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# FOOD HYGIENE

## Fourth Report

### of the Expert Committee on Environmental Sanitation

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WORLD HEALTH ORGANIZATION

PALAIS DES NATIONS

GENEVA

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**EXPERT COMMITTEE ON ENVIRONMENTAL SANITATION**

**Fourth Session**

*Geneva, 26 July - 1 August 1955*

*Members :*

Dr Humberto Ceballo, Veterinario Jefe de la Sección de Registro de Alimentos, Ministerio de Sanidad y Asistencia Social, Caracas, Venezuela

Mr R. Johnson, Secretary, The Sanitary Inspectors Association, London, England (*Rapporteur*)

Dr Shintaro Kotani, Chief, Food Sanitation Section, Public Sanitation Bureau, Ministry of Health and Welfare, Tokyo, Japan

Dr A. Nénot, Professeur agrégé à la Faculté de Médecine de Paris, Vincennes (Seine), France

Dr A. A. Sidky, Director-General, Cairo Municipal Health Department, Cairo, Egypt

Mr Walter D. Tiedeman, Resident Lecturer, School of Public Health, University of Michigan, Ann Arbor, Mich., USA (*Chairman*)

*Secretariat :*

Mr H. G. Baity, D.Sc., Director, Division of Environmental Sanitation, WHO (*Secretary*)

Mr R. N. Clark, Chief Adviser in Public-Health Engineering, Division of Environmental Sanitation, WHO

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## FOOD HYGIENE

### Fourth Report of the Expert Committee on Environmental Sanitation \*

The fourth session of the Expert Committee on Environmental Sanitation, which dealt with the subject of food hygiene, was held in Geneva from 26 July to 1 August 1955.

Dr P. Dorolle, Deputy Director-General of the World Health Organization, welcomed the members of the Committee on behalf of the Director-General and described the principles under which the WHO expert panels and expert committees work.

The Deputy Director-General stated that the subject of food hygiene as a factor in environmental sanitation is a very broad subject. It is manifestly impossible to establish uniform sanitation habits in all fields, applicable to all regions, all countries, or all kinds of civilizations, with their varied cultural patterns and habits. There are, however, general principles which can be established, even though their application must vary from one country to another because of the extreme variety of resources, levels of culture, education, standards of living, and industrial possibilities. Furthermore, it is necessary to consider the problem of the health education of the public and, in the field of food hygiene, the special problem of the health education of food producers and the food industry.

In conclusion, Dr Dorolle drew attention to the final item on the agenda, the suggested role for WHO in the field of food hygiene. Here, WHO relies on the suggestions of the experts, who can show how the Organization might be of greater service to the public-health administrations of the world. WHO is subject to some limitations, due mainly to the inter-governmental nature of the Organization, and its role must be understood within the framework of its Constitution and the Charter of the United Nations.

Mr W. D. Tiedeman was unanimously elected Chairman and Mr R. Johnson, Rapporteur for the session.

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\* The Executive Board, at its seventeenth session, adopted the following resolution :  
The Executive Board

1. NOTES the fourth report of the Expert Committee on Environmental Sanitation ;
2. THANKS the members of the Committee for their work ; and
3. AUTHORIZES publication of the report.

(Resolution EB17.R16, *Off. Rec. Wld Hlth Org.*, 1956, 68, 6)

## 1. Introduction

### 1.1 General

The Committee reviewed the world situation with respect to food-borne illness and the impact of food, as hereinafter defined, upon the health of the populace. It is well known that because food is frequently subjected to bacterial and chemical contamination, it has a direct, extensive, and important bearing on public health. Although records of such contamination are far from being complete, it is clear that a vast amount of ill health and human suffering is directly attributable to the consumption of infected or contaminated food.

Looking at the world at large, there appear to be vast differences in the effort made by those responsible for public health and environmental sanitation in protecting the public through the supervision necessary at every stage in the production, processing, and subsequent handling of foods from their source to the ultimate consumer. This situation is similar to that in many other branches of public-health work. Owing to differences in the stages of development as well as in customs and kinds of foods consumed, no common pattern for all nations can be set for programmes in this field.

It is recommended that primary consideration be given to establishing simple and effective programmes for the supervision at all stages of foods most commonly found to have carried disease, such as milk and milk products, meat and meat products, poultry and eggs, and fish including shellfish. Programmes should also include supervision of vegetables, fruits, and other food. Control should extend to the delivery, displaying, and serving of foods to the public. It should include such activities as the control of food handlers' cleanliness, encouragement of refrigeration, destruction of rodents and other vermin, and the control of food additives and spray residues. The reporting and investigation of all food-borne outbreaks of disease is a valuable adjunct to aid in the evaluation of the control programme and to point the way to the appropriate steps necessary to improve the effectiveness of the work.

Education—in the broadest sense of the word—of the public, of persons engaged in the food industry, and of health-department field personnel should be recognized as a primary necessity. The educational approach is recommended although it is recognized that enforcement measures may have to be used upon those who refuse to comply with regulations and teaching, particularly in the early stages of the development of new programmes.

Work in this field should be directed towards the greatest possible protection of health by the most effective use of available public funds. Although large appropriations will be needed, experience has shown that such expenditures are a sound investment. In formulating a food-hygiene programme, a primary essential is the creation of a properly trained field staff. Laboratories are necessary to complete the chain of food-control activities, but they should not be used as the sole means of control. Their effectiveness is in direct relation to other activities in the food-control programme, especially the field services.

## 1.2 Definition of terms

The following definitions were adopted for the purpose of this report :

(1) " Food " includes all substances, whether in a natural state or in a manufactured or prepared form, which are part of the human diet.

In considering the subject of food as a factor in environmental sanitation, however, the Committee has excluded from its consideration water, drugs, and therapeutic substances. The Committee recognizes the vital importance of water as an element in human diet as well as in food handling and food hygiene ; the purity and wholesomeness of water is a wide subject in itself, however, and calls for consideration by specialists in that field.

(2) " Food handling " means every activity, process, or treatment to which food is subjected from its growth, production, or manufacture until its final consumption, and which may have an influence on its safety, wholesomeness, or soundness for human consumption.

(3) " Food hygiene " means all measures necessary for ensuring the safety, wholesomeness, and soundness of food at all stages from its growth, production, or manufacture until its final consumption.

