved by ISO, as ISO 1539-1980.

ANSI X3.74-1981. American National Standards Institute. American National Standard Programming Language PL/I General Purpose Subset, ANSI X3.74-1981. Equivalent document approved by ISO, as ISO 6522.

ANSI X3.113-198X. American National Standards Institute. 1983. Proposed American National Standard Programming Language BASIC, ANSI BSR X3.113-198X, 1983.

Berk, K. N., and I. Francis. 1978. A review of manuals for BMDP and SPSS. J. Am. Stat. Assoc. 73:65-71.

Buhler, S., and R. Buhler. 1979. P-STAT 78 User's Manual. P-STAT, Princeton, N.J.

Culler, G. J., and B. D. Fried. 1965. The TRW two-station, on-line scientific computer: general description. Pp. 66-67. M. A. Sass and W. D. Wilkinson, eds. Computer Augmentation of Human Reasoning. Spartan Books, Washington, D.C.

Dawson, R., and J. C. Klensin. 1980. User extensions to statistical software. Pp. 332-334 in American Statistical Association Proceedings of the Statistical Computing Section.

DOD (U.S. Department of Defense). 1983. Reference Manual for the Ada(R) Programming Language, ANSI/MIL-STD-1815A-1983.

Francis, I., R. Heiberger, and P. Velleman. 1975. Criteria and considerations in the evaluation of statistical packages. Am. Statistician 29:52-56.

IMSL (International Mathematical and Statistical Laboratories). 1975. IMSL Library 2 Reference Manual. International Mathematical and Statistical Laboratories, Houston.

ISO (International Standards Organization). 1983. International Standard Programming Language--Pascal, ISO 7185, 1983. Also published as in the United States as ANSI/IEEE770X3.97-1983 and in the U.K. as BS 6192-1982.

Klensin, J. C. 1981. Short-term friendly and long-term hostile? Paper presented at the Conference on Easier and More Productive Use of Computer Systems, Ann Arbor, Mich., May 20-22, 1981. Reprinted in SIGSOC Bull. 13 (2-3, January 1982):105-110.

Muller, M. R. 1978. A review of manuals for BMDP and SPSS. J. Am. Stat. Assoc. 73:71-80.

NAG (Numerical Algorithms Group). 1983. NAG Fortran Library Manual, Mark 10. Numerical Algorithms Group, Oxford.

TASK FORCE ON Information Systems

REPORT AND RECOMMENDATIONS

THE OPPORTUNITY FOR AND INITIAL STEPS TOWARD INFORMATION SYSTEMS

Rapid advances in computing and telecommunications technology are providing unique opportunities to support food protection initiatives in the countries of the Americas. Technology is no longer the limiting factor. The hardware and software exist today and are constantly improving and becoming less expensive. These are providing the tools to effectively collect, store, retrieve, analyze, and exchange the relevant information to improve food safety. What is lacking are the human and financial resources required to design, develop, and put into use the necessary information systems. The development of an international network of food protection information systems is ambitious, but not impossible. It will require an overall master plan entailing a stepwise approach to development based upon agreed priorities and available resources.

The development of effective information systems to support information exchange is greatly complicated by the diversity of immediate information needs, governmental policies, and administrative infrastructures, and the resources available in different countries. Some of these problems are being overcome in related fields by the establishment of international standards and cooperative efforts. An example is the International Feed Composition (INFIC) data base; another is the International Network of Food Data Systems (INFOODS), which will establish regional centers for the integrated computer storage and dissemination of data on the nutrient and nonnutrient composition of foods. The experiences and precedents established in the global effort to develop INFOODS are directly applicable to the establishment of a network of information systems for food protection. An information system for food protection needs to be established in the Americas as soon as possible.

The design of supporting information systems for food protection should become an integral part of the plan of action of the Inter-American Conference on Food Protection. There are many specific problems that must be overcome, but these should not limit the establishment now of overall goals. As technology advances and better communication and cooperation develop to resolve system problems, contraints can be overcome. What is important is a sound start.

The first step should be an in-depth needs assessment that looks at all aspects of information classification, storage, retrieval, and exchange relevant to food protection. Once the needs are known, priorities should be established as a basis for identifying truly important issues and obtaining resources to respond to them. Such an effort will require cooperation, coordination, and adherence to accepted standards in order to ensure an integrated information system that avoids fragmented and needless efforts. Modern telecommunications will make it possible to exchange information throughout the network without the need for redundant collection and storage of data.

Objectives of Information Network Development

Information science systems are a technological tool that can be used to assist both governments and industry at the national and regional levels in achieving food protection, safety, and quality. The systems that are developed should foster improved methods of communications internationally and provide a basic set of guidelines and standards for operation of an information network.

More specifically, the objectives of an information systems network should be:

o to adopt standards and guidelines for food protection and nutrient composition data that will encourage a rational development of computer-based systems and data bases (INFOODS standards and guidelines for food composition and International Standards Organization (ISO) standards for computer programming languages and computer telecommunications are excellent models);

o to assist in the prevention of human illness and death from consumption of food contaminated by chemical or biological agents by providing information on allowable tolerances and on related analytical results and by providing the data needed to assist in epidemiological studies;

o to assist exporting countries to decrease economic loss resulting from food spoilage, waste, or economic deception by maintaining and making available accurate information on the quality and safety of food during production, transportation, and storage;

o to provide every country with data on contaminated or rejected foods in international trade in order to prevent their import;

o to establish the common linkages and indexes necessary for data exchange among the independent information sources (particularly the nutrient composition data bases and the data bases used in food protection, such as those concerned with pesticide residues and food additives); and

o to establish an electronic mail system among all food protection organizations in the Americas to disseminate urgent notification data to interested parties.

THE STRATEGY OF COMPUTER-BASED SYSTEMS

A unified approach for the Americas must be taken in developing a strategy for computer-based systems to assist in food protection. While national computer-based systems are used in conjunction with a given nation's food supply and reflect national situations, it is important that strategy take into account international trade in foods and food products. Any computer-based system established for food protection must take cognizance of the world market. If such a system is developed according to agreed-upon standards, the countries in the Americas would have a strong economic incentive, based upon trade opportunities, to participate in the development and use of the computer data bases.

Needs Assessment

In developing a computer-based system for food protection it is necessary to assess the information needs of the individual countries and the international community, with the understanding that differences in culture, economy, and technological capability directly effect the universe of information requirements. It is apparent from the papers presented and discussions at this Inter-American Conference on Food Protection that there are many critical information needs that have no current support, and that there has been no overall compilation of these needs of individual countries. The proper design of an information system is dependent on a thorough definition of requirements, the establishment of priorities, and a good understanding of environments in which a system is to function. It is essential that there be an in-depth needs assessment to identify and document the system requirements before any development efforts are undertaken.

After identifying the needs, the next step is to order the needs by their critical nature and feasibility. Then follows development of those modules that will have the greatest positive impact and return on investment. Since it will not be possible to implement all the system requirements at once, overall systems development should proceed stepwise, with each new development effort building on the foundation laid by earlier efforts. This approach is very attractive, since individual portions of the overall information system may be operational and may provide needed support without implementation of the entire system, which will certainly require many years of development.

Hierarchical Design

A hierarchical design should be built into the system architecture for the hardware, software, data, and telecommunications. This kind of design will allow a stepwise approach to development based on priorities and available resources, and will also allow various levels of participation by the different countries based on their individual situations. Because of the many functions the overall system will support, modules may be developed independently and at different times, but appropriate levels of linkage must be maintained in order to accomplish a truly integrated systems network. The potential user community is very diverse, and the involvement of users with the system will be equally diverse. It is important that each user be able to take advantage of those modules of the system from which that user may benefit most, without having to be burdened by system requirements of no benefit to the particular user.

Standards

In designing any information science system for food protection there are many complicated choices available. The adoption of uniform nomenclature standards and guidelines is one approach to creating some order from the chaos that results from the use of different names to refer to the same commodity from one country to another, or the use of different trade names to refer to the same pesticide. These nomenclature standards are applicable across the entire gamut of the food system, including its safety, quality, and protection facets.

