Chapter II

KEY ISSUES

vitamins

fats

minerals

carbohydrates

proteins

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An appreciation of three key issues that underlie the basic findings of this assessment can aid Congress in better judging appropriate options. These issues are:

1) Goals and priorities of human nutrition research,
2) Definition and funding of human nutrition research, and
3) Personnel resource requirements.

ISSUE 1—Goals and Priorities of Human Nutrition Research

The problems of setting goals and priorities for Federal human nutrition research are inseparable from the organizational structure of current research efforts. Such efforts are now fragmented. Fourteen Federal agencies (under seven departments) are involved in human nutrition research. Each department has independently established its own nutrition research goals and priorities—in line with how it interprets its own particular legislative mandates. The result is a piecemeal approach to nutrition research.

Although most nutrition experts agree that the main goals of nutrition research include the promotion of optimum health and performance, and the treatment of disease through diet therapy and support of other medical therapies, the Federal Government's activities lack such specific unifying goals. They are still guided by the traditional nutrient deficiency disease approach. This fails to meet the changing needs of the American people.

Indeed, nutrition research activities in Federal agencies are generally without focus. This confusion was pointed out by the National Institutes of Health (NIH) Director Dr. Donald Fredrickson's March 15, 1977 testimony before the Senate Committee on Appropriations: ", , research on nutrition is as yet, at NIH and elsewhere, a vast, diverse, and essentially unstructured set of activities.

This lack of overall focus is reflected in the poor coordination of research efforts among Federal agencies involved in such activities. Past attempts at coordination between the Departments of Agriculture (USDA) and Health, Education, and Welfare (HEW), the two principal funders of nutrition research, have usually been of short duration and little impact. International nutrition research, supported primarily through the Agency for International Development (AID), is essentially independent of domestic nutrition research.

The result of this absence of coordination is duplication—not only in the missions of some Government agencies but also in their research and other activities. For example, both NIH and USDA's Science Education Administration have similar research programs on protein, carbohydrates, lipids, vitamins, and minerals.

The Office of Technology Assessment also found a need in Federal nutrition research programs for better integration of data storage and retrieval. Collecting such data is necessary at all levels of nutrition research so that findings can be better utilized. However, various agencies now use different types of indexing, data storage, and retrieval systems. Thus they find it difficult to report results of research projects. Moreover, no agency has an efficient system of evaluating and col-

lating research findings. Because of a general lack of accessibility, it is often extremely difficult for agencies to communicate research information to the public or Congress.

Of course, some overlap in interests is inevitable in similar areas of research, and duplication of research results is a necessary part of scientific research. But unnecessary duplication should be avoided. Minimizing duplication by developing more efficient means of sharing information on planned, ongoing, and completed research is an achievable goal.

In the same sense that some duplication is a necessary part of scientific research, healthy competition among agencies may stimulate greater effort and ultimately benefit the public. But the proprietary stance taken by some agencies is wasteful and inhibits joint planning. Internecine struggles at higher levels of Government apparently foster such attitudes. However, career civil servants and the public, as well as the overall Federal research effort, suffer as a result. The turf battles that lead agencies to work at cross purposes should be eliminated. Agencies involved in nutrition research should demonstrate a commitment to coordination and the avoidance of unnecessary duplication. This commitment needs to be built in, not only at the "political" level of the higher echelons of Government but also in the career civil service.

The establishment at USDA of the Human Nutrition Center and the Human Nutrition Policy Committee and at HEW of the Nutrition Coordinating Committee are two positive steps toward intra-agency coordination. They not only indicate a commitment to nutrition research but also can serve as mechanisms for interagency coordination and information exchange.

The Food and Agriculture Act of 1977 specifies that the Secretary of Agriculture shall "periodically consult with the administrators of other Federal departments and agencies that have responsibility for coordinating Federal nutrition research activities. " However without the support and involvement of the Secretary of HEW, unilateral USDA efforts to coordinate research may not be effective. Likewise, it should be noted that this language is ambiguous. It does not specify "lead," and it leaves cooperation to the goodwill of HEW.

