

The Nutrition Foundation, Inc.

REPORT OF THE SCIENTIFIC DIRECTOR

JUNE 30, 1944

The Nutrition Foundation, Inc.

REPORT TO THE
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CHRYSLER BUILDING, NEW YORK

JUNE 30, 1944

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FOREWORD

THE NUTRITION FOUNDATION was organized by food and related manufacturers for the purpose of developing a comprehensive research and educational program in the science of nutrition.

The public service nature of the Foundation's work has been guarded carefully, including provision for distinguished representatives of the public on the Board of Trustees. The trustees have consistently emphasized the long-time point of view, even though the war has made it necessary to focus major attention upon problems related directly to the current emergency. Both military and civilian considerations have clearly justified this course of action.

The following types of activity were decided upon to give expression to the basic purpose of the Foundation:

1. Research of a long range nature to discover new fundamental knowledge in the science of nutrition, with confidence that in time such knowledge will contribute to a higher level of public health, to greater efficiency in agriculture, and to increased public service by the food industry.
2. Scientific research that is immediately applicable to the solution of recognized public health problems in the field of nutrition.
3. Educational activities, to assist in the development of well trained leadership and effective application of the science of nutrition, and
4. Research on a distinctly wartime basis, to aid governmental agencies in dealing with emergency problems.

TO THE TRUSTEES OF THE NUTRITION FOUNDATION

From May 1942, when the initial grants were made, to June 30, 1944, the Foundation appropriated \$530,040 for studies in the science of nutrition. The approximate distribution of these grants was as follows:

1. Human requirements of specific nutrients (proteins, vitamins, minerals, etc.) \$ 66,100.
2. The origins and functions of individual nutrients (sugars, fats, amino acids, vitamins, etc.) in living cells 134,150.
3. Maternal and infant nutrition 26,200.
4. Public health problems in nutrition 106,950.
5. Education and professional training 42,600.
6. Nutrition studies related directly to the war 151,040.

Many of the projects supported by the Foundation cannot be placed satisfactorily in a single grouping because the boundaries of interest and significance are not sharply defined. A purely exploratory study in 1943 may be of primary importance in solving public health or military problems in 1945; or a study of human nutrient requirements may be currently of equal interest to military officers, public health officials, food manufacturers, agricultural advisers, university professors, and practicing physicians.

HUMAN NUTRIENT REQUIREMENTS

Primitive man was undoubtedly compelled to spend most of his time and energy (generally estimated at 90% or more) in searching or fighting for food. Only about one-half of all our effort is now expended to maintain food supplies, so we have more time for other pursuits and cultural developments; but

there is still a good prospect that scientific advances will lighten the load much further. Meanwhile, there is general agreement that no large segment of the world's population has ever been consistently well nourished. The goal of achieving an adequate food supply is almost within our reach, mechanically, but in a scientific sense, there are great gaps in our knowledge of what must be accomplished. Neither optimum health nor a high degree of efficiency in supplying foodstuffs can be achieved until more knowledge is at hand.

When our program was being organized, the Scientific Advisory Committee was in complete agreement that the human protein requirement constituted one of the areas where research was most needed. Which of the 23 or more amino acids (the so-called "building blocks") in the proteins from meat, eggs, milk, legumes and cereals are *essential* for the nutritional needs of the human body? The pattern of requirements was reasonably clear for albino rats, but almost nothing had been established for man—and the world-wide demand for proteins of high quality, as supplied by milk, meat and eggs, was far greater than the apparent supply. Furthermore, attractive protein foods of high quality tend to be expensive in proportion to their energy content, so there were, and are, many practical problems to be solved along with the more basic items related to health and biochemistry.

By making a continuing research grant to the University of Illinois in support of the work outlined by Professor William C. Rose, well known for his classical studies on the protein requirement of animals, the Foundation was privileged to assist in establishing a fundamental unit of knowledge for all mankind to use. The early qualitative work, now nearly completed, is being followed by quantitative studies to find how much of each protein fragment is needed per day. It is clear that at least eight of the ten amino acids required by rats are also required by man. Medical, military and industrial applications based upon the past two years' study are already under way. Mankind has moved a step forward.

Closely related grants were made to assist:

1. Dr. Holt's studies of the human requirement for amino acids and related analytical studies, including estimates of the value of vegetable proteins, at Johns Hopkins University;
2. Dr. Murlin's direct comparative evaluation of foods high in protein content, at the University of Rochester;
3. Dr. Carter's study of special food proteins, such as yeast, at the University of Illinois;
4. Dr. Smith's measurement of the nutritive value of soybeans, at Wayne University;
5. The development of new microbiological methods of measuring amino acids, by Professors Beadle and Dunn, at Stanford University and at the University of California respectively; and
6. Dr. Cassidy's search for new techniques of separating amino acids, at Yale University.

The war period accentuated the critical need for knowing more about the human vitamin requirements also, even though the problem has long been recognized by students of nutrition as of major importance in relation to public health. The National Research Council performed a valuable public service in making an estimate of the human requirements for all of the essential nutrients, summarized in the Food and Nutrition Board's Table of Recommended Dietary Allowances. From the evidence at hand, however, only very rough estimates could be made for many of the groups listed. The Table differed distinctly from earlier compilations in that the quantities given were estimates of requirements for optimal or buoyant health, rather than quantities that would barely protect against deficiency diseases.