(4) " Food poisoning " means any apparently toxic disturbance following the ingestion of food, which while simulating chemical poisoning cannot be ascribed to any clearly defined poison. Such food poisoning includes :

(a) nervous disturbances of the paralysis type, such as those induced by the thermolabile toxin of *Clostridium botulinum* ;

(b) gastro-intestinal disturbances following the ingestion of food infected with various bacteria : *Salmonella*, *Enterococci*, *Clostridium welchii*, *Proteus*, *Escherichia coli*, and others.

Whatever the causative bacteria, the symptoms of food poisoning are always of the same type, predominantly digestive.

## 2. The Importance of Food Hygiene in Protecting Health

### 2.1 The relationship between environmental sanitation and food-borne illnesses

The number of illnesses which may be transmitted by food is large, but the incidence of individual food-borne diseases varies widely in different parts of the world. The Committee has not thought it necessary for the purpose of this report to compile a comprehensive list of all the illnesses concerned. They fall conveniently, however, into a number of groups. These groups are set out below, together with a few examples of the illnesses in each.

Allergies and deficiency diseases, although important to public health in many parts of the world, have been excluded because their prevention falls outside the scope of food hygiene.

#### CLASSIFICATION OF FOOD-BORNE ILLNESSES

<i>Group</i>	<i>Examples of illness in each group</i>
Bacterial toxins	Botulism Staphylococcal intoxication
Bacterial infections	Typhoid and paratyphoid fevers Salmonella food poisoning Tuberculosis Brucellosis Bacillary dysentery Streptococcal infections
Parasites	Taeniasis Hydatidosis Trichinosis Ascariasis Amoebiasis
Chemicals	Arsenic poisoning Lead poisoning Zinc poisoning
Natural poisons	Mushroom poisoning Rhubarb-leaves poisoning Ergotism

Many foods may be the vehicle of these diseases, the most important of which are milk, milk products, meat, fish, shellfish, eggs, salads, and vegetables commonly eaten raw, but their mode of contamination varies.

The deliberate and gross adulteration of foodstuffs with harmful chemical substances, which in the past was commonly practised in many countries,

has now largely disappeared through the enforcement of food legislation. Today, however, an ever-increasing number of chemical agents is being employed to protect growing crops, livestock, and stored food. Because such agents are valuable in controlling pests, weeds, and diseases, and so promote the healthy growth of crops and reduce waste of food, their use seems likely to be a permanent feature of agricultural and horticultural practice. Unfortunately, some of the pesticides now being employed are not only toxic to the pests against which they are used, but may also constitute a serious danger to man if improperly used. For example, parathion applied to crops too close to harvesting may be highly dangerous.

Clearly, proper steps should be taken to minimize the potential hazards from toxic residues which a treatment with pesticides may leave in the food to which it has been applied. In so doing, the advantages of crop-protection measures must be weighed against the possible dangers of poisoning food through their improper application. The Committee has noted that this problem is receiving active attention in many countries and feels that these studies should be properly co-ordinated at an international level.

The Committee understands that a Study-Group on Toxicology is to be formed by WHO in 1956 and recommends to the Organization that this group should be asked to make recommendations to governments on the use of toxic chemicals on agricultural products.

## 2.2 Economic factors

The economic loss resulting from illness has been recognized for many years. Winslow points out that the early pioneers in sanitary science recognized "that poverty and disease formed a vicious circle. Men and women were sick because they were poor; they became poorer because they were sick, and sicker because they were poorer."<sup>1</sup> The illness resulting from contaminated food is no exception to this rule, and the costs resulting to individuals and to governments impose a staggering burden upon the human race. "Every step that can be taken toward lessening this burden will not only diminish suffering and prolong human life; it will also increase productivity and promote prosperity."<sup>1</sup> Clearly, it is better to prevent disease than to cure it.

While the greatest economic benefits resulting from an adequate food-hygiene programme probably accrue from savings in the cost of sickness, and from increasing productivity arising from a healthy population, there are other important elements to be considered. Food spoilage may be

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<sup>1</sup> Winslow, C.-E. A. (1951) *The cost of sickness and the price of health*, Geneva, pp. 9, 16 (*World Health Organization: Monograph Series*, No. 7)

reduced through the use of hygienic practices, resulting not only in an economic gain, but in a nutritive gain also in terms of total food available for consumption. Furthermore, good practices result in a higher quality of foodstuffs, which command correspondingly higher prices.

It is certain that improvements in food hygiene cost money. The food industry must spend considerable amounts for better equipment and better operation, and food-hygiene agencies must also spend correspondingly greater amounts, but such costs are compensated to a great extent by gains in the general economy. It is pointed out that the efficient use of funds to improve food sanitation in an under-developed or rapidly developing country will bring a far greater return in terms of improved health, reduction of sickness, and advances in the economy of the country, than the use of an equivalent sum in a more highly developed country where all the easier methods are already in use.

Economic considerations usually affect the rate and manner in which improvements are put into practice. It may be necessary to proceed step by step, keeping in mind the necessities of each situation but aiming always at a consistent goal. In poorly developed areas, the sudden application of strict measures might result in the condemnation of large quantities of food which are necessary to sustain life. This poses a very difficult problem. People need good food for good health, but above all they need enough food. It may be necessary, therefore, to defer the full application of control measures until there is an assurance that they will not reduce nutrition to a dangerously low level.

### **3. Principles Applicable to the Control of Foods Commonly Known to Have Carried Disease**

#### **3.1 General**

Through the years certain basic principles and procedures have been developed for use in the application of food hygiene. An advance was made when man discovered the advantage of applying heat to foods even though he did not understand at that time what organisms were being destroyed or why it was advantageous to destroy them. Boiling was established as an effective means of checking food spoilage.

The drying of food for preservation also is an ancient practice. It was discovered through experience that fruits such as grapes and plums when dried in the sun would keep for long periods of time without decomposing. Early users made the most of this valuable process even though they did not know that the preservative action was due to the bacteriostatic effect of concentrating the natural sugars or salts in the fruit by the removal of water. As time passed, advances were made in methods of drying foods

by various mechanical means to speed up the process and make it independent of weather conditions. The introduction of roller- and spray-drying made it possible to apply this valuable principle of food preservation to such common products as milk and eggs. With these developments, however, sanitary control has become increasingly essential.

