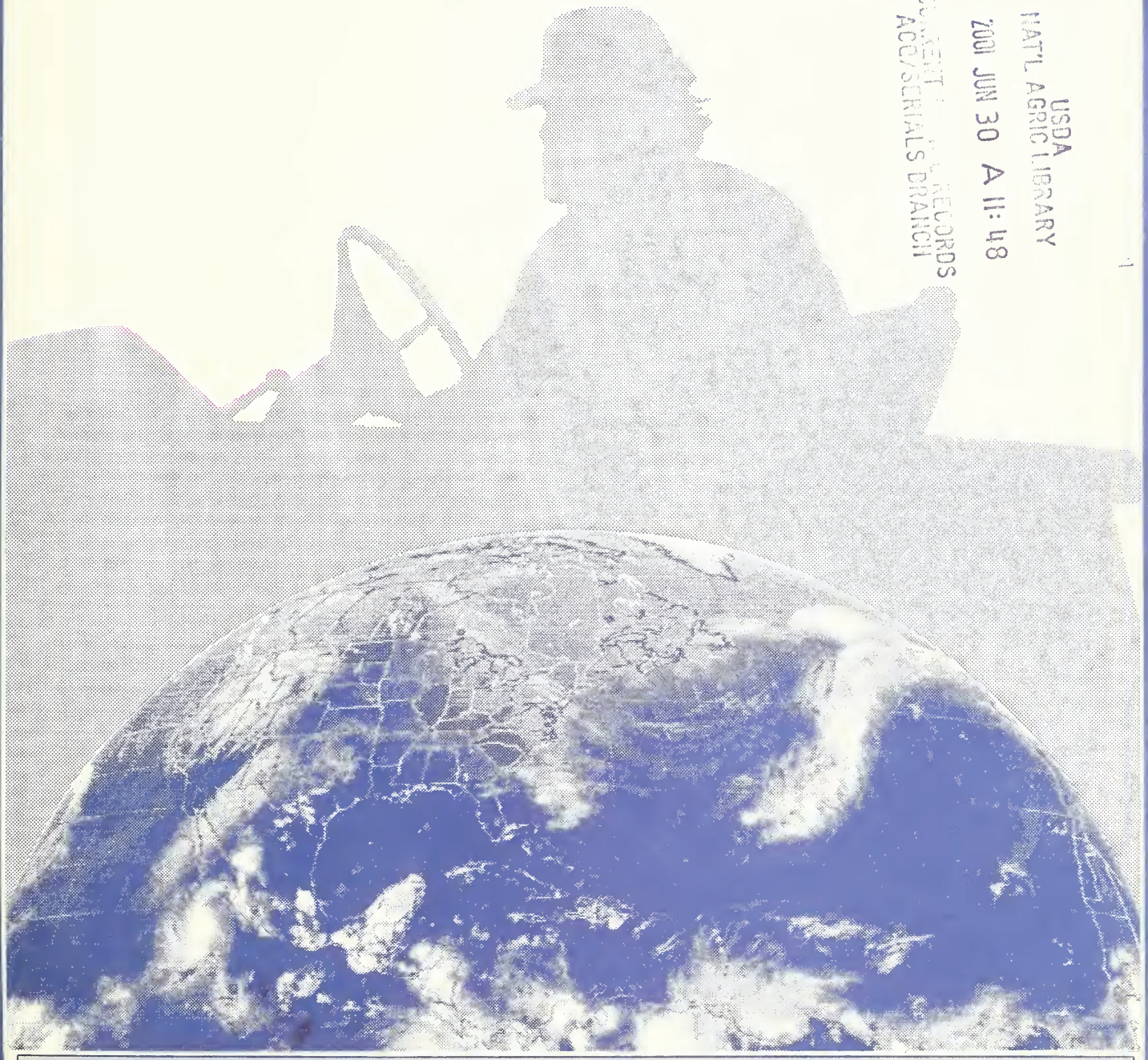
Agriculture in a World of Change



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FIFTY YEARS OF PROGRESS IN THE NUTRITION FIELD

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As we begin the last decade of the 20th century, and look toward the challenges and responsibilities of the human nutrition field in the next, it would seem prudent first to look back at the accomplishments of the immediate past and note the current status of our progress. A period of 50 years has been selected, since my graduate training in nutrition started at that time.