Limited supplies of stable, attractive, vitamin-rich foods have compelled increasing attention to the use of synthetic vitamins and food enrichment or fortification. Repeatedly, chemical supplies, manpower and equipment for the production of vitamins have been in severe competition with other war demands, resulting in government restriction and allocation. For these reasons as well as from public health and economic considerations, it is

important to know how much of each nutrient should be consumed regularly for the maintenance of optimum health. The requirements of individuals vary considerably, but for public health, army feeding, and educational purposes, approximate intake levels should be known, above which there is very little individual risk of deficiency. There appears to be very little danger of over-consumption of individual nutrients, such as minerals, vitamins, or amino acids, when supplied in common foods, though an intake of too much (*total*) food may lead readily to overweight and health impairment.

Professor Sevringhaus at the University of Wisconsin has undertaken a study of vitamin requirements, using as research subjects a large group of carefully selected prison inmates who serve with excellent cooperation on a voluntary basis. The degree of standardization and control of both dietary and environmental factors provides an almost ideal situation for research. The first publication arising from the study has given strong support for the vitamin C level recommended by the National Research Council.

Many persons, having noted that millions of people live year after year on lower intake levels than those recommended, without showing recognized symptoms of deficiency, have been hesitant to accept the new relatively high standards even though they were based upon a critical summation of the available evidence. Until the evidence is comprehensive and fully convincing, there will be corresponding difficulty in achieving whole-hearted support of the Board's recommendations—and presumably human health will continue to be needlessly low in the meantime. If any of the suggested levels of intake are too high, corrections should be made first for the sake of accuracy, and secondly because a corresponding economic gain would be possible by using foods of lower vitamin content.

Severe scurvy, an extreme state of vitamin C deficiency that is often accompanied by broken bones, minute and massive hemorrhages, teeth falling from their sockets, delirium and collapse, was

for thousands of years one of man's worst scourges. In its grossly obvious form, scurvy is becoming rare, but moderate deficiencies in vitamin C intake are unquestionably very common. A more definite appraisal of the health impairment that results from prevalent degrees of low intake of this and other nutrients is seriously needed.

In parallel with nutrition studies more definitely related to the war, Professor Ivy and his associates at Northwestern University are studying the human requirement of vitamin B₂ (riboflavin). Bread enrichment, milk production and consumption schedules, military ration planning, industrial feeding programs, and public health education provide typical examples of areas of activity that will be influenced markedly by the findings on riboflavin requirement.

In balance with other nutrition research needs, the problem of defining human requirements will probably continue to offer a very fruitful field of study for many years. A mere beginning has been made with respect to most of the mineral elements, the fats, the amino acids, and half the known vitamins.

The Foundation is assisting in studies of calcium utilization by Drs. Steggerda and Mitchell at the University of Illinois and Dr. Smith at Wayne University; iron utilization, by Dr. Hahn at Vanderbilt University and Dr. Holmes at Massachusetts State College; fat utilization, by Dr. Longenecker at the University of Pittsburgh; and biotin (vitamin H) balance studies by Dr. Parsons at the University of Wisconsin.

ORIGINS AND FUNCTIONS OF INDIVIDUAL NUTRIENTS

Basic to understanding and applying the science of nutrition is the problem of discovering what each nutrient does inside the body. One reason why biochemists and physiologists have become so interested in vitamins and the "trace" mineral elements (e.g., copper and zinc) is because these factors can be shown to control definite chemical reactions that sustain life. Practical

applications in the medical and agricultural sciences may follow slowly or rapidly, but there is no doubt among research men concerning the ultimate benefits to be derived from understanding the chemical and biological role of specific nutrients. Next to research in support of the war effort, this area of investigation has received greatest support by the Foundation.

Later developments from elementary findings in the field of "intermediate metabolism" (reactions within the body) generally exceed all expectations. For example, Dr. Banting's early accounts of success at Toronto in discovering how to prepare and use insulin for the control of diabetes were fittingly introduced by a sincere acknowledgment of indebtedness to earlier investigators who had added unexciting bits of knowledge concerning carbohydrate and fat metabolism in dogs and man.

Among the projects supported by the Foundation to study the origins and functions of individual nutrients, the following may be cited for illustration:

Dr. Stotz at Cornell University has undertaken a long-time study of the steps involved in the biological conversion of sugars to fats. Few chemical changes are more important in animal and plant physiology, not to mention the social and medical problem of "too much weight", yet remarkably little is known concerning the sugar-to-fat transition.

Grants in support of other basic studies of carbohydrate metabolism have been made to Professor Clarke and Dr. Stetten at Columbia University and to Professor Hastings and Dr. Westerfield at Harvard University. Over fifty percent of human energy is normally derived from such reactions, hence there is no doubt of their significance—they are basic to the whole body economy, including specialized liver, brain and glandular cells as well as muscles.

Through short intervals of time (hours or days), the most crucial nutrient requirement for maintenance of physical and mental efficiency is clearly the caloric or energy need. But through periods of weeks, months or years, impairment may result

from an inadequacy of any one of several dozen individual nutrients that are common to a wide range of foodstuffs. Unfortunately appetite is less reliable as an index of need for other factors, compared even to its faulty regulation of caloric intake.