Users of any food protection information system want such systems to be predictable and stable. From the user's point of view, what works today should essentially work tomorrow and should be the same as that which worked yesterday. Standards assist in making computer-based systems stable for the end users.

Wherever possible, standards that already exist should be adopted in order to avoid duplication of effort. Terminology standards have already been established for the Codex Alimentarius, but since these standards were not designed for a computer-based system they can only serve as starting points for an effort to develop international computer-based standards in concert with the participating food protectorates. Other established standards should be considered in developing standards for a food protection information system:

o When referencing any unique chemical entity such as a pesticide or food additive, the Chemical Abstracts Service Registry Number should be used as a unique identifier.

o INFOODS work in such areas as food nomenclature and terminology and food composition, which is based upon the U.S. Food and Drug Administration Factored Food Vocabulary, should be used to the extent that the INFOODS systems may be applicable. The Codex terminology for foods also can be used as a starting point; however, the terms and data stored must be searchable and retrievable by computer in a convenient manner for the end users of the data.

o International standards, such as the ISO X.25 standard for computer telecommunications, should be followed when accessing food protection information on computer data bases.

o International standards such as the ISO standards on computer programming languages should be followed where applicable. Examples are FORTRAN 77 (ISO 1539, ANSI X3.9-1978) and COBOL (ISO 9189, ANSI X3.23-1974).

Computer Hardware

Computer hardware for a food protection information system should be distributed according to a unified hierarchical approach. A central data facility with a large-scale mainframe capacity is necessary for the storage, retrieval, and analysis of large-scale data bases and those of interest to the overall community.

This facility should be accessible to all participants and be the focal point for all integrated processing.

Because of the diversity of needs and technological capacities of the Region's different countries, hardware architecture required by the individual countries may differ greatly. Such variance is not necessarily a problem as long as there is at least a minimum processing capability and a minimum acceptable conformance to compatibility standards. There should be microcomputer-based work stations within each country to act as terminals to the central computer facility and to store and process information of local interest.

Computer Software

The choice of an operating system, a data base management system, and programming languages to implement and maintain the information system will depend on the hardware selected and the requirements of the systems. In order to promote efficient and effective application development, it is important that every effort be made to utilize languages that conform to international standards and that are open to the rapid advances being made in the so-called fourth generation programming languages. System implementers should write routines to be utilized by the general user community for the purpose of storing, manipulating, and retrieving information from the system.

Individual system users may require further processing of data that are provided by the system software. In that case the user should be able to access the raw data in a form that may be processed by languages the user prefers, and not necessarily by the languages in which the system was implemented. Such access requires that the internal structure of the data be open and accessible, and that access not be limited by structural constraints imposed by the languages used to implement the system.

Data

The diversity of information needs leads to a hierarchy of data organization that allows access to the data at different levels. Frequently the most detailed data are needed at the lowest user level, while summary-type data are needed at the highest user level, where they are used to show trends and give overall perspectives. This pattern of usage results in a data structure in which different levels of data detail may be located at different levels in the network hierarchy. Such a structure distributes the storage and processing workload.

There is a need to establish standard data terminology and nomenclature, as well as standards for the collection of food safety data to be utilized by the system. The data problems and opportunities associated with such an effort will be similar to those currently being dealt with by INFOODS. It is important to understand the INFOODS approach in order to assure compatibility and consistency with INFOODS standards and to establish linkages between the two systems. The capability of integrating the two systems will result in the sharing and exchanging of information without duplication of effort.

Telecommunications

The existence of telecommunications presupposes that there is a desire to have a means of exchanging information. A hierarchical approach to data organization allows each country to participate in the system only to the extent that it wishes. At the lowest level, only an inexpensive computer terminal and a telephone would be required to access a central data base of food information. (With the advent of relatively inexpensive microcomputers, so-called dumb terminals should be allowed, but they are not recommended for use with an international food protection data base.)

At the next level up, a microcomputer work station would communicate with the central data base (again, over ordinary telephone lines--technically, a voice-grade line), would act as a terminal, and would store and process information of local significance. At a still higher level of sophistication, a distributed approach is feasible: local work stations would be linked by an appropriate means to a larger computer facility within the originating country's food protection organization; this facility in turn would be networked over dedicated links (via satellite, for example) to the central facility that stores the food protection information for the Americas. By following ISO networking standards, such linkages have already become commonplace in North and South America and can be expanded to take future requirements into account.

Participation Leading to Cooperation

The implementation of an information system on food protection in the Americas requires at each of its steps the active participation of all the countries of the Region. The absence of such participation would result in a lack of confidence and trust in the system, and in a system that would probably not support user needs.

Necessary to effective collaboration in such an information system is the participation of technical representatives of all the countries of the Region in the entire design and development process. Through active participation and cooperation by all countries, the system developed would thus be based on agreement, rather than being imposed by the more developed countries.

RECOMMENDATIONS

The Task Force on Information Systems makes two major recommendations. First, an electronic mail system should be established and implemented among all of the food protection organizations in the Americas for the purpose of disseminating urgent notification data to interested parties. The Pan American Health Organization (PAHO) should coordinate the system.

Second, a working group should be commissioned to study the scope and needs of a unified information system for food protection in the Americas. The working group should report back to the director of PAHO. Its report should recommend where the central data base should be located, what data should be initially stored in the central facility, and what costs would be involved in having the food protectorates of each country maintain work stations to access the central facility. The working groups' starting point might be the present report of the Task Force on Information Systems.

In considering standards to be adopted for computer data bases for food protection, the commissioned working group should coordinate its efforts with those of the INFOODS secretariat. The working group's efforts should be distinct from those of INFOODS, however, because the scope of food protection requirements is much larger than that being considered by INFOODS. The working group should also address independently the standardization of such information as basic epidemiological data and terminology, so that an inter-American epidemiological data base can be established. In many countries of the Americas basic epidemiological data are not currently available or standardized.

The working group should submit its initial report within one year after starting its needs assessment. Implementation of the working group's recommendations should begin as soon as adequate funding becomes available for each of the recommended tasks.

The working group must include as members representatives of the countries of the Americas who are specialists in information science and who are familiar with the information needs of the participating countries.

SESSION 5
Conference Achievements

Conference Summary

SANFORD A. MILLER

Attempting to summarize the Conference, with all of its different currents and ideas, is an extremely difficult task--a task the Action Plan Committee has done very well. Therefore, I would like to offer some of the ideas, concepts, and conclusions that I reached during the course of the Conference.

In his welcoming remarks to the Conference, Secretary John R. Block of the U.S. Department of Agriculture quoted President Ronald Reagan as follows: "The Western Hemisphere does not belong to any one of us. We belong to the Western Hemisphere. We are brothers historically as well as geographically." Nowhere is this truer than in the area of food and food control. Every nation in the Western Hemisphere is dependent upon the free flow of food--food of high quality, safe and wholesome--to assure survival. This is no less true of the developed countries of North America than it is of the developing countries of Latin America and the Caribbean basin. Indeed, food has always been a limiting factor in the survival of humans. Faced by a continuing sequence of hazards and a fundamentally hostile environment, humankind dealt with its problem only through the evolutionary development of an incredible series of adaptations. These adaptations have resulted in exceptional flexibility for utilizing a wide range of material as substrates for human metabolic machinery. Humans alone have the ability to add further to their food resources by manipulation of the environment, with resulting changes that, at least in the short term, offer survival advantages. In spite of these strategic advantages, humankind has almost always been faced by the spector of famine. Relatively minor changes in the environment have resulted in the death of millions, not necessarily because of the lack of ability to adapt to change but, rather, because of the inability to modify food production rapidly enough to meet the challenge.

Good times and bad, modern man attempts to cope with forces that have not yet been overcome in the millions of years of human existence. The difference today is the question of time. Changes are occurring with such rapidity, and have political and social implications of such a magnitude, that the possibility of ultimate disaster has become a constant concern of each individual and of national and international political bodies. It has become overwhelmingly clear that the need for action to assure a safe and abundant food supply should be an essential component of modern politics.