Nutrition--A Young Science

First it should be emphasized that nutrition is a young science. The nature of the oxidation of food and production of energy for the body was not clarified until 1774, only 226 years ago. And, it was not until 1891 that Wilbur O. Atwater, considered to be the father of human nutrition in this country, was appointed special agent in charge of nutrition programs for the Office of Experiment Stations, U.S. Department of Agriculture (Darby, 1975). He derived the "Atwater Units" of 4, 9, and 4 calories per gram for calculating the metabolizable energy content of foods based on their protein, fat, and carbohydrate content, respectively. He also initiated studies on food composition, energy requirements of humans, digestibility of foods, dietary intakes and food economics. But not until 1906 was the concept of "accessory food factors" described, which was followed in 1912 by the term "vitamine," given by an English chemist to a water-soluble factor which later turned out to be thiamin. In that same year, McCollum at the University of Wisconsin isolated a fat-soluble nutrient needed for cows and rats, and the vitamin era began. All the vitamins except two were discovered and isolated by 1940. Folacin was isolated in 1946 and vitamin B12 in 1948. I can attest to the latter as my own Ph.D. thesis problem was to fractionate an unidentified growth factor for chicks, termed the "animal protein factor," which was vitamin B12.

Deficiency Disease Era Ends

The advances made in nutrition during the first half of this century were truly fantastic and captured the attention of biochemists, physicians,

public health workers, food scientists, educators, economists, sociologists, epidemiologists, agriculturalists, and others. During this period, the knowledge needed to control the five historically important nutritional deficiency diseases (beriberi, scurvy, xerophthalmia, rickets, and pellagra) became available and was successfully applied. The era of frank nutritional deficiency disease was over by 1950. The success encountered during this period of prevention and cure of deficiency disease led several nutritional biochemists to study mechanisms of action at the cellular level, and to become molecular biologists. This is important, of course, but in the process, less and less research was directed toward the effects of foods and nutrients on the entire organism--or nutrition. And only in recent years have we realized the potential role of diet in the prevention or delay of onset of chronic diseases. Now most scientists and consumers recognize that their diet can affect their health aside from by preventing frank deficiencies.

Definition of Nutrition

This leads to the need for a clearer definition of nutrition as a science. Although the application of nutrition programs usually involves several related disciplines, the science of nutrition has been defined by Griffith (1965) as the science of the regulation and response of metabolism to ingested food. It includes the assimilation and metabolic utilization of food components, including all processes involved in the body when food is digested, absorbed, and utilized. Nutrition differs from cellular and molecular biology by considering the entire organism. This point is stressed as many people seem to regard nutrition as synonymous with a dietary regimen, a view which is far too narrow. Human nutrition is a science that explores food as an energy source, as a provider of building material for tissue growth and maintenance, and as a regulator of metabolic pathways for normal functioning of genetically dissimilar individuals--ranging from low birth-weight infants, pregnant teenagers, lactating women, to the elderly--under varying conditions of activity, stress, and environment. Nutrition, in its application, should help prevent obesity and chronic diseases, improve immune response, support physical endurance, assist neurological functioning and extend the length and quality of life.

Despite the complex nature of nutrition in the <u>whole person</u> and the many factors that cause the nutritional needs to vary among individuals, it should be clear that applied nutrition programs should be based on nutrition knowledge, and not merely on the consensus of well-meaning and informed people. Epidemiologic studies of groups of persons can never be considered appropriate for providing answers to nutrition problems of individuals. For such information, human nutrition studies are required.

Milestones in the Nutrition Field

- 1941. Food and Nutrition Division, Bureau of Home Economics, USDA, moved its laboratory to Beltsville, MD. This was the forerunner of the current Beltsville Human Nutrition Research Center.

- 1942. USDA cooperated with the Bureau of Labor Statistics in a survey of food consumption during wartime. Improvements over data collected in 1936 were reported, but low intakes of B vitamins, vitamins A and C, and calcium were noted. In 1955, national and regional surveys were performed of household food consumption and dietary levels.

- 1943. First Recommended Dietary Allowances (RDA) established by the Food and Nutrition Board. The third revision in 1948 contained allowances for calories, protein, calcium, iron, vitamin A, thiamine, riboflavin, niacin, and ascorbic acid. The 10th edition, released in 1989, includes RDA's for 20 nutrients, including calories, and gives estimated adequate and safe ranges for 7 additional nutrients. Dr. Hazel Stiebeling, Assistant Chief of the Bureau of Home Economics, USDA, was involved in initiating the RDA's.

