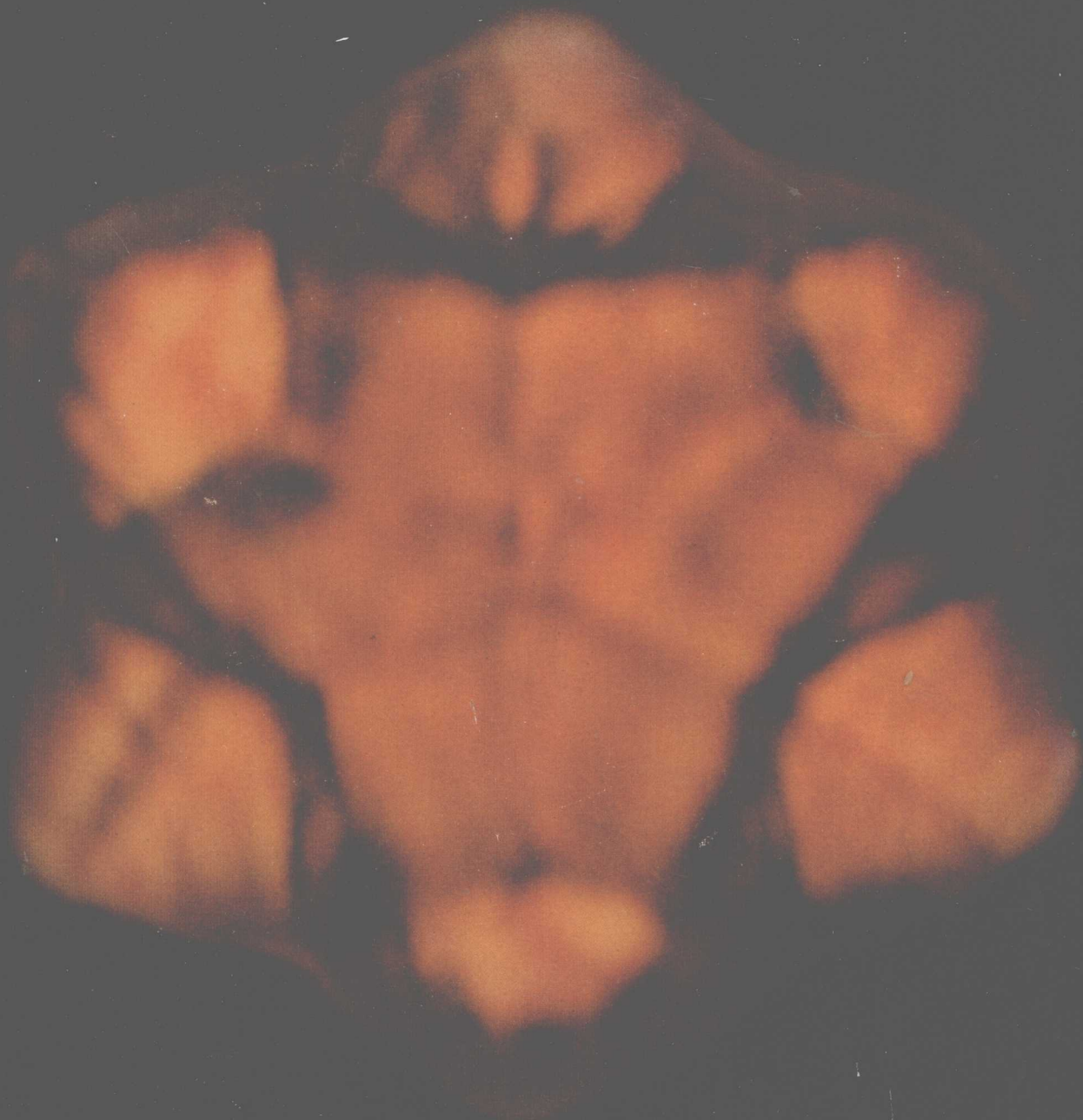
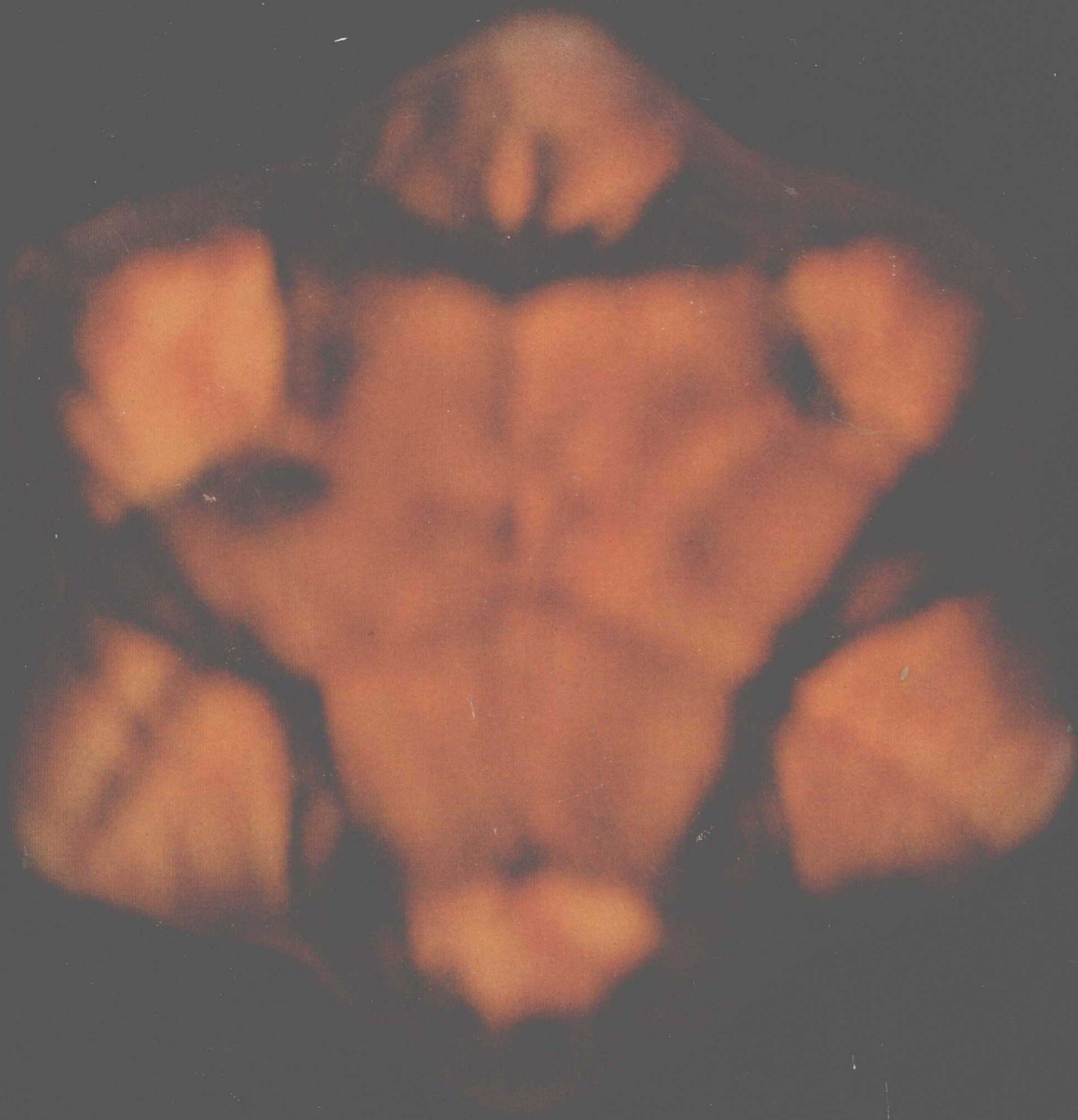


