The Role of Food Research in Planning for a Better Nutrition in the 21st Century: Government

Douglas L. Georganala

AFRC Institute of Food Research, Reading, Berkshire, England.

"Government is a contrivance of human wisdom to provide for human wants"
—Edmond Burke

Food and food availability have always been fundamental factors governing the development of mankind. Before organized governments existed, food supply and safety would have been of vital concern to every individual, family, nomad, and settled group or tribe. Now, in the modern world and particularly in developed countries, the supply of food would appear not to be an issue and overabundance is a popular topic. But this should not be an excuse for losing sight of the continued vital support of food to the security and quality of human life.

Major issues and food concerns are prevalent both in the developed countries and in poor or disadvantaged areas of the world, and governments cannot evade responsibilities. That governments do have a primary concern is self-evident when one considers:

1. Malnutrition affects hundreds of millions around the world. Famine is not infrequent in some regions. The consequences are summarized in a Food and Nutrition Bulletin editorial comment "the most pressing problem in peri-urban and rural communities, particularly poverty-stricken ones in the developing world, continues to be the synergism of malnutrition and infection" (1).

2. Ample food is available in developed countries but food abundance has not removed food/health threats and problems. In fact, it poses different problems, and the role of diet and major diseases is highlighted by national authorities—e.g., the Surgeon General in the USA (2).

3. Ill-health implications of bad nutrition are varied and serious. In talking with nutritionists one can easily identify some of the issues of life and death connected with the nature, quality, and balance of the food supply in developed countries.

4. Food-borne infections and poisonings are a serious aspect of the food scene. Although this workshop is focused on nutrition and food, we must remember that these other health issues connected with food also call for government action.
and policies. For example, records in many countries reveal significant levels of microbial food poisoning. Policies for good nutrition cannot be disassociated from concerns about the basic hygiene and safety of food. There has been, for example, a steady growth in recorded levels of food poisoning in England and Wales, and this has attracted a great deal of attention in recent times and also urgent government-initiated inquiries.

FOOD AND NUTRITION RESEARCH IN THE UNITED KINGDOM

There are many policy issues for governments arising from these food and nutrition issues, and one of these is government policy in relation to research on food and nutrition. It is of interest to record how one major government-funded institute is evolving its food research programs to provide an appropriate public science base on food. The example concerned is the Institute of Food Research, of the Agricultural and Food Research Council of the United Kingdom.

Institute of Food Research

The Institute of Food Research is the major publicly funded food institute in the United Kingdom and its research is focused on food quality and safety and the impact of new technology, particularly biotechnology. Within these programs there is a major commitment to research on nutritional aspects of food.

The United Kingdom food industry spends in excess of £100 million on in-house research and development (total retail sales value of foods in the United Kingdom exceeds £70 billion). Government spending on food research and development is about £30 million per annum. A significant portion of this amount supports statutory activities of government departments. However, approximately £16 million is given to the AFRC Institute of Food Research to fund advanced food research, and this funding comes to the institute through two separate government departments.

The funding of the Institute from the Department of Education and Science supports exploratory basic research relevant to food. Additionally, we receive funding to meet specific research objectives identified by the Ministry of Agriculture, Fisheries and Food. There has also been a major shift in government policy, whereby research classified as “near-market” is no longer supported by public funds, and can only be done if paid for by industry.

The main features of the Institute of Food Research now are its publicly funded core of basic and strategic research, its independence, and its growing emphasis on longer term research issues important to industry and to consumers. In addition, the Institute is moving away from traditional dedicated work on commodities—such as meat and dairy products—toward more advanced research relevant to the whole of the modern food industry.
Institute of Food Research Programs

Our research thrusts are concentrated on:

- Food properties and quality
- Diet and health/nutrition
- Food choice
- Food safety
- Impact of new technology, particularly biotechnology

We have a major research program on the fundamental, physical and chemical properties of food, which are important in food quality and in interaction with processes. At the same time we are building a new initiative exploring the human response to food properties, the sensory properties, and psychological issues such as the context of food decisions and consumer attitudes toward new technologies in food.