The need for improved coordination in nutrition research extends beyond the executive agencies to Congress. At present 14 congressional committees and 20 subcommittees are concerned with nutrition matters. The principals include the Senate Committees on Agriculture, Nutrition, and Forestry (Subcommittee on Nutrition); Appropriations (Subcommittees on Labor-Health, Education and Welfare, and Agriculture); the House Agriculture Committee (Subcommittee on Domestic Marketing, Consumer Relations, and Nutrition); the House Appropriations Committee (Subcommittees on Agriculture and Labor-Health, Education, and Welfare); House Interstate and Foreign Commerce Committee (Subcommittees on Oversight and Investigations, and Health and Environment); and the House Science and Technology Committee (Subcommittee on Domestic and International Scientific Planning, Analysis, and Cooperation, and the Subcommittee on Science, Research, and Technology). Since some duplication of interest exists, joint sessions of relevant congressional subcommittees to consider plans and hearings for oversight purposes should be considered.

There is a strong relationship between human nutrition research conducted abroad and research needs in the United States. The research goals identified in this report can be best achieved if international and domestic research activities are tuned together.

Nutrition research in other countries may help in solving domestic nutrition problems. For example, epidemiological investigations of certain chronic diseases require good information about disease incidence. This may be obtained from studies of societies with lifestyles and food habits very different from our own. The high incidence of malnutrition in some developing nations also provides an opportunity to investigate relationships between the nutritional status and functional performance of individuals in a way that would be impossible in the United States. It may be possible to extrapolate the results of studies of severe malnutrition abroad to marginal nutritional areas in this country.

The study of worldwide populations and food patterns is essential to the better understanding of some of the priority research areas of nutrition. Thus any effort to increase international nutrition research capabilities will have a dual reward—assistance to malnourished peoples abroad and increased knowledge of human nutrient needs and health status under changing environmental conditions.

ISSUE 2—Definition and Funding of Human Nutrition Research

If one accepts that the goals of human nutrition research are twofold—(l) the promotion of optimum health and performance, and (2) the treatment of diseases through diet therapy and the support of other medical therapies—then definition of human nutrition research flows from these stated goals, If all the research areas involving nutrition are listed, from basic studies on the metabolism of nutrients to genetic studies on the development of foods with specific nutrient characteristics, it is clear that some areas of research are more closely related to these stated goals than others. Accordingly, the definition of human nutrition research must take into account these relationships to stated goals.

In terms of this assessment, nutrition research falls into three broad categories. Most closely related to the stated goals is research into the biochemical and physiological effects of food on the body in health and disease. This category includes research on nutritional management of disease, nutrient needs and interactions, and research which promotes optimum health and disease prevention through diet.

Research on food and nutrition quality determinants is also related to the stated goals, but less directly so than the previous category. Under this heading would be research into food composition, especially the nutritive components and changes in nutrient composition that occur from point of origin to point of consumption; food safety; social, cultural, and economic aspects of food habits; feeding programs; nutrition education; consumer information; and nutrition surveillance and monitoring.

The third category of research involves basic research on sources of human food and basic biochemistry. Research into animal genetics, animal nutrition, plant nutrition, and plant genetics comes under this classification. While there is need to integrate such agricultural research with human nutrition concerns, these areas should not be considered human nutrition research. Similarly, basic research on metabolism of nutrients, if not directly applicable to people, should not be considered human nutrition research. Basic research on metabolism should be considered as basic research underlying all of the biomedical and life sciences. Human nutrition research builds upon this knowledge base, but the apparent commitment to and budget for human nutrition research should not be inflated by its inclusion.

Throughout this assessment, a recurrent problem has been that of definition of human nutrition research. Agencies report as human nutrition research studies that appear to have little to do with human nutrition. Examples are “Catalytic Functions and Metabolism of Vitamin B6 in Bacteria and Fungi, ” “Nutritional Imbalance and Metabolic Alterations in Fungi, ” or “Hepatoma Incidence in Trout on Dietary Aflatoxin and PCB. ” Such studies are worthwhile and contribute to our understanding of basic biochemistry but are not directly applicable to humans.

The almost unanimous consensus of the participants in the OTA study was that attribution of these Federal expenditures to “human nutrition research” was improper.