Later, the process of sterilizing foods in sealed cans was discovered and much misery was caused by botulism until health officials demanded adequate control. Similarly, the process of pasteurization was developed primarily for commercial use in wine making, but soon thereafter it was applied to the destruction of pathogens in milk. Workers in the field of environmental sanitation found later that much of the equipment used for pasteurization was unreliable. As the result of testing and much effort by control workers, equipment was improved and control measures were developed which have drastically cut down the incidence of milk-borne disease.

In the storage of foods the value of cooling and maintaining them at 10°C or lower has long been recognized as a means of checking bacterial growth. At first, this was done rather indifferently in colder climates, using natural ice. However, this led to refrigerated food storage as well as to rail transportation of refrigerated foods. With the advent of mechanical refrigeration better facilities for storing foods of many kinds were developed. In recent years the use of mechanical refrigeration has been extended to trucks and freight cars.

Along with these developments came the preserving of foods by quick freezing. While this method prevents multiplication of bacteria contained in the food being held frozen, it presents another problem in control for workers in environmental sanitation.

The use of bactericidal or bacteriostatic chemicals other than the common condiments in preserving foods is not a generally accepted practice, but nevertheless presents an added problem for the food-hygiene officer.

Among the newer methods advocated for destroying pathogens in foods is treatment by the use of ionizing radiation. While this is still in the experimental stage and appears to be uneconomical at this time, it will present new problems for the environmental-sanitation worker when and if it comes into commercial use.

In addition to methods used for destroying pathogens in foods and for checking their growth, the environmental-sanitation worker has other time-honoured procedures or tools at his command. Inspection and licensing are fundamental. Grading, scoring, and the issuing of approvals or certificates other than official licences or permits are procedures which may be found useful under special conditions but are not generally recommended.

Following inspection to enforce compliance with legal requirements, the collection and laboratory examination of specimens of products is most valuable. It is recommended that all unsatisfactory results reported by the laboratory be followed up immediately to secure compliance with legal standards.

### 3.2 Milk and milk products

Milk and milk products form an important part of the diet of man in a large number of countries, and much of the milk is consumed in its raw liquid state. The disease-conveying potentialities of these articles of food are great, however, and strict attention must be paid to their safety in all food-hygiene programmes.

From whichever species of mammal milk is derived, it is liable to contamination with pathogenic organisms; where inadequate steps are taken to eradicate animal disease and insufficient safeguards are observed during production and subsequent handling, the possibilities of dangerous contamination are considerable. The consumption of raw milk of any grade must always be fraught with potential, and often with actual, dangers to the consumer.

Other milk products are also potential vehicles of infection, such as raw cream, which may be regarded as being as potentially dangerous as raw milk. Live pathogenic organisms may also be found in ice-cream, although it does not always contain raw milk or cream. Certain varieties of cheese prepared from raw milk may also be responsible for conveying disease.

In those countries where milk can be pasteurized or sterilized commercially, a large measure of protection is provided against milk-borne disease, although reliance must not be placed on these processes alone. The health of the live animal and hygiene of production and handling at every subsequent stage are equally important.

In under-developed countries, the attempt to obtain the general adoption of pasteurization or sterilization of milk, or any other means of controlled heat-treatment, may present various difficulties of an economic, administrative, and technical nature. However, such countries should, as soon as these difficulties can be overcome, actively promote the general adoption of treatment processes which will improve the hygienic quality of milk.

It must be remembered that in these countries the milk is usually delivered to the consumer within a short time of production. A more practical safeguard in such areas is the effective boiling of milk in the home in accordance with traditional practice. Under certain circumstances,

powdered milk can also be safely supplied to consumers—especially infants—either in preference to liquid milk, which may be dangerous, or to supplement the liquid-milk supply in times of shortage.

The Committee notes that an Expert Committee on Milk Hygiene is to be convened in 1956.

### 3.3 Meat

Meat hygiene was discussed by the Joint FAO/WHO Expert Committee on Meat Hygiene, which met in Geneva from 6 to 11 December 1954, and as the report on this meeting<sup>1</sup> contains a good deal of information on this subject, the present committee has not thought it necessary to discuss it in detail.

One interesting fact is that in certain highly developed countries for which statistics are available, the majority of food-poisoning outbreaks have been traced to meat and particularly to processed and made-up meat which has become infected during its preparation. Freshly cooked meat is rarely implicated.

In the under-developed countries, however, the reverse appears to be the case. In these areas, because of endemic parasitic diseases both in animals and in human beings and the low standard of sanitation observed in waste disposal, raw meat frequently contains parasites which are harmful to man.

The health of the live animal is most important to human health, and the activities of veterinarians in preventing and eliminating zoonoses are an essential factor in food hygiene. There should be the closest collaboration, therefore, between the veterinary officer working in the field of animal health and the public-health officer responsible for the supervision of meat supplies.

The food-hygiene programme in any country should include proper provision for the efficient inspection of all meat at the point of slaughter. Meat inspection is, indeed, an essential part of environmental sanitation and food hygiene and is one of the most important duties of public-health officers. An important requisite in this connexion is the availability of properly designed and constructed abattoirs provided with adequate facilities.

Adequate supervision of the preparation and handling of meat must also be exercised by the public-health team both within the abattoir and at all subsequent stages until delivery to the consumer. A forthcoming

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1955, 99

WHO publication on meat hygiene<sup>1</sup> contains helpful detailed information on this subject.

Special precautions are necessary in plants where meat products are manufactured. Unless hygienic practices are strictly observed during manufacture and in transport and storage, there is a serious risk of the products becoming dangerously infected. Indeed, there have been many outbreaks of food poisoning due to the contamination of these products. The proper handling of meat in the kitchens of restaurants, canteens, and other places of commercial and communal feeding is equally important.

In recent years, the canning of hams by a pasteurizing process has been practised. Hams canned in this way can be kept for a limited time and, unless they are stored at a low temperature, bacterial growth and decomposition may quickly develop. In the opinion of the Committee, this practice is undesirable since the public are not accustomed to taking any special precautions in the storage of canned foods. If this process is permitted, the cans should bear some clear instructions on their storage.