- 1941-1945. During World War II, nutrition officers replaced medical officers in preventive medicine. It fell my lot as a Nutrition Officer in the Theatre Surgeon's Office, E.T.O., just after the stalags were discovered in Germany near the end of hostilities, to have three generals and a colonel descend on me in my Paris office to find out how few calories could be provided to prisoners and still maintain their health and conform to the Geneva Convention. Good data were collected about nutrient intakes, energy requirements, nutrient losses during preparation, and eating patterns of military troops. Special attention was given to the special nutritional needs of wounded on hospital trains.

- 1950. USDA published new tables of food composition which was the first version of Agriculture Handbook No. 8. It contained values for proximate composition, three minerals, and five vitamins for 750 food items--raw, processed, and prepared. Atwater and Woods published the first table of chemical composition of American Food Materials in 1896, with values for protein, fat, water, and carbohydrate by difference. The latest series of the Handbook contains data for up to 64 food constituents.

- 1955. The Interdepartmental Committee on Nutrition for National Defense (ICNND) was formed and started to conduct nutritional surveys in other countries, with counterparts from each country. Thirty-three country surveys were done, starting with Korea, Taiwan, and Pakistan. It was my good fortune to lead two of the survey teams and help brief most of the other U.S. teams as a consultant to the ICNND. This effort, led by Arnold Schaefer, involved approximately 500 scientists from at least 50 institutions and probably was one of the most successful international programs ever launched by an interagency committee. Protein-calory malnutrition, iron deficiency anemia, and vitamin A deficiency and blindness in children were the most commonly observed problems. These surveys helped many countries institute active public health programs in human nutrition.

- 1961. USDA developed the Economy Food Plan, later used as a basis for judging poverty thresholds and estimating allowances needed for food in public assistance programs. In 1975-1976, revised food plans at low, moderate, and liberal cost to meet the 1974 RDA. A Thrifty Food Plan also was developed for use as a suitable base for setting allowances for the Food Stamp Program.

- 1965. American Heart Association issued a statement on diet and heart disease:--Eat less animal (saturated) fat; substitute unsaturated vegetable oils; eat less cholesterol-rich foods; and if overweight, reduce calorie intake.

- 1965. USAID and USDA devised a fortified children's food supplement for distribution to developing countries. It was my privilege, during a leave of absence from the University of Maryland to NIH, to help in the formulation of this product, which cost approximately 9 cents per pound. Its nutrient content was sufficient to render the diet complete if consumed at a level of 20 - 30%, with wheat, corn, rice, or millet making up the rest. The name was soon changed to CSM, for corn, soy, and milk, its main constituents in addition to the very complete vitamin and mineral mixes, which were used later to fortify other commodities.

- 1965-1966. USDA conducted a nationwide survey of household food consumption, covering all four seasons and information on daily intakes of 14,000 individuals. Similar nationwide food consumption surveys were conducted in 1977-78 and 1987-88.

- 1967. Senate Select Committee on Human Needs was established and held hearings about hunger and malnutrition, which later led to concerns about nutrition and chronic disease, and in 1977 issued a report on "Dietary Goals for the United States." This Committee, chaired by Senator McGovern, was a major factor in increasing the awareness of the Congress, various agencies, industry, and the public as to the importance of nutrition in development and public health.

- 1968. Hunger USA was published, indicating that the extent of knowledge about dietary intake and malnutrition among the poor in the U.S. was inadequate to assess the problem. The report also stated that there must be a commitment by the Nation to the proposition that every child has the right to an adequate diet, and that every adult shall have the means to obtain an adequate diet. This led to major expansion of the USDA food assistance programs.

- 1969. Scientists at Beltsville discovered that chromium, as a part of an organic complex, functions with insulin in the regulation of carbohydrate metabolism. The following year nickel and vanadium were found to be essential for animals maintained in a dust-free environment.

- 1969. White House Conference on Food, Nutrition, and Health was convened by Dr. Jean Mayer of Harvard University. It was most

comprehensive with 26 panels meeting simultaneously. Each panel considered a specific topic and an extensive list of recommendations was developed. These had considerable impact on policy and programs that followed.