Fourteen different Federal agencies are engaged in some sort of nutrition research. Each agency has developed its own definition of human nutrition research and set priorities on the basis of how it interprets its legislation mandate. The agencies and their priorities are shown in table 3.

Federal expenditures for human nutrition research in FY 1977 (shown in table 4) were

Table 3.— Federal Government Agencies Active in Food and Nutrition Programs and Their Nutrition Research Priorities

Department	Agency	Food and nutrition programs	Research priorities
Health, Education, & Welfare	National Institutes of Health		*National Institute of Arthritis, Metabolism, and Digestive Diseases (N/AMDD), Basic* physiological studies of nutrients; basic metabolism studies; obesity; trace elements nutrition support of patients; fiber; anemias.
			National Institute of Child Health and Human Development (NICHHD). Nutrition and fetal development; metabolic capacities of normal, low-birthweight, and premature infants; diet modification for low-birthweight and premature infants; optimum nutrition in developmental years; nutrition and reproductive potential; genetic variability —nutritional interaction; prevention—metabolic antecedents of adult disease.
			National Cancer Institute (NC/). Nutrition support of cancer patient; nutrition in cancer etiology; host-tumor interactions and competition for nutrients; prevention strategies based on nutrition; diet and nutrition in the rehabilitation of cancer patients.
			National Heart, Lung, and Blood Institute (NHLBI). Nutrition in etiology of arteriosclerosis and hypertension; achieving and maintaining dietary change; development of food composition tables; methodology —collecting, recording, and evaluating dietary data.
			National Institute of General Medical Sciences (NIGMS). Traumatized/burned patients and nutrition.
			National Institute of Environmental Health Sciences (NIEHS). Neurotoxicity; mutagenesis; teratology; environmental contaminants in food.
			National Institute of Neurological and Communicative Disorders and Stroke (N/NCDS). Protein-calorie malnutrition, B-vitamin deficiencies and the nervous system; genetic disorders and the nervous system; specific nutritional problems in the central nervous system; stroke.
			National Institute of Dental Research (NIDR). Sucrose and caries; poor nutrition and periodontal disease; poor nutrition and oral mucus membranes; nutrition in craniofacial malformations and oral-facial structures; nutrition and salivary gland development.
			National Institute of Allergy and Infectious Disease (NIAID). Interrelated factors hearing on malnutrition, infection, and the immune system.
			National Eye Institute (NE/). Vitamins A, B-12, and other nutrients in visual processes; diseases of visual system, e.g., keratomalacia; metab-0lism of visual cells; protein changes in the lens.
			National Institute on Aging (N/A). Nutritional status of the elderly; aspects of increase in life span including dietary manipulations; vitamin supplementation in elderly; nutrient intake as a consequence of economic status in elderly; relationship among nutrition, cellular structure, and function in elderly.
			Division of Research Resources (DRR). Nutrient requirements for growth, gestation, lactation in primates and laboratory rodents; standard diets for specific objectives; interaction of various nutrients on physiological function in laboratory animals; differences in nutrient requirements among strains of animals within a species.
	Food & Drug Administration	Regulatory activities related to: nutrition labeling, ingredient labeling, food for special dietary use, food advertising, nutrition quality of foods	Nutrient efficacy and safety; nutrient interrelationships as concerned with disease prevention; nutrient bioavailabiiity for food fortification purposes; nutrient quality assessment of processed foods; medical food assessment; food composition and nutrient analysis as related to FDA mission; and consumer studies of perceptions about food values and nutritional quality and educational models to help correct misconceptions about them.
	Health Resources Administration	Health and Nutrition Examination Survey	Assessment of the nutritional status of the American people.