Professor du Vigneaud at Cornell University has extended earlier studies of the role of amino acids in albino rats to analogous reactions in the human body, with special reference to liver and kidney functions.

Professor Beadle and associates at Stanford University have made a number of advances in clarifying reactions of the amino acids in plant cells and in devising new methods for their measurement.

The synthesis and utilization of liver protein is being studied by Dr. Luck at Stanford University.

Comparative nutrition studies with different types of animals frequently give results of outstanding value. Dr. Woolley at Rockefeller Institute is being aided in his attempts to identify the newer vitamins in the B-complex, using guinea pigs as test animals. And Dr. Loring at Stanford University is comparing growth factors required by mold-like microorganisms with those required by the guinea pig. Both Dr. Beadle at Stanford and Dr. Cheldelin at Oregon State College are studying the growth requirements of microorganisms (bacteria and molds) as a means of developing new and superior methods of vitamin measurement, with good success. The chick's requirement of amino acids, of interest in practical problems of feeding as well as in relation to the requirements of other animals, is being studied by Dr. Almquist at the University of California.

Dr. Perlzweig at Duke University is studying the role of niacin, the anti-pellagra vitamin, and has devised new methods of measuring both the vitamin and its derived products.

Dr. Burkholder and his associates at Yale University have made observations of theoretical and practical significance on the for-

mation of vitamins in sprouting seeds, with special reference to soybeans.

Studies of variety differences and the genetic development of vegetables and fruits having superior nutritive quality have been of outstanding interest and significance. Grants in support of such work have been made to Purdue University (Zscheile and Lincoln), Yale University (Cowgill, Sinnott and Burkholder), and Ontario Agricultural College (Truscott). Each group has accomplished results of value. Striking differences have been shown in the nutritive value of common and new varieties of tomatoes and corn.

Dr. Hodge at the University of Rochester has contributed to clarification of the role of choline, a minor fat constituent often classed as a vitamin. Functionally, it is closely related to the amino acids and appears to play an important role in protecting the liver and kidneys. Dr. McCauley at the same institution is engaged in chemical studies of bone and tooth development and the healing processes after bone fracture.

Food fats exert a well-known sparing action upon animal requirements for vitamins B₁ and B₆, but there is relatively little known concerning the effects of variations in protein and carbohydrate intake upon vitamin requirements. Dr. McHenry is being aided in studies of the problem at the University of Toronto.

A group of fatty acids characteristic of many oils and fats (containing hydroxyl groups) is being studied at Massachusetts Institute of Technology by Dr. Harris. Their nutritive properties and general physiological effects are of widespread interest.

PUBLIC HEALTH PROBLEMS IN NUTRITION

Many leaders in public health research and education are convinced that during the next decade there will be a rapid and widespread recognition of nutrition as a basic factor in federal, state and municipal public health work. The medical profession

is beginning to feel confident that nutrition has sufficient scientific standing to be recognized as a field for professional specialization. Many of the lessons learned from animal experimentation are rapidly bearing fruit in the clinical sciences; and the urgency for health and efficiency in meeting the war emergency has served to focus attention upon the importance of good food.

The following examples will illustrate the type of work that the Foundation is undertaking in this area of research:

The opportunity of building a strong nutrition research and training center at Vanderbilt University seemed especially good from the point of view of allied support in the medical sciences and in having good cooperation between the medical school and the public health services. The project is supported jointly by the Rockefeller Foundation, the State Department of Public Health and the Nutrition Foundation, on a three year basis.

Dr. Elvehjem and Dr. Phillips at the University of Wisconsin have an excellent project under way, studying the relation of nutrition to protection against tooth decay in experimental animals. Progress of distinct interest has been made in studies with cotton rats and monkeys.

Supplementing the above project, studies directed toward solution of the dental caries problem are under way at the University of California, the University of Rochester, and Yale University. The complexity of the problem is perhaps well illustrated by the fact that the National Research Council arranged for Dr. G. J. Cox to spend over a year in making a critical appraisal of the world's literature to date on the relation of nutrition to dental caries, or tooth decay.

At McGill University, Dr. Struthers and Dr. Hunter have undertaken an intensive study of the relation of nutrition to rheumatic fever. Dr. Coburn, who has been aided by a grant to Columbia University, obtained encouraging results in preventing the recurrence of rheumatic fever in children by improving their diets. Nothing else was so beneficial. It should make a fine contribution to better child health if Dr. Coburn's work can be

confirmed in its general thesis and extended in the Canadian laboratories.

Dr. Spies has been aided by a grant to the University of Cincinnati primarily to assist in the development of more satisfactory methods of diagnosing deficiency diseases.

Drs. Lewis and Alden were given assistance in their study of chemical methods of detecting possible vitamin B₂ deficiencies, at Emory University.

Professor Sherman has received a grant in support of his studies at Columbia University on vitamin A intake in relation to bodily store and well-being at different ages.