Our nutrition research is substantial and is done collaboratively with clinical groups in hospitals and other research laboratories. Examples of programs include bioavailability of food components, mineral status in relation to different human diets, and questions of vitamin status in humans.

Food Safety

We are steadily increasing our commitment to research on food safety, given the continuing rise in food poisoning cases in the United Kingdom. Many of these food poisoning episodes can be prevented by existing technology and using existing know-how, but there are a wide range of unknowns. We are also concerned about future food poisoning trends and the possible appearance of new poisoning organisms, subjects for our growing research on food safety.

In addition, we believe that the absence of rapid and sensitive tests for food pathogen is a major stumbling block for control in industry and for enforcement by regulatory authorities. We have targeted programs on the detection of selected food poisoning microorganisms by an array of advanced techniques such as RNA and DNA probes, monoclonal antibody probes, and flow cytometry technology.

Biotechnology and Food

We are putting growing emphasis on biotechnology. Although it is unlikely to spread rapidly across all sectors of the food industry, there is clear evidence that in selected areas biotechnology is already being applied in the industry and will be further applied in a variety of ways. For this reason we have focused research programs on two challenging areas relevant to foods: protein engineering and the genetics of food microorganisms, such as lactic bacteria.

Protein engineering research at the Institute is aimed at understanding what protein
engineering means in terms of food components and particularly food enzymes. Involvement in this research requires talented scientists and substantial investment in X-ray crystallography, computer modeling, and the associated techniques required for mutagenesis and cloning—all of which we have installed at the Institute of Food Research. This is very basic research, but it is advancing rapidly and using the enzyme phospholipase A2 we have already shown that the heat resistance of the enzyme can be increased or decreased by specific engineered changes in its molecular structure. With this enzyme—which represents a class of enzymes important in food processing—we have engineered a new enzyme characteristic in the space of 6–9 months. This is an indication of the impact that the basic sciences of molecular biology may have on food processing in the coming decades, and the likely speed of advance.

The Future Institute

In summary what we are in the process of bringing about in a very few years is a complete modernization of the Institute of Food Research, to ensure it is equipped with an advanced multidisciplinary science base, and focused on likely issues of industry and public interest in food. It should be noted especially that whereas previously we were almost entirely concerned with industrial and government issues, we are now increasing our involvement with consumer issues and consumer interest groups with the aim of having an open institute available for exploration, discussion, and debate on key issues in food. In step with this goal we have set up an advisory board and a panel of visiting fellows including very senior industrial and academic leaders and prominent individuals from the consumer world.

The future trends for the Institute of Food Research in the United Kingdom will involve more research on safety, quality, and other issues of consumer concern, to provide impartial and independent information and opinion. Research teams will be multidisciplinary and there will be growing attention to the impact of new technology on foods. Overall, there will be intensified participation in international programs—and we are already well recognized participants in EC programs such as FLAIR, BRIDGE, and ECLAIR.

FOOD RESEARCH FOR BETTER NUTRITION—GOVERNMENTS

Returning now to my title, I believe that the policy of governments on food research for better nutrition will need to take account of two fundamental issues:

(1) The need for appropriate technologies to assist the supply of food in many areas of the world where there are food shortages or quality deficiencies; and

(2) In developed countries food research policies will need to focus on major issues of quality, safety, nutrition balance, and the impact of new technologies, such as biotechnology.
With specific reference to nutrition, some of the major research questions governments must address into the 21st century are described below.

**Food Technology Research**

Refined consideration of nutritional issues must be irrelevant in areas of the world where there are persistent or intermittent shortages of food or serious imbalances in the nutritional composition of the food supply. For these countries and regions, research must in the first place be focused on assisting the development and implementation of appropriate technology for maximizing food supply and availability.

There are many other issues affecting food supply, but technology is an important one, and research on questions of preservation and compositional assurance could be vitally important to the nutritional status of the peoples of such countries.

Much of the knowledge needed exists but research may have a role to play, for example, in new biotechnology approaches to the preservation of foods; in biotechnology in agriculture for improving farm-animal health, or for crop breeding to improve yields, quality, and reliability; in development of new (rapid, portable, etc.) techniques for contaminant detection, compositional analysis, etc.; and in producing improvements in traditional/regional biotechnology processing.