The recognition of this need led Malthus in the eighteenth century and Forrester in 1960 to predict catastrophe and, ultimately, the destruction of modern society stemming from the inability of food production to keep pace with population growth. Yet today, for the first time, there lies within our hands the ability to put these Malthusian concepts to rest once and for all. The green revolution of the 1950s and 1960s, which brought about the development of high-yield varieties of wheat and rice, has been expanded exponentially to include the most recent advances in biotechnology. These enormously powerful new tools have enabled us to produce both plant and animal strains with characteristics optimally suited to their growth environment and with maximum nutritional value. The potential impact of new, nonagriculturally based technologies for food production has also been enormous. Furthermore, the use of fermentation and chemical synthesis to produce sources of nutrients is well on its way. And yet, with success within our grasp and the vision of a world free from hunger beginning to materialize, new barriers continue to block the attainment of such goals. Technical issues, such as the assurance of safety and wholesomeness, barriers to the free movement of food in international trade, internal political issues that impede the implementation of national food laws, and the lack of trained, motivated personnel are all substantial issues that need to be resolved if the vision of a garden world, free from hunger, is ever to be achieved.

Five years ago it seemed to some of us that the time was ripe for an exploration of those issues with the goal of designing mechanisms to reduce or remove these barriers to the resolution of human food problems. In the Western Hemisphere in particular, it seemed appropriate that such an exploration take place, since the technological base had been growing in many of its countries. In addition, internal examination of the food laws in many of the countries had led to the realization that new approaches were required. Substantial increases in technological skills had taken place, and distribution of such skills among the countries of the hemisphere had become more widely dispersed. The need for free trade in food had also became a more vital concern, and there had been increasing awareness that international trade is an area in which the interests of individual countries intersect.

These developments led to the genesis of this Conference and its primary goal: to bring together senior scientists and technologists of the Western Hemisphere with the common interests of assuring the availability of high quality and safe food for all people in the hemisphere and maintaining the vision of a twentieth-century revolution in agricultural technology. I now turn to the definition of these problems and the proposed resolution of them by the Conference.

As Commissioner Frank Young of the U.S. Food and Drug Administration (FDA) said, safe food of good nutritional quality is not only the foundation of public health but also a right of all humanity. In much of the world today the main cause of morbidity is food-related disease, either directly through food as a vehicle for pathogenic organisms and their toxins or from toxic chemicals that find their way into food, or indirectly through foodborne disease's impact on the nutritional status and the economic well-being of the individual and society. Despite these facts, until very recently the profound impact of foodborne illnesses on health and economic well-being has not been well recognized by national governments or effectively approached by international organizations. To a significant extent, the ubiquitous nature of foodborne illness has made it less visible than the dramatic, but less globally significant, outbreaks of other diseases, which have received much greater attention and resources. Indeed, the Alma-Alta Declaration of the World Health Organization in 1978, establishing a worldwide goal of health for all by the year 2000, only implicitly considers food safety as an essential component of primary health care in public health, and does not address it explicitly as a major contributor to disease prevention and health promotion.

An example of the impact of foodborne illness on public health was noted by Dr. Carlyle Guerra de Macedo, Director of PAHO, in his address to the Conference. He observed that there were in 1980 alone more than 1 million cases of acute diarrhea in children under five years of age in the developing world. Among these children the death rate was 10 diarrheal deaths every minute of every day of every year. The majority of such illnesses are caused by food, directly by microbial contamination and indirectly by reducing nutritional status in marginally nourished children. When to this total is added the nondiarrhetic foodborne diseases such as botulism, typhoid, and parasitism and the chronic effects of chemical contamination of foods, the number of people affected and the impact of food contamination on function, well-being, and economic status is appalling.

Even in the industrialized countries, foodborne diseases are a significant cause of illness. Relatively high standards of environmental sanitation, personal hygiene, and refrigerated storage of food in most homes have virtually eliminated several serious foodborne diseases, such as typhoid fever, in these countries. Nonetheless, major outbreaks of such diseases do occur occasionally; indeed, the incidence of such diseases appears to be on the increase in developed countries, largely because organisms previously thought to be benign have developed resistance to current sanitary practices. Outbreaks of relatively less serious illnesses, such as salmonellosis, are still common, usually as the result of an error at one or more stages in the chain of food processing, preparation, distribution, and storage in commercial enterprises, public institutions, and private homes.

The acute effects of such illnesses are generally considered to be the most significant outcomes of their presence. Recent research, however, has emphasized that virtually all these organisms can also produce or contribute to chronic disorders of many kinds. Thus certain salmonellae, in addition to producing acute enteric disease, may be associated with the development of rheumatoid disorders of various kinds. Certain other organisms may be associated with the development of neoplasia in the gastrointestinal tract. Clearly, then, when evaluating the cost of such illnesses to society, not only the acute effects but also the chronic effects of the illness must be considered.

While the serious foodborne diseases are most prevalent in developing countries, diseases such as salmonellosis and staphylococcosis become much more common as these countries pass through the transitional phase to industrialization. However, the generally poor nutrition of much of the population in these countries renders the diseases a great deal more severe than in the fully industrialized countries. Also, the change from traditional, localized village or home food production to reliance on commercial catering establishments and retail distribution through street vendors may intensify the problem of foodborne disease. Equally important is the impact of such contamination on the capacity of a country in transition to market its products in world trade.

In addition to the problems associated with the microbial contamination of foods, significant health and economic consequences may result from the misuse of a wide variety of chemicals that are incorporated intentionally or unintentionally during the production, processing, storage, distribution, and consumption of foods. For example, pesticides and herbicides necessary to control insects and fungal pests in agriculture and ectoparasites in animal husbandry may be harmful when improperly used, and excess amounts of certain growth-stimulating drugs and hormones may be found as residues in edible animal tissues and plants. Moreover, naturally occurring environmental contaminants such as the mycotoxins can also prove to be a health hazard. Although there is little evidence that any approved chemical substance used in accordance with international and national recommendations has led to serious ill health, there is the risk that illegal use of certain chemicals in food can mask poor quality, disguise deterioration, or constitute a deliberate adulteration, and thus be harmful to health.

Widespread acute and chronic debilitation resulting from contamination of the food supply can also affect the economy and financial condition of the national and international community. Food is one of the most important commodities in the economy of any community. Thus, the economic impact of food contamination is felt everywhere and is a major consideration. Although there are relatively limited data on these effects, the various ways in which food contamination can affect individuals and whole populations suggests that economic losses to all economies in the developed and developing worlds must be substantial, if not overwhelming. Any attempt to assess the full costs of contamination would have to include not only the value of crops and animal products spoiled or destroyed as the result of contamination, but also the costs of treating people affected by the contamination and the loss of output or earnings resulting from morbidity, disability, or premature mortality. Recently, FDA scientists estimated that as many as 81 million or more cases of diarrheal disease of foodborne origin occur in the United States per year, and that the average cost for such food-associated illnesses falls close to $164 billion per year. Indirect costs to the economy resulting from these illnesses added to the total cost may equal or even double the direct patient-related costs. If the problem is of such an enormous magnitude in developed countries such as the United States, what must it be in countries where these diseases are even more of a threat to health. Because of the nature of the reporting systems under which we all must operate, we do not have any idea of the magnitude of foodborne disease, or of their cost to our economies each year. Furthermore, the impact of continued contamination on the ability of a country to engage in international trade also needs to be considered in economic evaluations.

For all countries in the hemisphere, the ability to participate in the trade of both processed and raw foods is essential to survival. This essential trade can be threatened by an importing country's restrictions on types and levels of contaminants--restrictions resulting from concern about the high incidence of contamination in exporting countries. The magnitude of such an activity can be staggering. In 1984, for example, the United

States detained 1,522 shipments of food imported from other countries of the Americas. This involved almost 64 million pounds of food valued at approximately $47 million. Although not all these detentions were associated with contamination or other health-related problems, there is no question that the vast majority of them were. Equally important, the lack of widespread, comprehensive local food control programs and the absence of a mechanism for interhemispheric information exchange has made it easy for unscrupulous shippers to dump unacceptable products in less developed countries after rejection by authorities in the developed world. Clearly, some type of communication system is required to facilitate the exchange of information.