Dr. Ralli at New York University is collaborating with Dr. Hoagland of the Rockefeller Institute in studies of the detailed peculiarities of liver function in handling vitamin A and fats when there has been fatty infiltration and cirrhosis. Dr. Chanutin at the University of Virginia has given special attention to the chemical changes in fats associated with breakdown of kidney tissue.

Dr. Sobotka is studying the role of vitamin A in normal and diseased tissues at Mt. Sinai Hospital in New York.

The capacity of liver cells to destroy cancer-stimulating compounds is being studied as part of a comprehensive research program at Memorial Hospital, under the supervision of Dr. C. P. Rhoads. The Foundation's grant, as in many other cases, provides assistance for work on a special phase of a broad problem. Good progress is being made toward isolation and detailed study of an active (protective) constituent in liver cells. Apparently a member of the vitamin B-complex is one of the active units. Clear-cut advances in a field so complex are likely to be slow, but ultimately may be of great value as the normal pattern of defense against cancer is built up step by step.

The high incidence of degenerative diseases in middle and later age groups presents a baffling problem to leaders in medical research. There is good reason to believe that an important factor in many such cases is poor nutritional environment through long periods of time—chronic, low-grade malnutrition that conven-

tionally is not recognized soon enough to ward off serious consequences.

The cumulative effects of border-line types of nutritional deficiency offer a promising field of study and a stinging challenge to those responsible for research, both in public health and in nutrition.

CONFERENCE ON NUTRITION IN RELATION TO PUBLIC HEALTH

In September, 1943, the Foundation was privileged to be host to a conference of research scientists and administrative officers who were intensely interested in the types of research that will give a better picture of the relation of nutrition to public health. A record of the discussions was printed and distributed to deans of medical schools and to federal, state, county and city health officers throughout the United States and Canada.

The participants in the conference, representing public health administrators, physicians, biochemists, medical school deans, statisticians and foundation directors, brought out clearly (a) the need for carefully organized, long-time studies, and (b) the need for further development of techniques for the evaluation of nutritional status. Other points emphasized were: frequency of failure to provide adequate control groups for reference; errors in records of food intake caused by losses during preparation; the need for specialized professional training; and the value of cooperative studies by physicians, biochemists, nutritionists and persons experienced in handling data from clinical studies.

MATERNAL AND INFANT NUTRITION

An excellent foundation for improving maternal and infant feeding is being established by the thorough study that Dr. Hoobler and her associates have under way in Detroit, at the Children's Fund of Michigan. Medical, dietary, nursing, and biochemical phases of the study are receiving exceptional consideration through long enough periods of time to make the

project of outstanding value. Quantitative studies of the nutrients consumed by the mothers and available to the infants during successive stages of lactation will extend well beyond the information that has been available in the past.

The advantage of a nation-wide, concerted attack on major problems is illustrated, too, in this case. Dr. Maynard and Dr. Herrington have organized a very similar and parallel study of the composition of cow's milk at Cornell University. The two groups are collaborating in the development and testing of analytical procedures, in the use of special equipment, and in arranging with Dr. Longenecker at Pittsburgh to make a detailed study of the fats in both types of milk. Facilities and equipment not readily available to either of the other groups will be available in Pittsburgh. One can scarcely question the advantage derived for all concerned, from this kind of voluntary team work.

Dr. Warkany's studies with albino rats at the University of Cincinnati have developed very interesting leads regarding the effect of the mother's diet upon malformations in the offspring. Such deformities as cleft palate, missing toes, fused vertebrae, and poorly formed jaws are induced by moderately poor diets and they are prevented by an improved diet (based originally upon supplementary liver or yeast). During the year, Dr. Warkany has shown clearly that the major factor concerned is vitamin B₂ (riboflavin), plentiful in milk, cheese, eggs and other common foodstuffs. There is genuine interest in the possibility that these findings will explain some of the deformities in human offspring.

Studies on the relation of nutrition to capacity for good lactation in experimental animals is being conducted by Dr. Cerecedo at Fordham University; and relations of vitamin A intake to the vitamin content of mother's milk, is being studied by Dr. Deuel at the University of Southern California.

A grant to Yale University, in support of studies under the direction of Drs. Morse and Van Wagenen, will make it possible to study maternal and infant nutrition through a long period in

a colony of well standardized monkeys. It has taken about 12 years of painstaking work to develop the colony. The studies will include primary consideration of maternal and infant nutrition, but will be extended to include the relation of diet to tooth decay, and the maintenance of health through successive generations. There will be an opportunity to observe the gradual or cumulative types of effects that are of special interest in relation to the current human pattern. In the experimental colony, however, it will be possible to induce definite and controlled degrees of deficiency and to avoid most of the uncontrolled variables that necessarily creep into human studies. The advantage of the shorter life-cycle of the monkey is illustrated by the fact that the Yale group now has fourth generation offspring since starting the colony.

According to the best evidence available, better food consumption by mothers before infants are born would mean, within a single decade, in the United States alone, several millions of infants in more robust health. An estimate of the number of infants that might be shifted from a "poor health" (distinct physical impairments) to a "good health" classification during the first two weeks of life, by means of their mothers eating better food, actually falls in the range of 900,000 per year. The prospect of raising the initial health level of nearly a million infants in the United States each year surely merits more than passing consideration.