**Diet and Health**

Improving the understanding of the link between different diets and the health or disease status of the national population must continue as a major research objective. In some cases research may have to be focused on subsections of the population, e.g., the young or the elderly, where risks may be more severe. These programs will include epidemiological research and clinical research on individual conditions, as well as research into the nature of health—i.e., what is the desired health state of "normal" individuals and how can this be undermined or maintained by nutrition?

**Food Consumption Data**

Associated with diet and health governments should be responsible for continuing research to improve measurements of, and to monitor the nature of, dietary intake by the population—this work is never ending because of the demographic changes in the population and/or because of changes in life-style or food product availability.

**New Scientific Opportunities**

Nutrition research is likely to undergo major evolution due to the impact of the new molecular and biological sciences. Government policies should encourage
science-driven inquiry into the nature of nutritional effects, using the most advanced molecular biology and genetic techniques.

One practical objective would be the development of new molecular biology probes that will allow the identification of individuals or groups as potential sufferers from diet-related ill-health—surely a highly desirable goal for public health policies.

Advances in physical and chemical sciences will also assist nutrition research, e.g., in advanced laboratory techniques such as mass spectroscopy and stable isotopes, allowing direct studies of mineral status in humans.

Here again government policy should allow for some "pump-priming" to encourage the application of new sciences to questions in nutrition.

**Food Choice**

Nutrition research should not be seen as confined only to the chemical nature of food and the physiological or clinical response of the consumer. Individual and group diets have substantial psychological and cultural aspects that dictate the type of foods eaten. There are also economic, educational, and information issues where the behavior of the population or segments of the population cannot be understood at this stage.

The factors leading individuals, families, or groups toward particular dietary patterns are likely to need continued research as social conditions change, because it will be essential for policymakers to determine how science-based nutrition improvements can work their way through into the diets chosen by individuals.

**“Natural” Nutritional Hazards**

Governments will also have to take account of likely changes over time in the actual nutritional/chemical composition of the food supplies at national and international levels. Changing patterns in world food trade will bring new foods into the national diet, while the new scientific techniques for plant and animal breeding could lead to changes in the basic composition of foods.

Governments will have to sustain research at an adequate level to ensure that any harmful effects arising in the diet from such changes are detected, quantified, and evaluated ahead of any chance of major damage to the public health.

**NUTRITION INFORMATION AND POLICY**

Overall, governments should not assume that present nutrition knowledge is anywhere near sufficient to ensure the steady improvement of public policies concerning nutrition and improved health. Much knowledge is indeed available but much still needs to be done into the next century in getting more understanding and consensus
over the main causes of morbidity and mortality and the possible links with life-style and food intake.

Where food shortages exist the role of science—including research into biotechnology and other appropriate technologies—will have an important part to play in improving the reliability and quality of food supply. In the face of such challenges governments will continue to have a key role to play in the stimulation and implementation of research-based knowledge.

TRANSFER OF NUTRITION KNOWLEDGE

The preceding pages have highlighted responsibilities of governments and the need for research. However, we must remember that there are other bodies concerned with the food supply chain, e.g., the agricultural industry, the agricultural-supply industry, the food-processing industry, the food distribution organizations, and so on. The structure and ownership will differ from country to country.

It is likely that with the serious issues relating to food and health both in developed and less-developed countries, much thought will have to be given to the transfer of nutrition knowledge into practice.

One can easily see key questions where responsible action will lie with various bodies. Examples include:

— achieving scientific consensus
— agricultural supply and pricing
— regulatory procedures for new technologies such as biotechnology
— nutritionally modified foods and their regulation
— the nutritional improvement of standard foods
— labeling of foods with nutrition information or claims
— education concerning nutrition

In the end such matters can only be achieved by varying degrees of collaboration between the different players in a very complicated scene.

In the United Kingdom there is now active discussion about a nutrition forum that will encompass the main research organizations concerned with diet, health, and disease, the government departments responsible for main aspects of policy, and the major sectors of the food industry. The intent is there, but it will take some time before the operational realities can be worked out. We should, however, be cautiously optimistic because all the parties are now aware of the need to improve matters. However, discussions about wider collaboration should not divert attention from the need for governments to stimulate and support appropriate longer term research.