At the national level, the economic impact of contaminated and adulterated foods goes far beyond their effect on the individual. For example, contamination can have long-term effects on consumer acceptance of products and can undermine international confidence in a country's food products in general. The cost of recalling a widely distributed product that is suspected or proven to be hazardous can be tremendous. Finally, the age-old problem of deliberate adulteration in many countries has an effect on the perception of the quality of food products not only within the country but also among trading partners.

It is clear that profound, often catastrophic effects result from widespread food contamination, yet with few exceptions, resolution of the problems associated with food contamination has not been a major national priority in most countries, at least not until recently. While there may be several reasons for this, the most important may be the complexity of the issue and the need for a broad-scale approach to its solution. For example, a clean water supply is essential for a safe food supply. In another context, the solution to the problem must include recognition that different food systems demand different strategies to assure food safety, that social and cultural factors must be taken into account by any program if it is to succeed, that the stage of technology involved in the movement of food from producer to consumer must be considered, and that the structure of the food system reflects closely the economic realities of the local situation.

Similarly, food habits have a bearing upon food safety and the strategy needed to assure it. It has become increasingly certain that in changing food habits in directions that promote greater safety, we are simultaneously changing and redefining social roles as well. Clearly the cultural dynamics of the food system represent very deeply ingrained practices that must be addressed by any program that attempts to provide increased control over the food supply. Nevertheless, food habits do change. Generally speaking, change requires three conditions: perceptions of the advantage to the one who changes, acceptable economic costs, and acceptable social costs. Unfortunately, these factors often tend to be ignored when national programs in food control are being developed. Consumer education and training must, therefore, be an essential part in any food safety strategy. An informed, vocal consumer, even as a minority, can be a powerful force for the enactment and enforcement of adequate food laws.

Progress itself is often a causative factor in increasing danger from contamination of the food supply, particularly when new technology is implemented without regard for the simultaneous development and utilization of appropriate controls. For example, mass production of animals by use of intensive methods often leads to an increase in the number of infected animals if proper precautions are not taken. The widespread and indiscriminate use of antibiotics, particularly by individuals ignorant of the possible consequences of such use, can cause profound public health problems. The indiscriminate use of pesticides, either in forage or when the animals are dipped or sprayed, can result in contamination of food. The application of modern technological practices to the preservation and distribution of food can also result in problems when appropriate controls are not used. In thermal processing, the use of contaminated water to cool cans after a heat treatment can lead to contamination of those canned foods, through micro-breaks in the can seals. Moreover, as countries continue their development from agrarian to industrialized societies, the increased use of catering establishments and street vendors can lead to a large number of problems. It has been said that the regulation of street vendors is probably the most difficult public health measure to accomplish in both developing and developed countries.

The litany of events recited above indicates that the consumption of unsafe food continues to lead to human disease, debilitation, and death, and to cause major economic losses. There is no greater or more important public health hazard, no more profound economic problem, than this. Food becomes unsafe for many reasons, including microbial contamination and growth, injudicious use of chemical additives, accidental addition of chemicals to food, environmental pollution, and inappropriate cultural practices. Despite public perception to the contrary, microbial contamination, rather than the use or misuse of chemicals, is by far the most important public health hazard we face.

For any successful intervention, food safety must be given sufficient priority in national and regional planning. At the very least it must receive the same priority as food production itself. Otherwise, the vicious cycle of poor health, foodborne disease, and economic disaster cannot be prevented or controlled. As Ambassador Gotlieb of Canada said in his opening remarks to the Conference, "There is one certainty on which to focus: no country has achieved stability and reasonable living standards by ignoring the health of its citizens or by relegating food protection to a subordinate role in its continuing development. For a nation to progress, food protection must of necessity always be high on the government's agenda."

Although there are many technological and scientific issues that need to be resolved before food safety problems can be solved, there also exists a series of legislative and trade problems that interfere with the assurance of a free flow of high quality food between the nations of the hemisphere. Of all the issues associated with these trade problems, certainly nontariff barriers have to be considered most important. In the regulation of health and safety, such barriers can be erected in various ways, for example, by the imposition of restrictions that require safety testing by the importing country or testing requirements that differ from those of the exporting nation. And even when testing requirements are met, the importing country may apply a different safety standard when acting upon the results of the tests. Thus in today's world it is becoming increasingly clear that to resolve these problems two issues have to be considered: management of the scientific and technical issues and management of the regulatory interpretation of the scientific facts within the context of national law. Too often these issues become confused, and scientific uncertainty and debate cloud the fundamental goals and serve to support narrow national interests. Nevertheless, when it is possible to segregate issues, the first task is to find a means for resolving the purely scientific matters and to find a common ground for the interpretation of scientific facts.

The distinction between a technical trade barrier and regulations based on national values concerning safety is often a fine one. At a time when we are torn between forces for harmonization on the one hand and forces for protectionism on the other, we face an enormous task in smoothing the way for making that distinction. In our opinion, the ability to treat scientific issues independently of national trade policy is essential for rational selection of regulatory options based on those issues. On the national scene, scientific regulatory agencies must be consistently sensitive to the scientific base supporting regulatory actions. In the international arena, it has become increasingly apparent that this sensitivity must be multiplied and sustained. More important, the need for international consultation on scientific issues before the selection of regulatory options in individual countries is becoming apparent. If we can obtain agreement on the scientific issues, more often than not disagreements on regulatory solutions will become fewer and fewer.

Nowhere is this more apparent than in the struggle for harmonization of food standards. We must be able to distinguish between those components of the standard that are absolutely necessary to ensure the safety or high quality of food and those that are the result of traditional industry practice or placed there for purposes of protectionism. The work of the Codex Alimentarius Commission is exemplary in that regard, but even the work of the Codex must be well integrated with the other aspects of food control within the hemisphere. Harmonization of standards is useless unless harmonization in other components of the regulatory process also occurs. Furthermore, harmonization is not practicable unless <u>all</u> concerned parties participate.

Thus, it is essential for all countries in the hemisphere to participate in and support the regional coordinating committee of Codex, the Commission itself, and its work.

It is also true that the national, legislative, and administrative structures under which food control takes place can have a substantial impact on the food control systems of the countries of the hemisphere. This has been well recognized by many countries, and many are in the process of reviewing and modifying national food law. Irrespective of the system that ultimately develops, there are two important components that have to be considered. First, cooperation among each of the governmental agencies involved in the regulation of food must be of the highest order. Without such cooperation conflict occurs among agencies, contradictory opinions are issued, and food trade grinds to a halt. More important, domestic control of safety becomes virtually impossible to implement. The second component concerns the enforcement of food laws. Without enforcement that is rigorous, impartial, continuous, and based upon the highest technical capabilities, the existence of such laws becomes moot.

We all agree that the rationale for government regulation of the food supply is identical within all the countries of the hemisphere. Stated simply, it is predicated on the recognition that in today's complex world, even sophisticated consumers cannot protect themselves from simple economic cheats, such as watered milk, much less from the potential harm caused by toxic contaminants or toxic additives in foods. The courts of many countries have consistently stated that public interest in the purity of its food is so great as to warrant the imposition of the highest standard of care on distributors. They also recognize that to a significant extent, the problem will become more complex as a result of the growth of science and technology and their impact on the life of the individual. As a consequence of this explosion in technological development, individuals no longer can depend on their own direct efforts for provision of the fundamental necessities of life such as food. Moreover, the increasing complexity of science makes it impossible for individuals to make informed choices without sufficient technical background. As both Thomas Jefferson and Abraham Lincoln said, it is the function of government to intervene to protect citizens when they are no longer capable of protecting themselves. It is on this principle that any discussion of food control and food safety must be based.

And indeed it was against this background, so ably described in the workshop papers and country reports of the Conference, that the concept of the Conference was developed. As the Conference progressed, several facts emerged. First, most of the scientific and technological base needed to accomplish the goals of safe food of high quality already exist. Second, there is no conflict between safe food and sufficient food; many of the solutions to assuring safety of the food supply are really quite simple and easy to implement (e.g., hand-washing). Third, there is within the hemisphere a growing recognition of the food safety problem and the desire to resolve it. Fourth, there is growing recognition in the hemisphere that the solutions to this problem are beyond the capability of any one country and as a result, require development of a hemisphere-wide approach. Fifth, the skills required to accomplish these solutions are distributed throughout the hemisphere and are not found solely in one country. Sixth, in addition to requiring help, each country has some contribution to make to the final resolution of food safety problems. And seventh, solutions must be based upon the development of some interhemispheric focus leading to identification of the appropriate priorities for directing and coordinating the enormous skills and resources throughout the hemisphere.