- 1968-1970. The Ten-State Nutrition Survey was conducted in Washington, California, Texas, Louisiana, South Carolina, Kentucky, West Virginia, Michigan, Massachusetts, and New York. The findings indicated that a significant proportion of the population surveyed was malnourished or was at high risk of developing nutritional problems. The kinds and degrees of malnutrition observed varied from one location to another and within population subgroups, thereby preventing any generalizations. This large survey led to the Health and Nutrition Evaluation Surveys, CDC, which were begun in 1971-1972.

- 1970. USDA dedicated a second human nutrition laboratory at Grand Forks, North Dakota, with a primary mission to determine the requirements of humans for trace elements. This laboratory has made significant contributions since that time, with a series of animal model and human studies conducted under controlled metabolic ward conditions. The human studies have focused on iron, zinc, copper, magnesium, and recently, boron. Animal studies have shown that dietary arsenic and silicon are required under certain conditions.

- 1970. A USDA report on "Benefits From Human Nutrition Research" by C. Edith Weir was released which reviewed the probable benefits from proper nutrition in this country, especially as related to the role of diet in the prevention of obesity and diet-related chronic diseases. This report was provocative due to the lack of focused research to answer the questions the report raised. It was one of the first substantive reports to emphasize that most of the health problems underlying the leading causes of death could be modified by improvements in diet.

- 1972. USDA established its first Departmental Committee on Food and Nutrition Research, as well as Departmental Committee on Food Safety, under Science and Education in the Secretary's office. It was my pleasure to serve as Chair of both of these bodies, which were quite active in stimulating interdepartmental coordination.

- 1972. "Organic foods" came into their own, with claims that were exaggerated and difficult to confirm.

- 1973. Nutrition labeling was initiated by the Food and Drug Administration. Labeling was optional for most foods but was required for others, as in the case of special diet foods. This has recently been revised to permit the addition of health claims consistent with scientific information.

- 1975. The Nutrient Composition Laboratory was established as a part of the Beltsville Human Nutrition Research Center. This unique ARS

facility is dedicated to the development of methodologies for sampling, quality control, and analysis of nutrients and other components of foods. This laboratory works very close with HNIS in support of the food composition databank.

- 1977. The Food and Agriculture Act of 1977, Title XIV, Section 1405, states:

  "The Department of Agriculture is designated as the lead agency of the Federal Government for agricultural research (except with respect to the biomedical aspects of human nutrition concerned with diagnosis or treatment of disease), ...and the Secretary, in carrying out the Secretary's responsibilities, shall...establish jointly with the Secretary of Health, Education, and Welfare procedures for coordination with respect to nutrition research in areas of mutual interest..."

  Section 1421(b) of the Act states: "It is hereby declared to be the policy of the United States that the Department of Agriculture conduct research in the fields of human nutrition and the nutritive value of foods and conduct human nutrition education activities..."

- 1978. The Joint Subcommittee on Human Research of the Committee on Health and Medicine and the Committee on Food and Renewable Resources, Federal Coordinating Council on Science, Engineering, and Technology, Office of Science and Technology Policy, was formed with 11 member agencies. In FY 1979, the Joint Subcommittee reported total human nutrition research expenditures to be $195 million, $39.5 million of which was by USDA. This subcommittee was replaced with the current Interdepartmental Committee on Nutrition Research in 1983.

- 1979. ARS initiated Human Nutrition Research Centers at Tufts University, Boston, MA, for studies of nutrition and aging and at Baylor College of Medicine, Houston, TX, for studies on the nutrition needs of children, pregnant and lactating women, and adolescents.

- 1979. NIH initiated support of Clinical Nutrition Research Units (CNRU), which are designed to create and strengthen human nutrition research, training, and education through coordinated effort, intellectual stimulation, and use of shared resources at medical centers. As Nutrition Program Director, National Institute for Arthritis, Diabetes, Digestive and Kidney Diseases, I experienced great satisfaction in helping to initiate the CNRU program at NIH.

- 1980. "Nutrition and Your Health: Dietary Guidelines for Americans" first issued by USDA and DHHS. Since then revised guidelines were released in 1985 and earlier this month. These dietary guidelines have been most useful in preventing over-statements and achieving harmony in nutrition education releases by Federal agencies. The Human Nutrition Information Service has developed a series of nutrition education

materials for teachers, professionals, nutrition educators, and the public to enhance the understanding and use of these guidelines.