CONCLUSION

Finally, some personal observations can be encapsulated as follows:

— Governments have responsibilities for human welfare and must be concerned about food-health interaction.
In many food/diet/safety/health questions, science knowledge needs to be improved.

Governments thus have a lead responsibility and should plan to maintain and fund food and nutrition research.

New scientific directions should be expected and fostered by governments.

Various mechanisms will be needed for transfer and application of food and nutrition knowledge, and government policies have a role in this.

REFERENCES


DISCUSSION

Dr. Horisberger: Your organization aims to carry out independent multidisciplinary research. What kind of decision tree do you have for selecting research projects?

Dr. Georgala: I have all sorts of help from advisory committees and outside experts who assist in our decision process. It is a complex decision tree. I get funding from the Department of Education and Science to do basic research of our own choice, and funding from the Ministry of Agriculture, Fisheries and Food directed to issues they are concerned about. For example, that department has strongly increased our research on food safety in recent times.

Dr. Harper: I am concerned about perception versus reality in the decision making process. For industry the bottom line is profit. Industry can respond to perceptions just as well as to realities and produce products purely to satisfy the perceptions of the consumer. Governments on the other hand must be careful to respond to realities and not waste limited funds on perceptions. How do you deal with this, when consumers create a demand for something that you are confident is a nonproblem? In relation to food safety, problems are often attributed to commercial processing but in the vast majority of cases, from my examination of the question, it is a consumer problem.

Dr. Georgala: Failures can occur all the way up the chain. There have been some spectacular episodes of food poisoning where the consumer was not to blame. In any event it is a disgrace that there should be a rising curve of food poisoning, however the blame is partitioned. In relation to consumer perceptions, these certainly affect government policy as well as food company policy. It is an important issue why the present trend seems to be so antiscience and antifood industry, and why there should be such a loss of credibility of government experts.

Dr. Schifman: I believe that a government-funded program to do with breeding animals with less body fat has been severely cut. Why is this? It seems to me that this would be a very important program in improving the British diet.

Dr. Georgala: There has been a policy decision to move away from government-funded commodity research, the responsibility for which should rightfully rest with the food industry, which has ample funds to support the research. Things to do with “near market” technology are no longer judged to be valid expenditures for the public purse and I agree with that.
Dr. Grütte: I think it is very important to follow the effect of changes in food consumption. These are small and slow at present in western Europe but large and rapid in eastern Europe. Their effects on health and life expectancy should be carefully monitored. There should be cooperation with institutions in eastern Europe to achieve this.

Dr. Georgala: I entirely agree, although there are significant changes in western Europe diets too which should be monitored. In Britain for example there are now many exotic foods available and if these are consumed by particular groups they could change the chemical composition of their diets significantly. The chemical composition of new crops derived by biotechnology also needs consideration.

Dr. James: The problem of government-funded nutrition research is in part due to the predominant insistence on directed research and in part to the lack of quality nutritionists. There is an extraordinary paucity of personnel in this field throughout Europe and those that there are may be driven away by frustration at having to do directed, politically motivated research. If we are not careful, committees will determine how research is done, which I think would be a recipe for disaster. However, there are grounds for hope. In France, Holland, Denmark, and Italy one finds that many of the agricultural institutes traditionally given over to commodity driven research are now beginning to take on more basic aspects of nutrition research and are putting more effort into human nutrition. One of the industry's major roles could be in forcing politicians to recognize that unpopular research fields with little chance of instant success, such as the field of molecular biology, may eventually prove to be of great benefit.

Dr. Georgala: The subject of nutrition must be opened to the enormous revolution that is going on in the fundamental sciences.

Dr. Hulse: In Canada it is estimated that food industries invest less than 0.2% of income on research, and that of 3,500+ registered food companies less than ten maintain an identifiable food research department. If future viability is going to depend on research capacity does this portend a gradual disappearance of smaller enterprises and an increased concentration in a relatively few large corporations?

Dr. Georgala: Almost month by month there are new mergers and take-overs in the food industry. In the UK as well there is only a handful of companies that could claim to have any research capacity at all.