### 3.4 Poultry and eggs

Wherever possible, the slaughtering of poultry should be conducted at special slaughtering centres, to facilitate inspection and the application of proper hygienic safeguards.

The eviscerating of poultry presents a problem, and practice varies. In some places poultry is not eviscerated before delivery to the retailer or to the consumer, whilst in others the viscera are removed at the point of slaughter. From the hygienic point of view, the Committee is in favour of evisceration as soon as possible after slaughter, if a proper inspection service is provided. Where poultry is not eviscerated, it is important that it be kept refrigerated until it reaches the consumer. It is also recommended that in warm climates eviscerated carcasses be similarly refrigerated.

The public-health implications of the use of hormone preparations and antibiotics in the feeding of poultry may be far-reaching, and the results of research in this field are eagerly awaited.

Control of eggs should include all kinds of eggs offered for sale. Clean production methods should be stressed. The washing of eggs before marketing should, however, be discouraged, because this removes the protective albuminous layer. Where the manufacture of powdered dried eggs is allowed, proper control should be exercised over the process and an upper limit for total bacteria count per gram should be established

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<sup>1</sup> *Meat hygiene*, Geneva, 1956 (*World Health Organization: Monograph Series*—in press)

and enforced. Control measures are equally necessary for shelled whole eggs.

### 3.5 Fish, including shellfish

In those countries with a highly organized fishing industry and well-developed fishing ports, fish should be inspected at the ports and any found to be unfit for food should be rejected. In countries where fish is not landed at recognized fishing ports where inspection can be carried out, the fish should be examined at inland distribution centres and markets. As with other foods, control should extend throughout the line of distribution until the consumer is reached and should include all canned and other preserved fish.

It has been reported that antibiotics have been used to preserve shrimps. At the present time not enough is known about the implications of the use of antibiotics for the preservation of food, the allergic conditions to which they may give rise, the creation of microbial resistance to antibiotics, and the effects on the intestinal flora. The Committee has reservations, therefore, on this practice and feels that the problems involved should be the subject of scientific study. In the meantime, the Committee does not recommend the use of these substances.

Shellfish present a special problem when grown in beds which are subject to sewage pollution. Outbreaks of typhoid fever and other forms of salmonellosis have resulted from the consumption of shellfish contaminated in this way. Shellfish growing-areas should be properly controlled and every shipment should be labelled to identify its source.

### 3.6 Vegetables

Vegetables which may be eaten uncooked and have been irrigated or sprayed with sewage or sewage effluent should at least be washed, and treated with an effective germicidal solution, before they are offered to consumers.<sup>1</sup>

In certain areas, there is a widespread practice of using weak solutions of certain chemicals, such as potassium permanganate, as disinfecting agents for fruits and vegetables. These are usually entirely ineffective for such purpose and give a false sense of security. Reliance on this practice is to be strongly discouraged.

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<sup>1</sup> In the USA, a solution of chloromelamine containing a wetting agent and buffered to pH 3.8 has been found to be effective in destroying bacteria and cysts of *Entamoeba histolytica* on leafy vegetables. It is used in a concentration of 200 parts per million and the vegetables, after washing, should be soaked in such solution for at least 5 minutes.

At present it is impossible to recommend a simple means for protecting the public from possible harmful effects of toxic spray residues on vegetables. It is recommended that the problem be referred to the Study-Group on Toxicology previously mentioned in section 2.1 (page 7), with the request for a practical recommendation for control.

### **3.7 Fruits**

Fruits likely to be eaten unpeeled which are sprayed with poisonous insecticides may have a toxic effect on the consumer. In some areas, special methods of washing are used which, however, are not universally applicable. Fungicides such as thiourea are also applied to the skins of citrus fruits; since these skins are used in the preparation of food this practice presents dangers to public health. It is recommended that these problems be referred to the Study-Group on Toxicology together with the problem of washing vegetables as stated in section 3.6.

### **3.8 Other foods**

Outstanding examples of other foods widely consumed throughout the world which require regulation and control are canned foods, frozen foods, and other commercially prepared foods such as custard-filled pastries, prepared meals, and prepared sandwiches. These foodstuffs present particular hazards against which adequate safeguards must be taken at all stages of preparation, distribution, display, and sale. Ice is also used in the preparation and serving of food; it should always be made for such use from pure drinking water and should be handled with proper hygienic precautions.

## **4. Problems Peculiar to Various Areas of the World in Maintaining Sanitary Food-Handling Procedures**

### **4.1 Possible dangers in production methods commonly used**

Improper methods used in the production of food may give rise to contamination of the food at the point of production, with consequent dangers to the consumer.

#### *4.1.1 Irrigation with sewage*

In many countries the irrigation of land with sewage is both a method of disposal and an important factor in improving both the quality and the quantity of vegetables and other agricultural products. It is clear that produce grown in soil to which sewage has been applied must become contaminated. In fact, the consumption of raw vegetables grown in this

way has led to mass infections with diseases such as amoebic dysentery and ascariasis.

In view of its importance, the Committee recommends that the irrigation of land with sewage should be controlled by sanitary authorities.

#### 4.1.2 *Night soil*

The disposal of night soil in areas lacking sewerage and sewage-disposal plant can cause serious dangers when applied to growing crops. In such areas it is recommended that the collection and disposal of night soil should be the responsibility of the sanitary authorities, or at least should be under their strict supervision.

#### 4.1.3 *Garbage feeding of pigs*

The feeding of pigs with uncooked garbage is, perhaps, the most important link in the chain of trichinosis infection and is a vulnerable point on which the sanitarian can concentrate his control efforts. Pig keepers should be required to boil garbage before feeding it to their pigs.

#### 4.1.4 *Salted and raw fish*

In some countries raw fish is sometimes consumed either in its fresh state or salted. Sometimes, fish which has been buried for a few days is salted and served for consumption. Cases of heterophyiasis infection of the intestines are of common occurrence amongst the population consuming fish prepared in this manner. The salting of fish when decomposition has commenced is also practised in some areas; this is open to serious objection, and salmonella and staphylococcal infections from such fish have also been reported. Education of the public and the use of control measures by public-health officers are needed in areas where these various methods are followed.