Table **3—continued**

Department	Agency	Food and nutrition programs	Research priorities
	Center for Disease Centrol		Epldemlological surveillance studies in cooperation with State agencies assistance to Al D i n similar international areas.
	Health Services Admin-istration		Collaborateive research and screening program for phenylketonurla,
	Alcohol, Drug Abuse, & Mental Health Admin-istration		Effects of alcohol consumption on 'nutrient metabolism and nutritional deficiencies; study of food additive consumption and hyperactivity in children.
Agriculture	Agricul-tural Re-search Service .		Human 'Reqirements for Nutrient Determine the requirements for lipid intake and identification of the forms of these nutrients in foods that may be useful in meeting these requirements. Determine the requirements for mineral intake by humans and identi-fication of the forms of these nutrients in foods that may be useful in meeting these requirements. Determine the requirements for vitamin intake by humans and identi-fication of the forms of these nutrients in foods that may be useful in meeting these requirements. Determine the requirements for protein and amino acid intake by humans and identification of the forms of these nutrients in foods that may be useful in meeting these requirements. Determine the requirements for carbohydrate and energy intake by humans and identification of the forms of these nutrients in foods that may be useful in meeting these requirements. Food Composition and Improvement To provide accurate, up-to-date, and comprehensive information in a readily usable form on the composition of all important foods for those nutrients required by and biologically useful to man. To provide the technology for the nutritional improvement of foods when enhanced levels of certain nutrients in the diet are needed to correct possible dietary faults. Food Consumption and Use To provide accurate, up-to-date, and comprehensive Information In a readily usable form on food consumption and dietary levels. To provide consultative assistance on food and nutrition problems and provide sound guidance materials on nutrition for the consumer and for nutrition educators, program leaders, and food program man-agers; to Identify techniques which will assist people in selecting nu-tritionally adequate diets within different budget Iimitatlons, to iden-tify means to modify undesirable food habits; to strengthen nutri - tionally desirable food choice. To identify and develop suitable and safe procedures for food man-agement and preparation for home and institutional consumers, for best retention of both nutritional and eating qualities and to avoid food-borne illness.
	Coopera-tive State Research Service ..		Nutrient requirements; nutritional status of special population groups including children, low income, and aging; metabolic function of nutrients in the diet and their Interact Ions: nutrient content of foods; effects of processing on nutrients: food delivery systems; food habits and use); dietary patterns.

Table 3—continued

Department	Agency	Food and nutrition programs	Research priorities
	Economic Research Service* **		Economic and social research relating to domestic food programs; nutrition policy in LDCS; food choices (demand); nutritional programs for the elderly,
Defense			Determination of nutritional and dietary standards for Armed Forces personnel subsisted under normal and special operating conditions; evaluation of nutritional adequacy of food as consumed; evaluation of the nutritional status of Armed Forces personnel; establishment of sanitary and food hygiene standards for all food program activities; food aspects of preventive medicine,
National Aeronautics & Space Administration			Nutritional control of neurotransmitters; role of dietary protein and specific amino acids i n optimizing human performance under stress.
Veterans Administration	Department of Medicine & Surgery		Research in disease and diet: nutrition and disease or clinical nutrition, dietary therapy; effect of disease on nutrition; environmental toxicants, alcohol, and nutrition; nutrition and cancer; nutrition and vision research; nutrition-related therapy. Metabolic effects: Investigations on or related to malabsorption syndromes, inborn errors of metabolism, and familial or inherited nutritional defects. Nutrition requirements: Studies of nutrient metabolism, malnutrition, neuroendocrine nutrient interactions, fundamental Intermediary metabolism involving the role of one or more nutrients.
State	Agency for International Development		Development of new low-cost nutritious foods; development and dissemination of new appropriate technologies; understanding nutritional needs and requirements; testing and evaluation of nutrition program alternatives; research on methodologies for improving national nutrition planning and programing.
National Science Foundation			Basic research in the behavioral, education, and social sciences in areas applicable to foods and nutrition.

"Under USDA'S recent reorganization, ARS is now called Federal Research, and is housed within the Science and Education Administration
"" Under USDA'S recent reorganization, CRS is called Cooperative Research and is housed within the Science and Education Administration
""" Under USDA's recent reorganization, ERS is called Economics and is housed within the Economics, Statistics, and Cooperatives Service
"""" Under USDA's recent reorganization, ES is called Extension and is housed withinthe Science and Education Administration

estimated at between $50 million and $117 million, depending on how "nutrition research" was defined. If for example, the NIH definition is used, NIH appears to be spending $80 million for human nutrition research. This broad definition takes in studies of basic biochemistry, studies which are not focused on nutrition but have a nutrition aspect, as well as studies of primary nutrition. If a narrow definition is used, one encompassing only those studies of direct clinical applications and disease prevention, the NIH nutrition research funding falls in the annual range of $20 million. Even the higher $80 million figure, incidentally, amounts to less than 3 percent of the NIH research budget.