As the Conference Objectives state, it was essential to develop a practical plan of action to accelerate progress in food protection activities throughout the hemisphere. It was also clear that such a plan must address several important objectives, covering communication and surveillance, cooperation and harmonization, education and training, and technical support and advice. During the course of the often vigorous debate over the best and most efficient way to proceed to attain these objectives, several themes emerged. First, money alone could not resolve food safety problems. Indeed, as the Conference progressed, several nonmonetary issues seemed to predominate, and the need for commitment was often mentioned--i.e., the need for governments to commit themselves to food safety as a national priority, rather than viewing it as a privilege for its citizens. (For many countries, such commitment would probably be best obtained in the area of international trade, the fallout from which would help improve domestic food protection.) A second theme dealt with interministerial coordination and conflict. Many countries have fragmented food laws and no compelling reason for cooperation among government agencies. Such laws need to be reviewed and the food safety effort focused in some way. A third major theme concerned information needs at both the regulatory and consumer levels. How to resolve information problems easily and efficiently is still a matter of debate. Finally, the need to establish priorities within the context of social, political, and economic realities as they impinge on health and trade was emphasized by nearly all the participants in the Conference.

These and several other important matters are reviewed in the extraordinary Action Plan presented to the Conference. Not only is each issue briefly and cogently described, but direct, clearly defined recommendations are made, and are directed toward PAHO, FAO, and all countries of the hemisphere. For the countries of the hemisphere, the Action Plan argues for modification of national food laws based on the WHO/FAO model code--modification designed to facilitate food protection by mandating interministerial cooperation and coordination. The essentiality of participation and the harmonization of standards through the Codex Alimentarius is underscored, as is the need for regional reference laboratories and other types of technical support.

Certainly the heart of the Action Plan is its proposal that PAHO and FAO jointly develop a program to strengthen and to assure food protection in the Region. More important, the Conference through the Action Plan established for the first time specific, direct, unequivocal frames of reference for such a program. To a significant extent these frames of reference are built upon the recognition of the complexity of the hemisphere's problems, as well as on the recognition that we are all in the same boat and only together can we sail it to our common goal. Moreover, the Plan's insistence on a single focus to coordinate, plan, implement, and evaluate food safety efforts gives hope that the necessarily limited resources of the Region will be efficiently directed. Finally, the Plan expresses the sense of urgency that pervaded the five days of the Conference. We all recognize that we are living on the edge of a volcano. To prevent its eruption will require strong, direct, and unequivocal support of efforts that will provide to all the peoples of the hemisphere not only enough to eat but also food that will improve their health and their quality of life.

APPENDIX A

Conference Participants

CONFERENCE PARTICIPANTS

PERCY ABOLS, Alternate Permanent Observer of Canada to Organization of American States, 2450 Massachusetts Avenue, N.W., Washington, DC 20008, U.S.A.

JAVIER ACOSTA ALEMAÑY, Secretario Técnico, Comité Coordinador del Codex para América Latina y el Caribe, Egido No. 602 entre Gloria y Apodaca, Habana, Cuba

JACQUES EDOUARD ALEXIS, Vice-Doyen, Faculté d'Agronomie et de Médicine Véterinaire, State University of Haiti, Port-au-Prince, Haiti

ARGENTINA HENRIQUEZ DE ALVAREZ, Encargada Dep. Educación al Consumidor, Secretaría Industria y Comercio, Andres Julio Aybar No. 21, Santo Domingo, República Dominicana

JAZMIN ANDRADE, 2nd. Secretary, Mission of Ecuador, 2535 15th Street, N.W., Washington, DC 20009, U.S.A.

PRIMO ARAMBULO III, Veterinary Public Health, Pan American Health Organization, 525 23rd Street, N.W., Washington, DC 20037, U.S.A.

ROSALBA ARIAS CRUZ, Sub-Encargada, Departamento Planificación Sectorial Jefe, División Agropecuaria ONAPLAN, Santo Domingo, República Dominicana

ABEL ASCARRUNZ NAVARRO, Vice-Ministro Asuntos Agropecuarios, Ministerio de Asuntos Campesinos y Agropecuarios de Bolivia, Casilla No. 20730, La Paz, Bolivia

LEO AVIGDOR, Expert in Food Legislation, Beranges 37, 1814 La Tour de Peilz, Switzerland
ANTONIO BACIGALUPO, Oficial Regional de Agroindustria, Organización de las Naciones Unidas para la Agricultura y la Alimentación, Avenida Santa María 6700, Santiago de Chile, Chile
CHARLES D. BAKER, Undersecretary of Health and Human Services, 200 Independence Avenue, S.W., Room 614G, HHS Building, Washington, DC 20201, U.S.A.
KATHLEEN BEHR, Office of International Affairs, National Research Council, 2101 Constitution Avenue, N.W., Washington, DC 20418, U.S.A.
CLIFFORD L. BELFIELD, Foreign Programs, Food Safety Inspection Service, U.S. Department of Agriculture, Washington, DC 20250, U.S.A.
PETER D. BELL, Carnegie Endowment for International Peace, 11 Dupont Circle, N.W., Washington, DC 20036, U.S.A.
CLAUDIA ANN BELLOT, Produce Chemist, Ministry of Agriculture, Botanic Gardens, Roseau, Dominica
ALAN H. BENTLEY, Director, Livestock and Poultry Products, Division of Agriculture, Agriculture Canada, 2255 Carling Avenue, Ottawa, Ontario, Canada K1A 0L9
JOHN R. BLOCK, Secretary of Agriculture, U.S. Department of Agriculture, 14th and Independence Avenue, S.W.-200A, Washington, DC 20250, U.S.A.
GEORGE E. BOECKLIN, President, National Coffee Association of U.S.A., Inc., 120 Wall Street, New York, NY 10005, U.S.A.
SONIA BOLAÑOS, Abogada/Consultora Legal, Pan American Health Organization, 525 23rd Street, N.W., Washington, DC 20037, U.S.A.
HECTOR BOURGES, Subdirector General de Nutrición, Experimental y Ciencia de los Alimentos, Instituto Nacional de la Nutrición, Vasco de Quiroga No. 15, 22 DF CP 14000, México
RICARDO BRESSANI, Jefe, División Ciencias Agricolas y de Alimentos, Instituto de Nutricion de Centro America y Panamá (INCAP), Apartado Postal 1188, Carretera Roosevelt, Zona 11, Guatemala, Guatemala
GEORGE ALEXANDER BRINDZA, Chief, Computer Systems, HHS/FDA/CFSAN, Food and Drug Administration, 200 C Street, S.W., Washington, DC 20204, U.S.A.
COLIN BROUGHTON, Director, Ontario Region, Field Operations Directorate, Health Protection Branch,

Health and Welfare Canada, 2301 Midland Avenue, Scarborough, Ontario, Canada M1P 4R7

ROBERTO MIGUEL CAFFARENA, Director de Industria Animal, Ministerio de Agricultura y Pesca, Colonia 892, Piso 7, Montevideo, Uruguay

ELIZABETH J. CAMPBELL, Center for Food Safety and Applied Nutrition (HFF-312), Food and Drug Administration, 200 C Street, S.W., Washington DC 20204, U.S.A.

A. EUGENIA CAÑAHUI DE PORRAS, Químico, Laboratorio Unificado de Control de Alimentos y Medicamentos LUCAM/INCAP, P.O. Box 1188, Carretera Roosevelt, Zona 11, Guatemala, Guatemala

PHILIPPE CARADEC, Attaché, French Embassy, 4101 Reservoir Road, N.W., Washington, DC, 20007, U.S.A.