### **4.2 Improper processing procedures**

The processing of foods embodies a great multitude of practices which vary according to the traditions and tastes prevailing in different countries, and sometimes within the same country. No effort is made by the Committee to enumerate all of the unsatisfactory practices, but a few illustrations may serve to point out how basic principles may be dangerously violated. In certain northern areas, pasteurization of milk is practised mainly as a means of preserving milk from spoilage. During the colder seasons, when spoilage is not a serious problem, pasteurization is discontinued. This practice arises from the belief that pasteurization is primarily an economic process, its purpose being to prevent the loss of product

through spoilage. In some widely separated regions, fish is allowed to decompose partially before its final processing, in order to suit local tastes as to colour, flavour, and texture. In other areas, canned hams are only partially preserved, in an effort to produce a certain flavour, and are kept without refrigeration. Reports have been received of lead shot being introduced into the gullets of poultry to increase the weight, which brings in both the element of fraud and the hazard of lead poisoning.

#### **4.3 Dangers in storing, delivering, and displaying food**

The storing, delivering, and displaying of food should be carried out with adequate precautions against contamination by physical, chemical, or biological agents. Illustrations of unusual hazards found in different areas could be extended to great length, but only a few such illustrations are given to show the range of practices. Food in some areas is wrapped in newspapers, and examples have been reported where coloured ink has contaminated moist foods such as fish. The use of newspaper should be discouraged as much as possible, particularly for wrapping moist foods, since the paper may have been subjected to much handling and may have become seriously contaminated. In many areas, such fruits as melons are cut and displayed for sale under conditions which are grossly insanitary. In certain tropical areas, milk vendors customarily throw a handful of straw into the top of filled cans to prevent the milk from splashing during transportation. In some highly developed areas, sandwiches with prepared meat fillings are dispensed from automatic coin machines without refrigeration and often without regard for dispensing the older merchandise in advance of freshly prepared sandwiches. In many areas, bulk milk is dispensed from the vendors' containers into jars or pitchers set out by householders.

In displaying food for sale, retail merchants tend to disregard the need to take adequate measures to protect the food from contamination and may satisfy their customers by merely chasing away flies. They ignore other dangerous sources of contamination, such as dirt and dust from the air, and the hands and breath of the customers themselves.

#### **4.4 Contamination of foods during serving**

The act of serving foods to consumers, both in public places and in private houses, presents the same typical problems, namely, that protection is needed against improper handling procedures, unclean containers and utensils, dirty hands, and lengthy exposure to local surroundings. In some areas, food is set out in large dishes, from which each individual serves himself with his own fingers, chopsticks, or fork. In many tropical areas, food is served on leaves, such as banana leaves, which in themselves

may present no hygienic hazard, but which are often soiled and contaminated. Flies often contaminate food at the time of serving. A common example in the Orient is in the sale of sugar cane, either peeled and cut into sections, or crushed, the juice serving as a beverage; it is virtually impossible to prevent flies from clustering on these tit-bits. In view of the wide range of possible situations, it is necessary to establish food-hygiene techniques which are adaptable to different conditions.

### 5. Commercial and Communal Feeding

One careless food handler, or one human carrier of disease, preparing food at home will jeopardize the health of only a small number of persons, mainly members of the family. When one such person works in the kitchen of a restaurant, hospital, factory, canteen, school, or other place where meals are supplied to many people, the number of potential victims is correspondingly greater.

Commercial and communal feeding present the most important food-hygiene problems. Dangers arise mainly from the methods employed in cooking and storing food. Food is often cooked long before it is served and kept warm for a number of hours. In certain instances it is transported long distances before serving. These practices provide conditions suitable for the multiplication of any pathogens which may have been present in the food when it was introduced into the catering establishment or may have gained access to it subsequently.

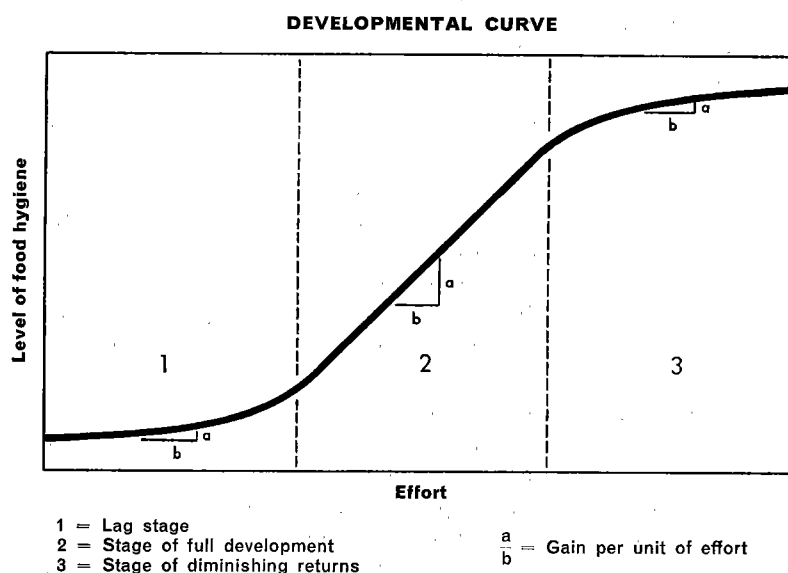
A special case of commercial feeding arises in air travel, which poses a number of unique problems. Instances have been reported, for example, of entire air crews having been taken ill with food poisoning simultaneously in flight, with serious implications for the safety of the passengers and aircraft. The Committee notes with satisfaction that WHO and the International Civil Aviation Organization are preparing a guide for air-travel sanitation, which deals with these problems in considerable detail. In the light of this development, the subject is not covered more fully in this report.

The principles of food hygiene in commercial and communal feeding are the same as in any other type of food handling but they need to be applied with particular care because of the special risks involved. Care is needed to ensure that food supplied to the catering establishment is in a wholesome condition when delivered. Within the catering establishment the food may become contaminated by members of the staff carrying pathogenic organisms, and by insect and rodent pests. There is also the possibility that bacteria may be conveyed by utensils. Bacteria may survive

on crockery, glassware, cutlery, containers, and other utensils, and strict cleansing is, therefore, most important for the destruction of harmful organisms from infected food, or from the mouth or hands of infected persons. Most important of all, food not intended for immediate consumption should be stored at a temperature sufficiently low to prevent bacterial growth. On no account should it be kept warm for long periods.