The Foundation's research program obviously could not be developed without the financial provision that has been made for maintaining a five-year advance budget. A shorter period would eliminate much of the effectiveness of the Scientific Advisory Committee or any similar group attempting to develop fundamental studies in the science of nutrition.

NUTRITION STUDIES RELATED TO THE WAR

Nutrition research related directly to the war emergency has

had a prominent role in our program and has received special consideration by the advisory committees, staff members and trustees from the beginning of the organization.

In making grants where the military aspect was of primary consideration, close collaboration has been maintained with the Office of the Surgeon General, the Office of the Quartermaster General, the Department of Agriculture, and with our own Food Industries Advisory Committee, supplementing the contacts available through the Scientific Advisory Committee. Many of the projects are obviously of a more technological nature than would be normal to our program, but there was no doubt of the need for immediate emphasis upon such problems as nutritive losses in dehydrated foods, effects of extremes in environment upon food requirements for optimal efficiency, and specific tests of the adequacy of overseas rations.

The retention of vitamins along with satisfactory flavor and color in dehydrated vegetables, fruits, milk, eggs and meats, has presented a problem of major importance to the Office of the Quartermaster General and the Office of the Surgeon General. Conditions for handling military food supplies in the South Pacific and North African theatres had scarcely been studied, in a modern sense, at the beginning of the war.

Nutritive losses in representative dehydrated meats were studied with the aid of research grants to the University of Chicago under the supervision of Drs. Evans and Kraybill, who worked in close collaboration with Dr. Elvehjem on the same problem, with the aid of a parallel grant to the University of Wisconsin. Samples were supplied by industry and stored for testing in accordance with plans approved by the Office of the Quartermaster General.

Studies of dehydrated vegetables were undertaken jointly by Drs. Maynard and Gortner at Cornell University and Drs. Nelson and Dawson at Columbia University, again in accordance with the counsel of government representatives and experienced men

in industry. Similar studies under Dr. Tressler's supervision at Cornell University also received a supporting grant.

Projects in which primary emphasis was placed upon maintaining working efficiency under environmental conditions of interest to the armed forces were supported at the University of Minnesota, under Dr. Key's supervision, and at Harvard University, under the supervision of Dr. Forbes. Both groups have reported numerous findings of direct interest to the armed forces.

Two laboratories studying nutrition in relation to aviation have received grants: Northwestern University, under Dr. Ivy, and Columbia University, under the supervision of the Scientific Director. Progress has been made by both groups in the direction of enabling men to maintain optimal efficiency at altitude, and reports describing the results in detail have been submitted regularly to the appropriate government offices.

Special aspects of the relation of nutritive status to resistance to shock, have been studied by Dr. Duryee at Post Graduate Hospital, New York; Dr. Greenberg at the University of California has observed significant relationships of nutritive status to bone healing; Dr. Milhorat at Cornell University has contributed valuable information concerning protein metabolism during starvation; and Drs. Aron and Farmer have studied special aspects of the relation of nutritive status to tolerance of arsenical drugs used by the armed forces.

A number of grants were made in support of studies of food composition and losses in nutritive value during processing or large-scale cooking, in accordance with recommendations of the armed forces. The following are examples:

To the University of Chicago for Dr. Halliday's studies on the effects of large scale cooking; to Fordham University for Dr. Hennessy's work on thiamin losses in cereal products; to Oregon State College for Dr. Fincke's studies on the vitamin content of frozen and cooked vegetables; to Notre Dame University for studies on the vitamin content of low-cost vegetables; to Alabama Polytechnic Institute for investigations of factors affecting vita-

min A stability and utilization; to Oklahoma Experiment Station for assistance in compiling data on food composition for several groups working cooperatively in experiment stations; to the University of Minnesota, for studies by Dr. Palmer and his associates on the production of a butter for use in the tropics; to the University of Wisconsin for Dr. Peterson's survey of the vitamin A content of butter and cheese; and to the University of Michigan for support of Dr. Lewis' study of a new form of food poisoning that has occurred in areas where vetch and related products were consumed as emergency foods.

Three grants have been made in support of the work of the Food and Nutrition Board of the National Research Council, an agency that has rendered outstanding public service to the nation during the war emergency.

A large part of the technological work supported by the Foundation because of its direct relation to the war effort has been completed. When the war is ended, a corresponding transfer of funds will be made to support work of a more fundamental nature.

EDUCATION AND PROFESSIONAL TRAINING

The research funds expended in strong university centers are yielding a harvest of scientific information that should more than justify the expenditures, and in addition, they are contributing to the advanced training of about 200 very promising men and women for positions of leadership in the future. This dual role of research fellowship funds can be developed more fully and will have much greater emphasis in the post-war period when there will be normal opportunities to select research assistants and fellows with great care.

Placement of young scientists returning from the armed services on fellowships in research centers will be especially valuable in facilitating their readjustment to civilian life.

A grant to Harvard University will enable Dr. Stare to select a

few outstanding physicians for post-doctorate training in medical nutrition. There is great need for such men to assist in raising the level of teaching and research in nutrition in schools of medicine and public health. A few key men, well placed, can do much to improve the level of accomplishment over the entire nation. A similar opportunity will be available to a few dieticians of special promise.