NORAH ELBA MANGIANTE DE CARRANZA, Director, Area Alimentos, Instituto Nacional Farmacología y Bromatología, Subsecretaría Regulación y Control, Caseros 2161, Buenos Aires, Argentina

ALBERTO EMILIO DE LAS CARRERAS, Director, Cámara de Exportadores, Consultor Privado, Cordoba 1184, Buenos Aires, Argentina

JOSE A. CARVALHO, 1st Secretary, Brazilian Embassy, 3006 Massachusetts Avenue, N.W., Washington, DC 20008, U.S.A.

MAX CASTILLO, Americas Desk, International Affairs, Food and Drug Administration-Room 1147, 5600 Fishers Lane, Rockville, MD 20852, U.S.A.

ARNALDO D. CASTRO DOMINGUEZ, Funcionario, Ministerio de Salud Pública, Calle 23 y N. Vedado 4, Habana, Cuba

JULIAN CHACEL, Director de Estudos e Pesquisas, Centro de Estudos Agricolas, Instituto de Estatistica e Econometria, Fundacao Getulio Vargas, Praia de Botafogo 190, Caixa Postal 20.120, Rio de Janeiro, Brasil

OSCAR CHAVEZ, International Trade Division, Organization of American States, 1889 F Street, N.W., Washington, DC 20006, U.S.A.

EDWARD ALBERT COMISSIONG, Chief Chemist/Director of Food and Drugs, Chemistry/Food and Drug Division, Ministry of Health and Environment, 115 Frederick Street, Port-of-Spain, Trinidad, W.I.

GENE COPE, Department of Commerce, National Marine Fisheries Service, Page II Building, 3300 Whitehaven Avenue, Washington, DC 20235, U.S.A.

JAIME CORREA, Latin America and Caribbean Bureau, Agency for International Development, 320 21st Street, N.W., Washington, DC 20523, U.S.A.

JOHN T. CRAIG, 51 Lakeview Drive, Terre Haute, IN 47803, U.S.A.

DARLA E. DANFORD, Project Officer, Inter-American Conference on Food Protection, Food and Nutrition Board, National Research Council, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, DC 20418, U.S.A.

JOHN E. DAVIES, Professor, Department of Epidemiology and Public Health, University of Miami, 12500 S.W. 152nd St., Miami, FL 33177, U.S.A.

KIRK DAVIS, Embassy of St. Kitts and Nevis, 1730 Rhode Island Avenue, N.W., Washington, DC 20036, U.S.A.

RICHARD J. DAWSON, Officer-in-Charge, Food Quality and Consumer Protection Group, Food and Agriculture Organization, United Nations, Via della Terme di Caracalla, Rome 000100, Italy

LUIS H. DIAZ LOPEZ, Director Técnico, Control de Alimentos, Dirección General de Servicios Pecuarios, Avenida Reforma 8-60, Zona 9, Guatemala, Guatemala

LAURENCE R. DUSOLD, Senior Chemist/Computer Specialist, Food and Drug Administration, 200 C Street, N.W., Washington, DC 20204, U.S.A.

JOSEPH EDMUNDS, Ambassador, Embassy of Saint Lucia, 2100 M Street, N.W., Suite 309, Washington, DC 20037, U.S.A.

ERSTEIN EDWARDS, Deputy Chief of Mission, Embassy of St. Kitts and Nevis, 1730 Rhode Island Avenue, N.W., Suite 501, Washington, DC 20036, U.S.A.

ROSS ELLIOT, Director General, Field Operations, Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2

MARIO ERALES ALMENGOR, Sub-Jefe del Departamento de Registro y Control de Alimentos, Ministerio de Salud Pública y Asistencia Social, 10 Avenida 14-65, Zona 1, Guatemala, Guatemala

ELMER C. ESCOBAR, Director de Saneamiento, Ministerio de Salud, Calle 16, No. 7-39, Bogotá, Colombia

CHARLES W. FELIX, Conference for Food Protection, Inc., P.O. Box 1581, Leesburg, VA 22075, U.S.A.

GABRIEL FERDINAND, Director, Veterinary Public Health, Ministry of Health, 35A Brunton Road, St. James, Trinidad, W.I.

MARIO V. FERNANDES, Coordinator, Veterinary Public Health Program, Pan American Health Organization, 525 23rd Street, N.W., Washington, DC 20037, U.S.A.

GUSTAVO FERRARI, Secretario Comercial, Embajada Argentina, 1600 New Hampshire Avenue, N.W., Washington, DC 20009, U.S.A.

MIGUEL J. FORT, Jefe del Instituto Nacional de Desarrollo Agroindustrial (INDDA), Avenida la Universidad 595, P.O. Box 11294, Lima 14, Perú

ERASMO J. FRANKLIN, Analytical Biochemist and Director, Ministry of Natural Resources, Central VETLAB. P.O. Box 181, Belize City, Belize

HERNAN L. FUENZALIDA PUELMA, Asesor Juridico, Pan American Health Organization, 255 23rd Street, N.W., Washington, DC 20037, U.S.A.

PETER FURTH, Vice President, Louis Furth, Inc., P.O. Box 19, Maspeth, NY 11378, U.S.A.

JULIO CESAR GARCIA, Executive Secretary for Economic and Social Affairs, Organization of American States, 1889 F Street, N.W., Washington, DC 20006, U.S.A.

SINDULFO MELQUIADES GARCIA SANTACRUZ, Jefe de la División de Saneamiento General, SENASA, Ministerio de Salud Pública y Bienester Social, Mariscal Estigarribia, Tacuary, Asunción, Paraguay

SHERWIN GARDNER, Vice President, Science and Technology, Grocery Manufacturers of America, 1010 Wisconsin Avenue, N.W., Washington, DC 20007, U.S.A.

L. L. GAST, Associate Administrator, Food Safety and Inspection Service, U.S. Department of Agriculture, 14th and Independence Avenue, S.W., Room 327-E Administration Building, Washington, DC 20250, U.S.A.

ALBERTO GELLON, Subsecretaría Regulación y Control, Ministerio Salud y Acción Social, Defensa 120 Of. 4074, Buenos Aires, Argentina

LIZETE GOMEZ SERNA, Secretaria Ejecutiva del Comité Méxicano del Codex Alimentarius y Jefa del Area de Normalización de Alimentos, Secretaría de Comercio y Fomento Industrial, Avenida del Rosal 184, Colonia Molino de Rosas, Codigo Postal 01470, Delegación Alvaro Obregon, México

ALLAN GOTLIEB, Ambassador of Canada, Canadian Embassy, 1746 Massachusetts Avenue, N.W., Washington, DC, 20036, U.S.A.

ROBERT B. GRAVANI, Associate Professor, Department of Food Science, Cornell University, Ithaca, NY 14853, U.S.A.

DAVID A. GREGORKA, National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106, U.S.A.

GABRIEL DE LA GUARDIA, Ambassador of Panama, Embassy of Panama, 2862 McGill Terrace, N.W., Washington, DC 20008, U.S.A.

CARLYLE GUERRA DE MACEDO, Director, Pan American Health Organization, 525 23rd St., N.W., Washington, DC 20037, U.S.A.

EMILIO GUTIERREZ Q., Executive Director, Cámara Costarricense de la Industria Alimentaria, Apartado 7097-1000, San José, Costa Rica

RICHARD L. HALL, Vice President, Science and Technology, McCormick and Company, Inc., 11350 McCormick Road, Hunt Valley, MD 21031, U.S.A.

GLEN HANSEN, First Secretary (Agriculture), Canadian Embassy, 1746 Massachusetts Avenue, N.W., Washington, DC 20036, U.S.A.

ARTNEL S. HENRY, Executive Director, Bureau of Standards, 6 Winchester Road, Kingston 10, Jamaica

JOSEPH P. HILE, Associate Commissioner for Regulation Affairs, Food and Drug Administration, 5600 Fishers Lane, Room 1485, Rockville, MD 20857, U.S.A.

MOYSES NATAN HONIGMAN, Asesor Regional, PASB, Pan American Health Organization, 525 23rd Street, N.W., Washington, D.C. 20037, U.S.A.

RALPH ICHTER, Agricultural Attaché, Embassy of France, 4101 Reservoir Road, N.W., Washington, DC 20007, U.S.A.

FRED B. JACOBSON, Consultant, Cocoa Merchants Association of the United States, 1905 Pine Street, Philadelphia, PA 19103, U.S.A.