- 1980. Western Human Nutrition Research Center was established by ARS at the Presidio of San Francisco, with a mission mandated by Congress to develop improved methods for evaluating nutritional status and to conduct studies on human nutritional requirements. This became the fifth center in ARS/USDA to focus its research on problems in human nutrition.

- 1983. Interagency Committee on Human Nutrition Research (ICHNR), was formed and cochaired by the Assistant Secretary of Health, DHHS, and the Assistant Secretary for Science and Education, USDA. ICHNR guided the development of the Human Nutrition Research Information Management System (HNRIMS), published in 1986 "Human Nutrition Research: A Federal Five-Year Plan," and convenes biennial conferences of Federally supported human nutrition research units and centers (next conference to be held at Lister Hill Auditorium, NIH, on February 20-21, 1991). The ICHNR has been an effective mechanism for coordination of human nutrition research activities at the Federal level.

- 1984. A Subcommittee for Human Nutrition of the USDA Research and Education Committee, under the Secretary's Policy and Coordinating Council, was formed. This Subcommittee has served as the coordinating mechanism of human nutrition research and education activities in the Department. It prepares the Annual Report to Congress on USDA's Human Nutrition Research and Education Activities each year. A Dietary Guidance Working Group has been functioning under the Subcommittee for reviewing all releases from USDA which relate to dietary guidance to assure that all releases conform to current policies.

- 1984. USDA convened the Human Nutrition Board of Scientific Counselors (as mandated by Congress) to advise the Secretary regarding program direction priorities, scope of activities, and quality of the Department's human nutrition research and education.

- 1984. A USDA Food and Nutrition Policy Statement was issued by the Secretary.

- 1985. The USDA/HNIS initiated its series of Continuing Survey of Food Intakes by Individuals, by collecting 1-4 day food and nutrient intakes on women 19 to 50 years of age and their children 1 to 5 years of age in the conterminous States. This type of survey approach, together with a running average for each age and sex group, is expected to replace the large nationwide surveys conducted at 10-year intervals.

- 1988. Interagency Committee on Nutrition Monitoring (ICNM) was formally established in recognition of the need for sustained, coordinated efforts to monitor the nutritional status of the American people. ICNM has three active working groups which address food composition data needs, information dissemination and exchange activities, and means of strengthening survey complementarity.

- 1988. The first "Surgeon Generals' Report on Nutrition and Health" was released with a summary of the evidence relating diet and incidence of chronic disease, with recommended diet changes for their prevention. This was followed in 1989 by the National Research Councils publication, "Diet and Health: Implications for Reducing Chronic Disease Risk" which further strengthened the basis for making dietary guideline recommendations.

- 1988. The National Research Council, in its report "Designing Foods: Animal Product Options in the Marketplace" identified preferred nutritional characteristics of animal products, assessed current technologies and options open to consumers, and devised a strategy for constructive change in food products consistent with the current dietary recommendations.

- 1990. Year 2000 national nutrition health promotion and disease prevention objectives announced by DHHS, "Healthy People 2000," contained specific nutrition related goals designed to prevent illness and premature death in the U.S.

- 1990. Congress passed the National Nutrition Monitoring and Related Research Act of 1990 (H.R. 1608) for approval by the President.

Where Are We Now?

- The Knowledge Base.--We do know more about the nutritional needs of people than we ever have before, but our knowledge base is still far from adequate. We have identified minimal levels of most essential nutrients for most people, but have little understanding about the toxic levels or optimal range of levels for individuals. We know that single nutrients work in unison with others and that the consumption of an excess of some may result in increased demand for others. The entire area of metabolic stress effects and the marked individual differences in this area is essentially unexplored, though important to the long-term health and well-being of each individual.

  We have an impressive data base on nutrients in foods, without which one would have great difficulty in planning healthful diets. But even this area is incomplete for several nutrients, as well as for other phytogenic substances in foods of unique health significance.

  Our understanding of those dietary factors which relate to chronic disease is embarrassingly limited, although hopefully progress is being made in reducing consumption, especially of saturated fatty acids. Yet there is no agreement as to which saturated fatty acids are the culprits. For example, saturated fatty acids with less than ten carbons and, perhaps, stearic acid may have little effect on serum cholesterol levels in most people.