The publication of Nutrition Reviews was undertaken to enable professional people who work directly with the public to keep abreast of research progress in the science of nutrition by means of an authentic, unbiased, prompt review of the world's scientific literature. The vocabulary and style have been adjusted primarily on the basis of service to physicians, public health workers, food technologists, dietitians, teachers, home economists, science writers and others who have had scientific training.

Under the editorship of Dr. Stare of the Harvard University Schools of Medicine and Public Health, Nutrition Reviews has reached a high level of public service. The circulation is now approximately 8,000 copies, reaching nearly every section of the world where mailing services are available. Through the courtesy of the Josiah Macy Jr. Foundation, copies are being distributed to all library and hospital units in the armed services. The counsel of an Editorial Advisory Committee, consisting of outstanding leaders in nutrition research and education, has been very helpful in the development of the publication. Beginning in May, 1944, a Portuguese edition of the reviews has been printed and distributed in Brazil under the supervision of Dr. Josue de Castro, Director of the Servico da Alimentacao Nacional and Professor of Medicine in the University of Brazil, Rio de Janeiro.

Consideration has been given to additional ways of reaching the public in regard to advances and sound principles in the science of nutrition, but the advisory committees have felt that further steps in that direction should not be undertaken by the Foundation at present.

COOPERATION WITH GOVERNMENT AGENCIES

Opportunities to be of service to the national government, other than by means of research grants from the Foundation, have come chiefly through membership on committees, for example, the Advisory Committee to the Research and Development Division of the Office of the Quartermaster General, the Executive Committee of the Food and Nutrition Board, the Medical Nutrition Committee of the National Research Council, and an advisory committee to the Agricultural Research Administration.

Close cooperation in developing the Foundation's program, in turn, is facilitated by representatives of the Public Health Service, the Department of Agriculture, the Federal Security Agency, the Office of the Surgeon General and the Office of the Quartermaster General on our Board of Trustees and Advisory Committees.

SCIENTIFIC ADVISORY COMMITTEE

Twice each year the fifteen members of the Scientific Advisory Committee meet as a group to discuss the development of the Foundation's program and to act as a referee body in preparing grant-in-aid recommendations for consideration by the Board of Trustees. Before each meeting the committeemen examine all applications for grants and forward their independent suggestions or recommendations. The Foundation is greatly indebted to members of the committee for their critical, unselfish and constructive guidance in developing all aspects of the program. Out of the discussions at regular and informal meetings, come many leads for initiating and correlating new research projects.

The organization of the Foundation is unusual in that a completely independent group of scientists has so much authority in directing the expenditure of funds, but it is clear that the plan is working satisfactorily and that it reflects the desire of the trustees to keep the program entirely in the public interest.

FOOD INDUSTRIES ADVISORY COMMITTEE

The counsel of members of the Food Industries Advisory Committee has been very helpful (1) in their ardent confirmation of the need for more basic information in the science of nutrition, so that it can be applied with confidence by the food industry, the medical profession, and other agencies in serving the public; (2) by making clear the need for effective adaptation of research findings to practical situations as quickly and economically as possible; and (3) by their many sound suggestions regarding areas of research that might be developed with a high degree of public service.

The committee members' interpretation of fundamental studies to their respective technical and executive associates has been an important factor, too, in the Foundation's development.

PUBLICATIONS RESULTING FROM GRANTS-IN-AID

The publication of research findings that are based upon grants from the Foundation is left to the judgment of those receiving grants. A note of acknowledgment usually appears at the beginning or end of the papers as they appear in the scientific journals. Because of the nature of the subject matter and the standing of the journals it is natural that most of the papers appear in the *Journal of Biological Chemistry*, the *Journal of Nutrition*, the *Journal of the American Chemical Society*, or *Science*. Reprints of each paper are requested for distribution to committeemen, so that they may be fully informed regarding progress on the projects at the corresponding stages of accomplishment.

A list of research papers to date will be found at the end of the report.

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In concluding this report, it is a privilege to comment on the sincere interest that has been shown by the trustees and committeemen in the work and development of the Foundation.

The confidence manifested in the value of fundamental research to the community, in a broad sense, is at once reassuring and challenging to those who share in the enhanced opportunity to study nature's laws.

*The science of nutrition is the
science of food and its relation
to life and health.*

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Nutrition Reviews, F. J. STARE, Editor	
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67. Metabolism of vitamin A, carotene and fat in cirrhosis and fatty infiltration of the liver	8,000.00
ELAINE P. RALLI and C. L. HOAGLAND, New York University	
68. Conservation of the nutritive value of foods	2,000.00
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RESEARCH PAPERS PUBLISHED IN SCIENTIFIC
JOURNALS, ARISING FROM GRANTS OF
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The Increase of B Vitamins in Germinating Seeds.

BURKHOLDER AND McVEIGH (Yale University).

Proceedings of National Academy of Sciences, Vol. 28, p. 440, October, 1942.

The Role of the Amino Acids in Human Nutrition.

ROSE, HAINES AND JOHNSON (University of Illinois).

Journal of Biological Chemistry, Vol. 146, p. 683, December, 1942.

Transmethylation as a Metabolic Process in Man.