CLYDE JOHNSON, Deputy Government Analyst, Analyst Food and Drugs Dept., 19-21 Long and Evans Street, Charlestown, Georgetown, Guyana

F. K. KAFERSTEIN, Responsible Officer, Food Safety, Environmental Hazards and Food Protection, World Health Organization, 1211 Geneva 27, Switzerland

ROBERT KEIFER, U.S. Environmental Protection Agency, 401 M Street, N.W., Washington, DC 20460, U.S.A.

PAUL KIFER, Associate Director, Office of International Agriculture, Oregon State University, Corvallis, OR 97331, U.S.A.

EDDIE F. KIMBRELL, Deputy Administrator, Commodity Services, Agricultural Marketing Service, U.S. Department of Agriculture, Room 3064 South, Washington, DC 20250, U.S.A.

JOHN C. KLENSIN, Principal Research Scientist, Laboratory of Architecture and Planning, INFOODS 20A-226, Massachusetts Institute of Technology, Cambridge, MA 02139, U.S.A.

DIETRICH W. KNORR, Professor, Department of Food Sciences, University of Delaware, Newark, DE 19716, U.S.A.

JESUS KUMATE, Subsecretario de Servicios de Salud, Secretaria de Salud, Leija No. 7, Planta Baja, Colonia Juárez-Cuauhtémoc, 06696 México, D.F., México

PIERRE-ANDRE LAGUERRE, Ministère du Commerce, No. 18 Rue Legitime, Port-au-Prince, Haiti

MIGUEL ANGEL LAGUNES V., Industria Conasupo, S.A. de C.U., Valencia No. 36 Esq. Cadiz, Col. Insurgente Mixcoac, México, D.F., México

S. T. AGNES KONG TSE LAM, Director of the Central Laboratory, Ministry of Health and Environment, P.O. Box 1911, Paramaribo, Suriname

ALVIN G. LAZEN, Chairman, Commission on Life Sciences, National Research Council, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, DC 20418, U.S.A.

ALEXANDER LEWIS, Public Health Superintendent, Public Health Department, Ministry of Health, St. Vincent, W.I.

JOAO BAPTISTA DE LIMA FILHO, Chefe do Servico de Registro e Cadastro, Ministerio de Saude, Esplanada dos Ministerios, Brasilia, Brasil

ANNE E. LINDSAY, Chief, Policy and Special Projects, Office of Pesticide Programs, U.S. Environmental Protection Agency, 401 M Street, N.W., Washington, DC, 20460 U.S.A.

GUILLERMO LOPEZ CALLEJA PARIS, Departamento Control de Alimentos, Ministerio de Salud, San José, Costa Rica

CORNELIUS LUBIN, Permanent Secretary, Ministry of Health, Housing and Labour, Castries, Saint Lucia, W.I.

PAUL LUNVEN, Director, Food Policy and Nutrition Division, Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, Rome 000100, Italy

JOHN R. LUPIEN, Director, International Affairs Staff, U.S. Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857, U.S.A.

RAJ K. MALIK, Chief, Food Quality and Standards Service, Food Policy and Nutrition Division, Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla, Rome 000100, Italy

EMMANUEL DE MARGERIE, Ambassador of France, Embassy of France, 4101 Reservoir Road, N.W., Washington, DC 20007, U.S.A.

RUSSELL J. MARINO, Vice President and Director, Corporate Quality Assurance and Product Safety, Ralston Purina Company, Checkerboard Square, St. Louis, MO 63164, U.S.A.

ALBERTO MARRERO TERRERO, Jefe, Organismos Internacionales, Comité Estatal de Normalización, 12 No. 314 e/3. y 5. Miramar, Habana, Cuba

JAVIER MEJIA DIAZ-GRANADOS, Jefe, División de Regulación Técnica, Ministerio de Agricultura, Carrera 10, No. 2030, Oficina 311, Bogotá, Colombia

EDUARDO MENDEZ RUBELLO, Consultant, P.O. Box 24-322, México, D.F., México

SILVIA MENDOZA G., Division of Biological Sciences, Department of Bioengineering, Simon Bolivar University, Apartado 80659, Caracas 108, Venezuela

SILVIA C. MICHANIE, CEPANZO/PAHO, Microbiologia e Higiene de Alimentos, Casilla de Correo 3092, 1000 Correo Central, Buenos Aires, Argentina

BEVERLEY C. MILLER, Director, Regulations Division, Jamaica Bureau of Standards, 6 Winchester Road, Kingston 10, Jamaica

SANFORD A. MILLER, Director, Center for Food Safety and Applied Nutrition, Food and Drug Administration, 200 C Street, S.W., Washington, DC 20204, U.S.A.

KAREN MITZNER, International Food Nutrition and Nutrition Program, E-38 756, Massachusetts Institute of Technology, Cambridge, MA 02139, U.S.A.

ROLANDO MONTUFAR RUIZ, Departamento Inspección de Productos de Origen Animal, I.P.O.A., Centro de Desarrollo Ganadero, Canton El Matasano, Soyapango, El Salvador, S.S.

ROBERTO H. MORETTI, Professor, Sadia-Concordia S.A., Al Tocantins, 525-Alphaville, 06400 Barueri, São Paulo, Brasil

ROBERT F. MORRIS, Agency for International Development, S8T/AGR Room 413A SA-18, Washington, DC 20523, U.S.A.
SIDNEY EARL MORRIS, Minister of Health, Government of St. Kitts and Nevis, P.O. Box 333, Basseterre, St. Kitts, W.I.
ALEXANDER B. MORRISON, Chairman, Department of Food Science, University of Guelph, Guelph, Ontario, Canada N1G 2W1
MARIO MUÑOZ, Ministerio de Salud, Director, Servicio de Salud Metropolitana del Ambiente, Baudra 72, Santiago, Chile
HARRY C. MUSSMAN, Executive Vice President, National Food Processors Association, 1401 New York Avenue, Suite 400, Washington, DC 20005, U.S.A.
STUART NIGHTINGALE, Associate Commissioner for Health Affairs, Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857, U.S.A.
MICHAEL NORTON, First Secretary (Science), British Embassy, 3100 Massachusetts Avenue, N.W., Washington, DC 20008, U.S.A.
SUSHMA PALMER, Director, Food and Nutrition Board, National Research Council, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, DC 20418, U.S.A.
HORACIO PALMIERI, Specialist, Department of Social Affairs, Organization of American States, 1889 F Street, N.W., Washington, DC 20006, U.S.A.
JOSE PALOMINO HUAMAN, Ministerio de Salud, Director de Zoonosis y Protección de Alimentos, Dirección General del Medio Ambiente, Pachacutec 900, Jesús Maria, Lima, Perú
JAIME RAMIRO PAZ RUIZ, Jefe, Divulgación Sanitaria y Educación Continua, Control de Alimentos y Vigilancia Veterinaria, Ministerio de Salud, Apartado 10033, Zona 4, Panamá
DIETRICH QUAST, Assessor da Diretoria, Copersucar, Rua Boa Vista 280, São Paulo, Brasil
FERNANDO QUEVEDO, Regional Advisor on Food Safety, Veterinary Public Health Program, Pan American Health Organization, 525 23rd Street, N.W., Room 924, Washington DC 20037, U.S.A.
TORIBIO QUINTANILLA, División de Epidemiología, Ministerio de Salud Pública y Asistencia Social, Calle Arce, No. 827, San Salvador, El Salvador, C.A.

ALIX RAYMOND, Ministry of Commerce, No. 18 Rue Legitime, Port-au-Prince, Haiti, W.I.

NICHOLAS RAYMOND, Information Advisor, Food and Agriculture Organization, 1001 2nd Street, N.W., Washington, DC 20201 U.S.A.

JOSEPH REID, Chief Health Inspector, Ministry of Health, Central Board of Health, St. John's, Antigua, W.I.

ROBERTO RESENDE, Consultant Agroindustries, UNDP, Apartado 4480, Lima, Perú

J. F. RIOU, Director, Bureau of Field Operations, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2

PABLO ROLDAN-MODRAK, Minister Counselor, Embassy of Colombia, 2118 LeRoy Place, N.W., Washington, DC 20008, U.S.A.