Similarly, little is really known about the effects of various types of dietary fiber on digestion, absorption and metabolism, despite the many ways our food industry has found to increase "dietary fiber" in food products. For example, does anyone know whether the soluble fibers which are largely digested in the colon by bacterial action with an increase in the formation of secondary bile acids, is likely to be beneficial or detrimental to health?

We know that most people consume far less than the level of dietary copper estimated to be adequate for humans, and that fructose feeding increases the requirement for copper, especially in male rats. Copper deficiency in animal models leads to changes which are generally associated with coronary heart disease in man. We know that the consumption of fructose by Americans is on the increase, but it is unclear as to whether low copper intakes may be involved in the high incidence of coronary heart disease.

- The Consumer Role.--Consumers are concerned about healthful diets. Consumer perception drives the market. Industry provides consumers with the products they will buy. But research-based information is needed to provide correct and lasting answers to the questions related to diet and health. We still have a shortfall in our knowledge base. The consumer is leading the market and consumer demand is based on their perception of what is best for them. Focused studies in humans are needed to provide the knowledge base for nutrition educators, professionals, industry, and for consumers. But progress is being made.

- Changing Eating Patterns.--A recent paper (Stephen and Wald, Am. J. of Clinical Nutrition, 52:457) has reviewed 171 studies published since 1920-1984 on assessment of individual food intakes of all ages, all ethnic groups, and both sexes. Analysis by regression showed that fat provided an increasing amount of the dietary energy from 34% in the 1930's to 40-42% in the late 1950's to 1960's. The falling steadily to approximately 36% in 1984. this value for 1984 is similar to 37% and 35% of the energy from dietary fat observed in the 1-4 day continuing survey of food intake of women and children in 1985-86 respectively by USDA. Saturated fatty acid intakes also were found to decrease after the mid-1960's, while the intake of polyunsaturates increased. These values are in sharp contrast to the supply trends showing the amount of fat available for consumption during this period. It appears then that the amount of total fat and indeed the amount of saturated fatty acids consumed, as a function of energy, has been falling gradually during the past 25 years, and that this reduction in fat consumption has preceded the steady decline in mortality from coronary heart disease over the past 20 years.

  Although data are lacking, it is presumed that the mean consumption in dietary fiber is beginning to increase. More fruits and vegetables based on supply are being consumed per capita--20% more in 1988 than in 1980 and 37% above 1971.

During the period from 1966-68 to 1986-88, the Economic Research Service has reported that consumption of chicken rose 72%, turkey 80%, fish and shell fish 38%, cheese 135%, low-fat milk 276%, broccoli 940%, cauliflower 180%, while beef consumption fell 7%, eggs 21%, whole milk 53%, butter 20%, and red meat 9%.

At the same time, the disposable income, on average, spent for food in the U.S. declined also from 22% in 1949 to just under 12% in 1988. During that period, the proportion of cost of food spent away from home to total food cost doubled from 19% to 38%.

- Technological Advances.--Technology has exploded in recent years, giving the nutrition scientist and educator many new tools which can greatly extend the scope and effectiveness of programs. Computers and other improved communication devices will strengthen the systems approach to problem solving and enhance the transfer of technology to application. The use of radioactive isotopes has permitted the labeling of nutritional substrates and the ability to trace their metabolism in animal models, and to some extent in humans. But now scientists have the ability to enrich foods with non-radioactive stable isotopes for studies in pregnant women, infants, and all other age groups with no risk to the individual. Studies with stable isotopes can be used to measure size of metabolic pools, turnover rates and to compute requirements or toxicities. Improved instrumentation and methodology for separation and quantitation of extremely small amounts of specific metabolites or regulators permit such progress. Continued use of techniques as high pressure liquid chromotography, mass spectrometry, nuclear magnetic resonance (imaging), genetic probes, fluorescent tracers, and other sophisticated approaches should permit progress in the future at an even more rapid pace. Biotechnology and the ability to identify, sequence, and clone genetic material will permit an effective focus on the basis for differences in individual dietary needs.

- Federal coordination and Support.--In my view, the extent and effectiveness of coordination of human nutrition.activities at the Federal level has never been better. Representatives from all Federal agencies regularly meet to consider human nutrition research and nutrition monitoring efforts, with Assistant Secretaries from DHHS and USDA providing leadership. In addition routine information exchange and coordination is a structured activity in these Departments. The interactions across the Federal agencies are quite healthy and encouraging. All agencies seem to share the same common goal--to improve the nutritional status and health and well-being of the American people. In terms of policy makers, there is substantial visible support of this goal.