HEW and USDA are responsible for the majority of federally supported human nutrition research. Seventy-five percent of Federal nutrition research is conducted outside of the two departments through competitive grants and contracts. Using the more realistic funding figure of $50 million for FY 1977, NIH at HEW funded 44 percent of the total, and the Science and Education Administration (SEA) at USDA funded 43 percent of the total. The Science and Education Administration encompasses what were formerly known as the Agricultural Research Service and the Cooperative State Research Service. Under USDA's new reorganization, most human nutrition research will be coordinated by SEA's Human Nutrition Center.

The Science and Education Administration Cooperative Research (SEA-CR) of USDA is unique among Federal agencies in that it links

Table 4.– Federal Expenditures for Human Nutrition Research

An Approximation of FY '77 Expenditures (millions of dollars)

Agency	Office of Science & Technology Policy[a]	Office of Management & Budget[b]
Department of Health, Education, & Welfare	$ 88.6	$22.0
National Institutes of Health	80.4[c]	22.0[d]
Food and Drug Administration	3.9	
National Center for Health Statistics	2.4	
Alcohol, Drug Abuse, and Mental Health Administration	1.1	
Health Services Administration	0.5[c]	
Center for Disease Control	0.3[c]	
Department of Agriculture	22.0	21.8
Agricultural Research Service	14.0	13.2
Cooperative State Research Service	7.5	8.1
Economic Research Service	0.5	0.5
Agency for International Development	2.9	0
Department of Defense	**2.3***	**2.2**
Veterans Administration	0.5[c]	4.1
National Science Foundation	0.3[c]	0
Grand total	**$116.6**	**$50.2**

[a]Office of Science and Technology Policy. New Directions in *Federally Supported Human Nutrition Research,* December 1977

[b]Office of Management and Budget *Special Analyses—Budget of the US. Government FY 1979.*

[c]This figure includes studies designed to assess the mechanisms and the consequences of food or nutrient intake in the intact organism, particularly man, Investigations involving nutrient variables at the cellular or subcellular level, including metabolic studies in animals and man, research designed to elucidate the metabolic role or function of an essential nutrient in both animal models and man, as appropriate, all studies concerned with genetic- nutrient-environmental interactions; dietary studies expected to produce changes in health status, including the maintenance of health and the treatment of disease in man.

[d]This figure includes biochemical, physiological, and clinical studies of nutritional needs for normal growth, development, and health, nutritional needs of patients with specific common diseases; and experimental assessments of feeding programs

*Estimates of FY 1976 expenditures provided by draft Government Accounting Office report, *Human Nutrition Research—Need for a Coordinated Approach to Advance Our Knowledge, 1977*

Federal and State research efforts. SEA-CR administers funds that Congress appropriates to the States for agricultural research, This work is conducted at the State agricultural experiment stations, land-grant colleges and universities, approved schools of forestry, colleges of 1890, and Tuskegee Institute. In FY 1977, the States used $7.5 million of the Federal money available to them for human nutrition research. The States themselves provided $11.7 million for human nutrition research in 1976. Most of the Federal money came from funds authorized by the Hatch Act, as amended, and P.L, 89-106 (an act to amend the Agriculture Act of 1954). The funds are accounted for under the Hatch Act research program called People, Communities. and Institutions, which comprised 12 percent of total Hatch Act research funds in 1977.

Federal human nutrition research may be financially undernourished. However, no ana1ysis of the adequacy of present funding levels could be made since current estimates of Federal spending for human nutrition research are questionable, Estimates for FY 1977 range from $50 million to $117 million (table 4). The lower figure, based on agency responses to a standard questionnaire, was developed by the Office of Management and Budget (OMB) for the FY 1979 budget, The higher figure came from an OSTP working group and appeared in the December 1977 report "New Directions in Human Nutrition Research. "

Neither is reliable. The $50 million, for example, fails to include certain nutrition research activities within HEW, AID, and the National Science Foundation. The $117 million, on the other hand, includes $80.4 million of NIH spending—much of it of tenuous c.onnection to human nutrition research. In testimony before the Senate Select Committee on Nutrition and Human Needs on October 17, 1977, NIH Director Dr. Donald Fredrickson conceded that, based on a strict definition,

his agency devoted only around $20 million to human nutrition research in FY 1977 (a figure reported to OMB).