DU VIGNEAUD & SIMMONDS (Cornell University Medical College).

Journal of Biological Chemistry, Vol. 146, p. 685, December, 1942.

Further Experiments on the Role of the Amino Acids in Human Nutrition.

ROSE, HAINES, JOHNSON & WARNER (University of Illinois).

Journal of Biological Chemistry, Vol. 148, p. 457, May, 1943.

The Probable Identity of Najjar and Holt's Fluorescent Substance, F₂.

HUFF AND PERLZWEIG (Duke University).

Science, Vol. 97, p. 538, June 11, 1943.

Cardiovascular Adjustments of Man in Rest and Work During Exposure to Dry Heat.

TAYLOR, HENSCHEL & KEYS (University of Minnesota).

American Journal of Physiology, Vol. 139, p. 583, August, 1943.

The Composition of Sweat, with Special Reference to the Vitamins.

MICKELSEN AND KEYS (University of Minnesota).

Journal of Biological Chemistry, Vol. 149, p. 479, August, 1943.

The Utilization of the Methyl Groups of Choline in the Biological Synthesis of Methionine.

SIMMONDS, COHN, CHANDLER & DU VIGNEAUD (Cornell University Medical College).

Journal of Biological Chemistry, Vol. 149, p. 519, August, 1943.

Vitamins in Edible Soybeans.

BURKHOLDER (Yale University).

Science, Vol. 98, p. 188, August 27, 1943.

- Provitamin A and Vitamin C in the Genus *Lycopersicon*.
LINCOLN, ZSCHEILE, PORTER, KOHLER AND CALDWELL (Purdue University).
The Botanical Gazette, Vol. 105, p. 113, September, 1943.
- The Fluorescence of Vitamin A.
SOBOTKA, KANN AND LOEWENSTEIN (Mount Sinai Hospital).
Journal of American Chemical Society, Vol. 65, p. 1959, 1943.
- Observations on the Biological Value of a Mixture of Essential Amino Acids.
ALBANESE & IRBY (Johns Hopkins University, School of Medicine).
Science, Vol. 98, p. 286, September 24, 1943.
- The Methylation of Nicotinamide by Rat Liver in Vitro.
PERLZWEIG, BERNHEIM & BERNHEIM (Duke University).
Journal of Biological Chemistry, Vol. 150, p. 401, October, 1943.
- Biotin, Pantothenic Acid and Riboflavin Balances of Young Women on a Milk Diet.
GARDNER, NEAL, PETERSON & PARSONS (University of Wisconsin).
Journal of American Dietetic Association, Vol. 19, p. 683, October, 1943.
- A Rapid Method of Estimating N¹-Methylnicotinamide in Urine.
HUFF AND PERLZWEIG (Duke University).
Journal of Biological Chemistry, Vol. 150, p. 483, October, 1943.
- The Performance of Normal Young Men on Controlled Thiamine Intakes.
KEYS, HENSCHEL, MICKELSEN AND BROZEK (University of Minnesota).
Journal of Nutrition, Vol. 26, p. 399, October, 1943.
- Conversion of Inorganic and Hemoglobin Iron into Ferritin Iron in the Animal Body. Storage Function of Ferritin Iron as Shown by Radioactive and Magnetic Measurements.
HAHN, GRANICK, BALE & MICHAELIS (University of Rochester).
Journal of Biological Chemistry, Vol. 150, p. 407, October, 1943.
- N¹-Methylnicotinamide, a Metabolite of Nicotinic Acid in the Urine.
HUFF AND PERLZWEIG (Duke University).
Journal of Biological Chemistry, Vol. 150, p. 395, October, 1943.
- The Anti-Bacterial Action of the Xanthine Oxidase System.
GREEN AND PAULI (Columbia University).
Proceedings of Society for Experimental Biology and Medicine, Vol. 54, p. 148, 1943.

The Natural Occurrence of Riboflavin Deficiency in the Eyes of Dogs.

SPIES (University of Cincinnati).
Science, Vol. 98, p. 369, October 22, 1943.

Determination and Content of Carotene and Vitamin A in Wisconsin Butter.

BERL AND PETERSON (University of Wisconsin).
Journal of Nutrition, Vol. 26, November, 1943.

The Persistence of Heat Acclimatization in Man.

HENSCHEL, TAYLOR & KEYS (University of Minnesota).
American Journal of Physiology, Vol. 140, p. 321, December, 1943.

The Effect of the Sodium Chloride Intake on the Work Performance of Man During Exposure to Dry Heat and Experimental Heat Exhaustion.

TAYLOR, HENSCHEL, MICKELSEN & KEYS (University of Minnesota).
American Journal of Physiology, Vol. 140, p. 439, December, 1943.

Glycine Oxidase.

RATNER, NOCITO AND GREEN (Columbia University).
Journal of Biological Chemistry, Vol. 152, p. 119, January, 1944.

A Biochemical Lesion of Lysine Deficiency in Man.

ALBANESE, HOLT, FRANKSTON, KAJDI, BRUMBACK & WANGERIN (Johns Hopkins University, School of Medicine).
Proceedings of the Society for Experimental Biology and Medicine, Vol. 52, p. 209, 1943.