Budgeting support also has increased in the past 25 years. In my perusal of a report to Congress from the Agricultural Research Service in 1963, it was interesting to note that the FY 1963 ARS budget contained only $.53 million for nutrition research of which $.5 million was intramural support. Food Science and Food Consumption research were funded at levels of $1.1 million and $.31 million, respectively. HNRIMS projects in contrast in 1988 contained $70 million for projects related to human nutrition research. From FY 1963 to FY 1991, the ARS budget for human nutrition research has grown from $0.5 million to $50 million or 8% of the total ARS budget. The NIH funding for human nutrition and related research, manpower development, training, and education amounted to $276 million in FY 1988 or approximately 4% of the total NIH budget. In FY 1988, total funding for human nutrition research and education was $300.6 million in DHHS and $385 million for all Federal agencies. In FY 1990, USDA also expended $168 million for human nutrition and information programs, including the Expanded Food and Nutrition Education Program (EFNEP) and the educational aspects of the Women, Infants, and Children (WIC) Program.

Of course, the budget is determined by the Congress and the President, and the overall need to limit Federal expenditures, even in high priority areas is clear. It is important, however, that policy makers recognize the huge impact proper nutrition can have in curtailing health care costs by preventing obesity and diet-related chronic diseases and promoting good health.

The Future Challenge

Despite the fact that the progress in human nutrition in the past is quite impressive, there is a huge area of unknown remaining. Actually, scientists are just beginning to ferret out and describe cellular level mechanisms and to identify the specific difference(s) and location(s) in genes that account for metabolic variation among individuals. Hopefully, this new information can be related to all of the other events which occur in the whole organism using mathematical modeling techniques. We can expect the development of even more sensitive instruments than are now available, and the greater use of stable isotope labeling. Yes, major advances will accrue in the building of a sound knowledge base for human nutrition.

In the future, better knowledge about food and nutrition can be expected to improve the quality of life and extend productive, healthful lifespans. Already, scientists at the Children's Human Nutrition Research Center have found ways to improve growth and development of low-birth weight infants and to improve their immune response. Studies on nutrition of adolescents, especially of the pregnant teenager, are expected to materially reduce the incidence of low-birth weight infants and infant mortality. Other studies of nutritional needs of the elderly and the role of nutrition in the aging process, conducted at the Human Nutrition Research Center on Aging at Tufts University, show that old, frail individuals respond to exercise if

adequately nourished; that dietary vitamin E can increase the immune response of the elderly; that the dietary intake of calcium, even after menopause, can reduce the loss of bone density and the onset of osteoporosis in women; that atropic gastritis, observed in 30% of persons over 60 years, have greater needs for vitamin B12 and folacin due to poor absorption; and vitamin C and other antioxidant nutrients appear to be associated with a reduced incidence of cataracts in old people.

Already studies at the Western Human Nutrition Research Center, San Francisco, and at the Grand Forks Human Nutrition Research Center show that nutritional status (vitamin B6, zinc, copper, iron, boron) affects behavior and performance in animal models and in people. It is known that iron status affects temperature control and that certain stresses also are known to increase the need for nutrients. Already too, the Beltsville Human Nutrition Research Center and others have shown the risk for coronary heart disease and colon cancer is lowered by reducing the level of fat. Similarly, the value of complex carbohydrates and dietary fiber components have been shown to reduce glucose uptake, insulin production, and risk of developing mature onset diabetes. Genetic probes can be expected to identify traits of individuals that put them at risk, so that appropriate dietary measures can be implemented to prevent a dietary health problem. Nutritional status is believed to be related to the loss of tissue function and the aging process. It is not yet known that diet is related to the occurrence of Alzheimer's disease, but this too is not unlikely. These are but examples of the progress that can be expected to result from a more complete knowledge of human nutrition in the future.

The food supply can be expected to keep changing, as the consumers' perceived needs for a healthful diet is expressed in market demand. Since the consumers perception is largely based on various sources of information, including advertising, professional counseling, and various media, it will remain important to maintain strong nutrition education activities, where the information disseminated represents the best interpretation of science based knowledge available.

I am "bullish" about the future opportunities for human nutrition research and education in improving the long term health and well being of all people.