WALTER A. ROSENBLITH, Foreign Secretary, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, DC 20418, U.S.A.

SIDNEY E. RUSSELL, Department of Agriculture, P.O. Box 3028, Nassau, Bahamas

IRVING D. SACKETT, Jr., Department of Commerce, National Marine Fisheries Service, Page II Building, 3300 Whitehaven Avenue, Washington, DC 20235, U.S.A.

LESLIE CLAYTON SAYERS, Head, Agriculture Statistics, Ministry of Agriculture, St. Georges, Grenada

STEVEN SCHATZOW, Director, Office of Pesticide Programs, U.S. Environmental Protection Agency, Crystal Mall Building No. 2, 1921 Jefferson Davis Highway, Room 115, Arlington, VA 20460, U.S.A.

DONALD SCHWALL, Deputy Director, Middle East Project, Midwest Research Institute, 425 Volker Blvd., Kansas City, MO 64110, U.S.A.

NEVIN S. SCRIMSHAW, Institute Professor and Director, International Food and Nutrition Program, Room E-38 756, Massachusetts Institute of Technology, Cambridge, MA 02139, U.S.A.

JUDITH SEGAL, Director, Policy and Program Planning, Food Safety and Inspection Service, U.S. Department of Agriculture, 14th and Independence Avenue, S.W., Room 327-E Administration Building, Washington, DC 20250, U.S.A.

BALMORE M. SILVA, Ministry of Natural Resources, Belmopan, Belize

HAROLD J. SIMON, Professor of International Health Policy, Director of International Programs, University of California at San Diego, La Jolla, CA 92037, U.S.A.
BARRY. L. SMITH, Chief, Food and Regulatory Affairs Division, Food Directorate, Health Protection Branch, Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2
MERTON V. SMITH, International Affairs Staff, Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857, U.S.A.
ROBERT SMITH, Inspection Branch, Department of Fisheries and Ocean, Ottawa, Ontario, Canada K1A 0L2
DEBORAH A. STAPELL, United Fresh Fruit and Vegetable Association, 727 N. Washington Street, Alexandria, VA 22314, U.S.A.
EDWIN K. STRACHAN, Deputy Director, Department of Environmental Health Services (M.O.H.), P.O. Box 2086, Nassau, Bahamas
NOLVIA LETICIA SUAZO VELASQUEZ, Directora Regional del Departamento de Control de Alimentos, Ministerio de Salud Pública, Centro de Salud (MPB), San Pedro Sula, Honduras
T. M. TJANG A. FA, Senior Veterinary Officer, Ministry of Agriculture, P.O. Box 1016, Paramaribo, Suriname
GUSTAVO TORO ALAYON, Ministerio Sanidad y Asistencia Social, Caracas, Venezuela
JAIRO TORRES SANCHEZ, Jefe, División de Tecnología, Organization of American States, 1889 F Street, N.W., 4th Floor, Washington, DC 20006, U.S.A.
ADAM J. TRUJILLO, Director, Orlando District, U.S. Food and Drug Administration, 7200 Lake Ellenor Drive, Orlando, FL 32809, U.S.A.
RUURD F. VAN DER HEIDE, Head, Food Hygiene and Nutrition Department, Ministry Welfare, Public Health and Culture, P.O. Box 439, Leidschendam, The Netherlands
CONSTANTINUS C.J.M. VAN DER MEYS, Director, Nutrition and Quality Affairs Services, Ministry of Agriculture and Fisheries, Bezuidenhoutseweg 73, The Hague, The Netherlands
FEDERICO VARGAS PERALTA, Ambassador Designate of Costa Rica, Embassy of Costa Rica, 2112 S Street, N.W., Washington, DC 20008, U.S.A.

JEANNIE VERGNETTES, Conseiller Technique, Secretariat d'Etat Budget et Consommation, 393 Rue de Rivoli 75056, Paris, France

WILLIAM J. WALSH, Coordinator for Biomedical Research and Health Affairs, U.S. Department of State, Washington, DC 20520, U.S.A.

HERBERT WEINSTEIN, Technical Research Director, General Foods International, 250 North Street, White Plains, NY 10625, U.S.A.

L. A. WILL, Office of the Caribbean Program Coordination, Pan American Health Organization/World Health Organization, P.O. Box 508, Bridgetown, Barbados

CAROLYN FILLMORE WILSON, U.S. Department of Agriculture, Technical Office, Bldg. 1072, BARC-East, Beltsville, MD 20705, U.S.A.

FRANK E. YOUNG, Commissioner, Food and Drug Administration, 5600 Fishers Lane, Room 1471, Rockville, MD 20857, U.S.A.

APPENDIX B

Committee on the Inter-American Conference on Food Protection: Affiliations and Major Research Interests

COMMITTEE ON THE INTER-AMERCIAN CONFERENCE ON FOOD PROTECTION: AFFILIATIONS AND MAJOR RESEARCH INTERESTS

CHAIRMAN

NEVIN S. SCRIMSHAW, Institute Director, International Food and Nutrition Program, Massachusetts Institute of Technology, Cambridge, Massachusetts
Major Interests: International health and health education, clinical and public health nutrition; nutrition and infection; epidemiology of nutrition and disease.

VICE CHAIRMAN

HAROLD J. SIMON, Professor of International Health Policy, Director of International Programs, University of California, San Diego, La Jolla, California
Major Interests: International health and health policy; infectious diseases; epidemiology; clinical research; pharmaceuticals for developing countries; education of health care personnel.

MEMBERS

JOHN E. DAVIES, Professor and Chairman, Department of Epidemiology and Public Health, University of Miami, Miami, Florida
Major Interests: Pesticide residues in humans and food; clinical epidemiology.

ROBERT B. GRAVANI, Associate Professor, Department of Food Science, Cornell University, Ithaca, New York
Major Interests: Food safety and sanitation; food microbiology; regulatory affairs; education and training.

RICHARD L. HALL, Vice President, Science and Technology, McCormick and Company, Inc., Hunt Valley, Maryland
Major Interests: Food technology; food toxicology; safety evaluation.

DIETRICH W. KNORR, Professor, Department of Food Science, University of Delaware, Newark, Delaware
Major Interests: Food processing; food quality; food biotechnology.

RAJ K. MALIK, Chief, Food Quality and Standards, Food Policy and Nutrition Division, Food and Agriculture Organization, United Nations, Rome, Italy
Major Interests: Food quality control; food safety; consumer protection; national policies and strategies for food protection; infrastructure development; management of food control systems, food standards, training, and inspection.

ALEXANDER B. MORRISON, Chairman, Department of Food Science, University of Guelph, Guelph, Ontario, Canada
Major Interests: Food safety; national and international regulatory controls over foods; public health.

FERNANDO QUEVEDO, Regional Advisor on Food Safety, Pan American Health Organization, Washington, D.C.
Major Interests: Food protection and safety; food microbiology; training and education.

CONSULTANT

ABRAHAM HORWITZ, Director Emeritus, Pan American Health Organization, Washington, D.C.
Major Interests: International public health and preventive medicine; international health planning and policy; international nutrition.

NATIONAL RESEARCH COUNCIL STAFF

DARLA E. DANFORD, Project Officer, Committee on the Inter-American Conference on Food Protection, Food and Nutrition Board, Commission on Life Sciences, Washington, D.C.
Major Interests: Clinical nutrition and metabolism; public health and international nutrition; trace elements.

SUSHMA PALMER, Director, Food and Nutrition Board, Commission on Life Sciences, Adjunct Assistant Professor of Pediatrics, Georgetown University School of Medicine, Washington, D.C.
Major Interests: Nutrition; growth and development; nutrition and immune response.

FRANCES M. PETER, Editor, Commission on Life Sciences, Washington, D.C.
Major Interests: Scientific communication.

NRC NAS NAE IOM

NATIONAL ACADEMY PRESS

The National Academy Press was created by the National Academy of Sciences to publish the reports issued by the Academy and by the National Academy of Engineering, the Institute of Medicine, and the National Research Council, all operating under the charter granted to the National Academy of Sciences by the Congress of the United States.