## 6. General Objectives

The Expert Committee on Environmental Sanitation, in its third report,<sup>1</sup> in commenting on sanitation programmes in their various stages of development, introduced the concept of the developmental curve. This curve may be divided into three general sections: a lower or lag section, with a flat slope, where a comparatively large expenditure of effort results in a comparatively small advance in the stage of development; a middle or developing section, with a steeply rising slope, where a definite expenditure of effort produces a corresponding gain; and an upper section of diminishing returns, with a flatter slope, where a large expenditure of effort produces a relatively small advance, principally in terms of refinements and increased efficiency.



<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1954, 77, 4 (section 1.1.3)

In the under-developed areas, sanitation programmes are either non-existent or have made little measurable progress. These areas are in the lag stage on the bottom part of the curve. Sanitation programmes in rapidly developing areas are in the intermediate stages on the sharply rising part of the curve, and in the more advanced areas the programmes are on the top, flatter slope, where further advance is gained only with great effort and refinement. This concept is useful in forming judgements as to the best type of food-sanitation programmes for any given area. It imposes the consideration that practical food-hygiene programmes must be related to the general stage of development, as measured by economic, social, and cultural levels.

### **6.1 Under-developed areas**

Food-hygiene programmes in under-developed areas are usually faced with problems of public inertia and apathy, with woeful sanitary conditions and practices, and with a shortage of adequate means. Initial small gains are made only with a large expenditure of time, effort, and funds. A start, however, must be urged and it is only after overcoming the public inertia, apathy, and despair that progress will be effective. It is necessary to start with the means at hand, but if progress is to be made these means must be used effectively. It may be necessary to start with only one man in the field of food control, but the first step should be the development of a trained field staff, since field work is the basis of good food hygiene. The key to a good field staff is good training, and training activities should be provided as one of the earliest efforts.

With a well-trained and effective field staff in being, the next steps would be towards the development of complementary services, such as laboratories and training institutes. One cannot expect to develop satisfactory food hygiene without a good sanitation programme, including a safe water-supply and adequate facilities for excreta disposal. These are not a part of a food-hygiene service, but their lack or inadequacy is damaging. This emphasizes the desirability of developing food-hygiene programmes within the context of a developing general public-health programme. It is manifestly difficult to reduce food-borne disease in the face of a diseased population, with its multitude of sources of infection left open and untreated.

### **6.2 Rapidly developing areas**

Rapidly developing areas provide what are probably the most encouraging situations. Inertia has been overcome, poverty, ignorance, and disease are on the wane, and every effort brings a corresponding gain. But in these situations a number of serious problems must be met. The

most pressing problem is that of change. The economy and environment of the country are changing, and new problems are arising. At the same time the public find it difficult to adjust their minds and outlook to the new situation and their habits and thoughts tend to remain in the past. In an area where the economy, the social and the cultural levels are all advancing, a food-hygiene programme, together with the total public-health programme, must either advance at a comparable rate, or become outworn and inadequate.

More-advanced training should be given to field staff; more-effective means should be used for the health education of the public; use should be made of universities and other institutions for research and study on particular problems; higher standards should be set for food-processing plants and, in fact, for the food industry as a whole; attention should be turned increasingly away from the correction of grossly insanitary conditions towards checking the transmission of specific diseases. The problem is to bring these things about, and a food-hygiene organization is faced with the difficulties of finding, training, and supporting a more and more highly specialized staff, and of providing the means and equipment for them to work effectively.

### **6.3 Highly developed areas**

In many areas a point has been reached where the most needed elements of food hygiene are in full operation. The general objective of a programme in such an area is to maintain a fully effective operation and at the same time to increase efficiency to the end that the best possible results may be attained with the least possible expenditure of effort and means. Emphasis is put on the highest level of training and on the development of more-refined techniques.

Increasing use is sought of the resources of the food industry itself, both in the development of equipment and methods, and in the practice of "self-policing". As the general level of development advances, more and more auxiliary services can be utilized. Such difficulties as procuring a safe water-supply tend to disappear as the availability of well-constructed and well-operated public water-supplies increases, and dangers of certain types of infections are greatly reduced as the number of active cases and carriers of disease is brought down to manageable levels. Food-hygiene agencies can give increasing attention to fundamental research on specific problems, and to this end can use not only their own laboratories and institutes, but other public and private resources as well. The collection of statistics and the investigation of food-borne outbreaks are brought to a high level of refinement, and serve to pin-point the problems of food control. Public opinion no longer presents a problem of inertia and apathy;

it may, on the contrary, lay increasing demands for greater effectiveness on food-hygiene organizations. The basic problem to be faced at this level, as at all levels of development, is to make sound progress, in keeping with the general development of the area. It is necessary to guard against complacency and to avoid sanitary "backsliding" due to over-confidence. Eternal vigilance is the price of safety.

## **7. Technical and Administrative Procedures for Improving Conditions**

### **7.1 Fields of activity**

Suggested general fields of activity are given here as a possible guide in the establishment of new programmes or in the revision of existing programmes in food hygiene. Work in one of these may be productive without the others, but an effective and well-balanced programme will employ most of them.

1. Clean food handling methods are a primary requisite in food hygiene. Studies of the practices of workers in performing individual food-handling operations commonly used and likely to cause contamination, with a view to improving and simplifying them, should be most productive. It is recognized that workers are not inclined to practise cleanliness unless it is made easy for them to do so and they are made to understand why cleanliness is important. Some operators of food establishments as well as food sanitarians base their appeal to workers on the grounds that cleanliness keeps customers, brings new customers, and improves business which is necessary for their own security and possibilities for advancement.

2. Field men should be on the alert to detect the improper use of chemicals in food establishments. They should determine that use is made only of chemicals listed by authorities as being safe in colouring or otherwise treating foods. They should prevent the use of toxic metals such as lead in containers or surfaces of equipment with which foods may come into contact. Furthermore, they should be instructed to see that only approved pesticides are used for the extermination of insects or rodents; that they are not allowed to get into the food; and that they are coloured or stored in such a way that they cannot be mistaken for food or accidentally introduced into it.