Physiological and Biochemical Functions in Normal Young Men on a Diet Restricted in Riboflavin.

KEYS, HENSCHEL, MICKELSEN, BROZEK AND CRAWFORD (University of Minnesota).
Journal of Nutrition, Vol. 27, p. 165, February, 1944.

Interrelation of Methionine, Choline, Betaine and Arsenocholine in the Chick.

ALMQUIST & GRAU (University of California).
Journal of Nutrition, Vol. 27, p. 263, March, 1944.

The Excretion of Thiamin, Riboflavin and Nicotinic Acid by Fasting Men.

PERLZWEIG, HUFF & GUE (Duke University).
Federation Proceedings, Vol. 3, No. 1, March, 1944.

The Minimum Ascorbic Acid Need of Adults.

KYHOS, GORDON, KIMBLE & SEVRINGHAUS (University of Wisconsin).
Journal of Nutrition, Vol. 27, p. 271, March, 1944.

- Fluorophotometric Analysis of Vitamin A Esters.
SOBOTKA, KANN & WINTERNITZ (Mount Sinai Hospital).
Journal of Biological Chemistry, Vol. 152, p. 635, March, 1944.
- Studies on the Urinary Excretion of Riboflavin.
FEDER, LEWIS & ALDEN (Duke University).
Journal of Nutrition, Vol. 27, p. 347, April, 1944.
- Pyrimidine Nucleosides and Nucleotides as Growth Factors for Mutant Strains of Neurospora.
LORING AND PIERCE (Stanford University).
Journal of Biological Chemistry, Vol. 153, p. 61, April, 1944.
- Amino Acid Absorption and Utilization in the Chick.
KRATZER (University of California).
Journal of Biological Chemistry, Vol. 153, p. 237, April, 1944.
- Water-Soluble Vitamins in Sweat.
SARGENT, ROBINSON & JOHNSON (Harvard University, Fatigue Laboratory).
Journal of Biological Chemistry, Vol. 153, p. 285, April, 1944.
- The Antibacterial Action of Derivatives and Analogues of p-AminoBenzoic Acid.
JOHNSON, GREEN & PAULI (Columbia University).
Journal of Biological Chemistry, Vol. 153, p. 37, April, 1944.
- Determination of Urinary Amino Nitrogen by the Copper Method.
ALBANESE & IRBY (Johns Hopkins University, School of Medicine).
Journal of Biological Chemistry, Vol. 153, p. 583, May, 1944.
- l-Amino Acid Oxidase of *Proteus Vulgaris*.
STUMPF & GREEN (Columbia University).
Journal of Biological Chemistry, Vol. 153, p. 387, May, 1944.
- Metabolism of Phosphorylcholine.
RICHARD F. RILEY (University of Rochester School of Medicine).
Journal of Biological Chemistry, Vol. 153, p. 535, May, 1944.
- Identification of Folic Acid as One of the Unknown Dietary Essentials for Guinea Pigs.
WOOLLEY & SPRINCE (Rockefeller Institute).
Journal of Biological Chemistry, Vol. 153, p. 687, May, 1944.
- Unsaturated Synthetic Glycerides. VII. Preparation and Properties of Synthetic l-Monoglycerides and Simple Triglycerides of Linoleic and Linolenic Acids.
DAUBERT & BALDWIN (University of Pittsburgh).
Journal of American Chemical Society, Vol. 66, p. 997, June, 1944.

Congenital Malformations Induced in Rats by Maternal Nutritional Deficiency.

WARKANY & SCHRAFFENBERGER (Children's Hospital).

Journal of Nutrition, Vol. 27, p. 477, June, 1944.

Absence of Rapid Deterioration in Men Doing Hard Physical Work on a Restricted Intake of Vitamins of the B Complex.

KEYS, HENSCHEL, TAYLOR, MICKELSEN & BROZEK (University of Minnesota).

Journal of Nutrition, Vol. 27, p. 485, June, 1944.

Interrelationship Between Thiamine and Riboflavin in the Liver.

SINGER, KENSLER, LEVY, POORE, RHOADS AND UNNA (Memorial Hospital, New York).

Journal of Biological Chemistry, Vol. 154, p. 69, June, 1944.

The Effect of Vitamin Deficiency on Estradiol Inactivation by Liver.

SINGER, KENSLER, TAYLOR, JR., RHOADS AND UNNA (Memorial Hospital, New York).

Journal of Biological Chemistry, Vol. 154, p. 79, June, 1944.

A Convenient Method for the Preparation of Synthetic Xanthopterin.

TOTTER (University of Arkansas).

Journal of Biological Chemistry, Vol. 154, p. 105, June, 1944.

The Ornithine Cycle in Neurospora and Its Genetic Control.

SRB AND HOROWITZ (Stanford University).

Journal of Biological Chemistry, Vol. 154, p. 129, June, 1944.

A Leucineless Mutant Strain of Neurospora Crassa.

REGNERY (Stanford University).

Journal of Biological Chemistry, Vol. 154, p. 151, June, 1944.

Component Fatty Acids of Early and Mature Human Milk Fat.

BALDWIN AND LONGENECKER (University of Pittsburgh).

Journal of Biological Chemistry, Vol. 154, p. 255, June, 1944.

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