Another statistic which raised questions came from the Veterans Administration (VA). GAO put the VA's FY 1976 nutrition research spending at $0.5 million. In FY 1977, the VA reported sharply increased expenditures of $4.1 million, even though nutrition research was not recognized as a high priority by the agency.

In some cases, it was difficult to determine how much (if any) money was being spent for certain types of important nutrition research. For instance, the Federal Government is now annually spending about $70 million on nutrition education programs. It is unclear whether any of these funds are devoted to research on which methods are most effective for reaching people.

OTA concluded that most estimates of human nutrition research funding were questionable and that total funding fell considerably short of the reported $117 million level. Regardless of which overall figure is more nearly accurate, certain areas identified by OTA are not now receiving sufficient Federal support, the result of a lack of recognition of their importance and zero or almost no funds. Those areas most in need of increased funding are the role of diet in the prevention of chronic disease and obesity, nutrition education and consumer information, monitoring nutritional status, and nutrition policy and management.

ISSUE 3—Personnel Resource Requirements

Estimates of the number of scientists engaged in human nutrition research also proved elusive.

In an attempt to determine the current number of scientists engaged in human-nutrition research and the numbers of research scientists being trained, OTA contacted five professional societies and six Government agencies. Of the professional societies, the American Public Health Association, Institute of Food Technologists, and American Chemical Society make no attempt to distinguish between members engaged in research versus other career orientations and therefore could not supply information on the proportion of their membership engaged in human nutrition research or training of nutrition research scientists. Membership in the American Institute of Nutrition (AIN) is limited to those who have made significant contributions to the field of nutrition research. By definition, all of AIN's 1,730 members are nutrition research scientists. This number seriously underestimates the total number of scientists in the field, since junior people are not eligible for membership and very few behavior and education researchers are included. AIN does not keep any figures on training. Of the American Dietetic Association's 21,751 members in 1977, 764 state they are engaged in research activities. This does not indicate the degree of involvement and, of course, neglects those outside of dietetics engaged in nutrition research.

The two Government agencies that fund the largest portion of nutrition research, HEW and USDA, do maintain figures on scientist-years devoted to nutrition research and 5-year projections of personnel needs, At USDA in FY 1976, 193,5 scientist years were devoted to human nutrition research as defined by the agency, The 5-year projection of need for nutrition research scientists at USDA is for 260.7 scientist years, a 20-percent increase.

In a written response to an OTA questionnaire, NIH informed OTA that 70 scientists were employed in human nutrition research in 1977. But NIH Director Fredrickson sub mitted a written statement to the Senate Select Committee on Nutrition and Human Needs that during that same time period 180 intramural investigators in NIH were directly involved in human nutrition research. Of that number, 20 were defined as "classical nutritionists" when nutrition research was defined as "the study of food and nutrients, " In FY 1977, 20 lead scientists, those holding M. D., Ph. D., or D.V.M. degrees, and 50 junior scientists were conducting nutrition research

at Letterman Army Institute of Research of the Department of Defense.

Before a comprehensive nutrition research program is established, consideration must be given to the ability of the field to sustain such a program. No accurate figures exist on how many scientists are currently engaged in human nutrition research. Furthermore, few reports on nutrition research mention this aspect of planning.

Implementation of the research priority areas identified in this report may require changes of emphasis in existing graduate and professional nutrition training programs as well as increased training support. For graduate students in nutrition and food science, such changes might include greater stress on nutritional pharmacology, food science principles, nutrition education, nutritional status evaluation, and nutrition-related diseases. Training would be further strengthened by postdoctoral research work with either humans or experimental animals. Greater emphasis on nutritional biochemistry and clinical nutrition in undergraduate medical education may help attract physicians to the field.