3. The control of vermin and rodents in all establishments in which food is produced, stored, or served is a necessary food-hygiene activity. The economy of having such plants free of rodents should be stressed as an aid to securing the co-operation of plant owners. Of course, the most effective procedure is to ratproof plants thoroughly and to eliminate all

nesting-places inside them. This can be and has been done. Similarly, cockroaches and other insect pests require a place to live as well as food and drink, and can be deprived of shelter by the use of good building methods and well-built equipment. Flies and other insects can be controlled by established methods. Sanitary collection and disposal of refuse, together with general cleanliness of premises, is the most important measure of pest control.

4. It is well known that much human suffering has been caused by animal diseases transmissible to man, and that only healthy animals should be used for the production of foods of animal origin. Since this problem is being dealt with by the Joint WHO/FAO Expert Committee on Zoonoses, it is only necessary here to point out the importance of the subject.

5. There is much to be gained by reporting, investigating, and publicizing outbreaks of food poisoning or other food-borne diseases. Although it is unlikely that much, if anything, can be done to check an outbreak before the results of the investigation are known, it is important that the investigation should start immediately and that the results should be known to the food-hygiene officers as quickly as possible. The information gained, however, should serve to define clearly the channels through which such disease is spread in the local community, and to reveal ways and means of preventing future outbreaks. The record also is an aid in creating official and public interest in the food-hygiene programme.

## **7.2 Health education**

The Expert Committee on Health Education of the Public, in its first report,<sup>1</sup> said :

“The aim of health education is to help people to achieve health by their own actions and efforts. Health education begins therefore with the interest of people in improving their conditions of living, and aims at developing a sense of responsibility for their own health betterment as individuals, and as members of families, communities, or governments.”

### *7.2.1 Health education of the public*

The need for health education of the general public, in relation to food hygiene, falls into two general headings. The first is the necessity of developing public support of food-hygiene programmes ; the second is to improve the practices of handling, storing, and preparing food in the home, so as to preserve the safety of food to the final consumer. The techniques of health education are varied, and are not restricted to one-way methods

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1954, **89**, 4

such as radio talks, television programmes, lectures, films, leaflets, posters, and newspaper articles. These methods assume that the learner is a more or less empty vessel into which information is poured, to be drawn forth as required. This method may be supplemented by two-way methods, such as discussions, committees, councils, interviews, drama, and live demonstrations, which are more concerned with situations where people learn by experience, by taking part in some activity. Examples are visits by schoolchildren to food establishments, or discussions of a health visitor with a mother regarding the preparation of a meal.

#### *7.2.2 Health education in the food industry*

The health education of all who are engaged in feeding the public, from the producer to the final server, is an essential element of their over-all training. It is important that food workers should understand the reasons for hygienic practices, and not be expected simply to follow prescribed practices blindly. Every opportunity should be taken to use educational methods, particularly during inspections and other contacts made by food-hygiene personnel, so as to relate the underlying principles of hygiene to the activity being undertaken. Health education in the food industry should extend not only to technicians, but to managerial personnel responsible for forming policies.

### **7.3 Enlistment of local participation**

In countries at all stages of development, there is some value to be gained by encouraging local people to take part in the food-hygiene programme. Every individual is so directly affected by food that interest is widespread. One of the many ways in which this principle may be utilized is the appointment of advisory committees. The advice received may not be very valuable at the start, but it still helps to make the public understand the programme, thus gaining valuable support. Another example of utilizing local aid is to get the owner or management of each food-processing or manufacturing establishment to appoint a respected and popular representative as the technician responsible for sanitation. In small plants this may be the son or daughter of the owner, and in large ones the plant superintendent. This person is almost always present to see what is going on, whereas the representative of the health department makes only occasional visits.

### **7.4 Administrative organization of food-hygiene programmes**

The food-hygiene programme should be an integrated part of the over-all health programme. No fixed pattern can be given, as the need varies with the status of development of the country or community. It is

clear that a capable, well-trained staff, whether large or small, is a primary necessity. The programme director should be responsible to the director of environmental sanitation under the health officer, but there will be differences in the detailed pattern of organization in various countries. The post should carry a sufficiently large salary and a sufficiently high prestige to attract and hold a well-qualified person who will be respected by the public and the food industry alike. With only the minimum of direction he should be given freedom to develop the programme in food hygiene and be held strictly responsible for its successful administration. Other positions should be graded according to responsibility, remembering that the public's evaluation of the health department generally is based upon the competence and good judgement of the field representatives with whom they come in daily contact. The need for a properly trained and organized field staff cannot be over-emphasized. Other services should be provided as the programmes progress and the need for them is established.

### **7.5 Legislation**

Effective legislation is necessary to secure proper observance of hygienic practices, but it should be possible to change it quickly and readily to keep pace with scientific and technical advances. For this reason it is an advantage to have the basic legislation embodied in statutes and to set forth the more detailed and technical provisions in regulations made by those having the statutory power to do so.

### **7.6 Relationship to other agencies**

Co-operation with other agencies usually will add impetus to the health department's programme in food hygiene. As an example, food technologists employed by private firms, who are well trained in the processing and presentation of food and its nutritive value, are primarily interested in improving the physical properties of foods to increase sales. By introducing hygienic practices they can not only improve the commercial value of their products but can also contribute materially to the advancement of food hygiene. Growing interest in improving and conserving food in under-developed countries makes this a co-operative effort profitable for both the food hygienist and the food technologist.

Within the health department, co-operation of food-hygiene personnel with others is necessary also for good results. As has been stated elsewhere in this report, good water-supplies and adequate waste-disposal facilities, for example, are needed at all food plants.

While food hygiene does not always have a direct bearing on nutrition, the food-deficiency diseases and food allergies do affect health, and,

with the common interests of good food and good health, co-operation should benefit workers in both fields. Co-operation also may be carried on to advantage with departments of agriculture and national development agencies.

### **7.7 Economics of food-sanitation programmes**

The problems of securing and making the most effective use of funds for the operation of their respective programmes is common to all divisions of the health department, including that of food hygiene. Directors of programmes in food hygiene should attempt to gain the support of industry and the public through making them acquainted with the savings in products, money, and health resulting from good enforcement. To make this possible, it will be necessary to evaluate accomplishments from time to time. It also will be advantageous to evaluate economic losses from food-borne outbreaks which might have been avoided if more adequate financial support had been given to the food-hygiene programme.

## **8. Personnel**

### **8.1 General**

The Expert Committee on Environmental Sanitation at its second session<sup>1</sup> studied the problem of the education, training, and utilization of personnel for environmental sanitation. In the present report the Committee has already referred to the important part which must be played by those personnel in the public-health team who are responsible for the field work in any comprehensive and co-ordinated food-hygiene programme. The success of any such programme depends to a very large extent on the ability of the field staff to perform their tasks efficiently.

It is obvious, therefore, that very careful attention must be paid to their education and training. But their efficiency does not depend on their technical ability alone. Personality and integrity are also highly important since a major part of their efforts will be directed towards securing voluntary compliance with the principles of food hygiene and the acceptance of the requirements of legislation, while at the same time these officers must be relied upon to enforce the law without intimidation.

### **8.2 Personnel requirements**

Medical officers of health have an over-all responsibility for food hygiene as part of their public-health duties. The bulk of the work in

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1952, 47

promoting food hygiene in most countries is performed by health inspectors, and veterinarians have related functions in this field.

The duties of health inspectors include the inspection of meat and other foodstuffs, food sampling, the inspection of premises in which food is handled, the education of food handlers, and the investigation of outbreaks of food-borne illnesses. Their activities extend over the whole range of food handling from the source to the ultimate consumer, and they must be able to take effective action to safeguard health whenever they discover food which is unfit for human consumption or detect faults which are contrary to good food-hygiene practices.

In carrying out these duties, they should normally endeavour to correct faults and secure desirable improvements by education and persuasion, but when these methods fail and circumstances demand more rigorous action, they must enforce the provisions of the law.

As the Expert Committee on Environmental Sanitation pointed out in its second report,<sup>1</sup> the health inspector is a well-established public officer in many countries and has made invaluable contributions to the improvement of environmental sanitation of these countries for more than a century. His work in the field forms the foundation of any well-organized and comprehensive food-hygiene programme and it is surprising, therefore, to find that there are still many countries in which this type of officer does not exist in their environmental-sanitation system. In the opinion of the Committee, this is unfortunate and it is felt that these countries would be well advised to study the advantages of employing health inspectors not only in food-hygiene work but in the realm of general environmental sanitation also.

The number of health inspectors required for food-hygiene work will naturally depend on the nature and extent of the problems involved and the funds available. There should be sufficient officers to enable reasonable progress to be made in the improvement of food hygiene. If the number of officers in relation to the problems facing them is far too small, they may find themselves overwhelmed by the magnitude of their task. There is then a danger that a sense of frustration may lead them to regard the problems as insurmountable and stifle the initiative and drive which they should always display.

In highly developed countries, and to a large extent in the rapidly developing countries also, the health inspectors of the standard and in the numbers required can be recruited from within the national boundaries. In under-developed countries, however, it may be necessary to obtain for immediate duty the services of health inspectors from abroad, although

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1952, **47**, 12 (section 2.8.1)

it will be possible to recruit and train some local people for ultimate assignment to these posts.

### 8.3 Training

The training of health inspectors must be based on a sound knowledge of the basic sciences such as physics, chemistry, bacteriology, parasitology, epidemiology, anatomy, and physiology, which are fundamental to the practice of environmental sanitation. These subjects should form the foundation of their training and superimposed on them should be specialist studies in the various subjects falling within the scope of environmental sanitation. The training programme must make provision for adequate practical training. Health education is playing an increasing part in securing hygienic food practices and it is important, therefore, that personnel should be instructed in its principles and techniques.

The objective should be to give the students a sound general knowledge of the principles of environmental sanitation in all its aspects. Provision should also be made for advanced training, either of a general nature or in specialist subjects. In the second report of the Expert Committee on Environmental Sanitation,<sup>1</sup> it was envisaged that some health inspectors may graduate in sanitary science or hygiene at university level. The Committee commends this idea to WHO and recommends that encouragement be given by the Organization for the creation of university courses.

The type of training described in the foregoing paragraphs should certainly be followed in highly developed countries and should be the ultimate objective in others. In the under-developed countries and the rapidly developing countries, the level of training will be largely determined by the educational level of the available recruits, and for inspectors performing routine duties a lower standard of training than that outlined may have to be accepted temporarily; those holding administrative and supervisory posts should be more highly trained, wherever possible.

Whatever the level of training may be, however, proper provision should be made for refresher courses so that personnel have facilities for keeping abreast with scientific and technical advances.

## 9. Suggested Role for WHO in the Field of Food Hygiene

The Committee considers that WHO can play an increasingly important role, and can move into a position of international leadership, in the

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1952, **47**, 12 (section 2.8.1)

field of food hygiene. Several steps can be taken, which fall within the existing policies and patterns of activities of the organization.

One of the important steps is to supply consultants and advisers to governments to assist with the establishment of suitable organizational structures and operating procedures in the field of food hygiene. Similarly, WHO can assist governments in establishing demonstration projects which can serve not only to demonstrate methods and techniques, but also to train national personnel.

In the field of food hygiene, WHO can be of considerable assistance in disseminating technical information and stimulating action through international study-groups, seminars, and conferences. There are other means of stimulating action and making available scientific information, and these should also be utilized to the greatest possible extent. One of these other methods is the publication of manuals which would set forth clearly the steps to be taken and the techniques and standards to be used in carrying out elements of food-hygiene programmes in different situations.

In the field of education and training, WHO can extend aid to institutions by providing them with teaching staff, equipment, and materials. This is one of the most profitable types of aid since it leads to an increase in both the numbers and the levels of training of food-hygiene personnel. Another important step in this direction is the granting of fellowships, and the Committee recommends that governments should be stimulated to use both study and travel fellowships for the broader training of food-hygiene personnel.

WHO can render a valuable contribution in the field of food-hygiene research, both by co-ordinating research in different parts of the world, and by stimulating new research aimed at developing more efficient and more effective technical methods, as for example the preservation of food by its exposure to ionizing radiation.