SCOPE[®] MANUAL ON
NUTRITION



Upjohn

SCOPE[®] MANUAL ON
NUTRITION



Upjohn



SCOPE[®] MANUAL ON NUTRITION

MICHAEL C. LATHAM, M.D.
ROBERT B. McGANDY, M.D.
MARY B. McCANN, M.D.
FREDRICK J. STARE, M.D.

The Department of Nutrition
School of Public Health
Harvard University

PUBLISHED BY THE UPJOHN COMPANY, KALAMAZOO, MICHIGAN

LIBRARY OF CONGRESS CARD NUMBER 71-112745

© 1970, 1972, THE UPJOHN COMPANY, KALAMAZOO, MICHIGAN. ALL RIGHTS RESERVED.
NO PART OF THIS WORK MAY BE REPRODUCED OR UTILIZED IN ANY FORM OR BY
ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING,
RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM,
WITHOUT PERMISSION IN WRITING FROM THE PUBLISHER.

SECOND EDITION

THE UPJOHN COMPANY, KALAMAZOO, MICHIGAN S-9232

Baird A. Thomas
Editor

Table of Contents

Preface	7
Introduction	8
Recommended Dietary Allowances of Nutrients	13
Special Medical Problems With a Nutritional Component	
Nutritional Concepts in Heart Disease	16
Obesity	19
Dental Caries	22
Osteoporosis	26
Iron Deficiency Anemia	27
Protein-Calorie Malnutrition of Young Children	28
Xerophthalmia-Keratomalacia	37
Thiamine Deficiency Syndromes Including Beriberi and the Wernicke-Korsakoff Syndrome	38
Pellagra	41
Scurvy	43
Rickets and Osteomalacia	44
Endemic Goiter	48
Nutrients	
Protein	53
Carbohydrate	54
Fats	54
Water	56
Minerals	56
Iron	56
Calcium and Phosphorous	58
Iodine	60
Fluoride	61
Sodium and Potassium	63
Magnesium	64
Copper	65
Sulphur	65
Trace Elements	65

Vitamins	
Vitamin A	66
Thiamine (Vitamin B ₁)	67
Riboflavin	68
Niacin (Nicotinic Acid)	72
Vitamin B ₆	74
Pantothenic Acid	76
Cyanocobalamin (B ₁₂)	77
Folacin	79
Vitamin C (Ascorbic Acid)	80
Vitamin D	83
Vitamin E	86
Vitamin K	88
Biotin	89
Addendum to Second Edition	90
Food Faddism	90
Lactose Intolerance	92
Finale	93
Suggested References	94





Preface

*Fredrick J. Stare, M.D.
Professor of Nutrition
Chairman, Department of Nutrition*

Our major job has been, and is, teaching, training, researching, and sending "our products" elsewhere to teach, train, research, and be of service in nutrition, which we consider an important and a largely neglected field of health and medicine. When the idea, and then the first draft of this Manual of Nutrition was born, my three collaborators were all young physician-nutritionists, members of Harvard's Department of Nutrition. But before this Manual was completed, two of my associates had left us. Dr. Michael Latham is now Professor of International Nutrition at Cornell University in Ithaca, New York and Dr. Mary B. McCann after a brief period with the United States Public Health Service in a position of key responsibility relative to the nutrition surveys conducted in ten states is now Professor of Nutrition and Chairman of the department at Teachers College, Columbia University. I am indebted to both of them for their help, particularly Dr. Latham who has continued to do more than his share.

Dr. Robert B. McGandy was an Associate Professor of Nutrition with us and played an important role in the preparation of the final draft for the first printing of this Manual. But he also has now left our department and is an Associate Professor of Physiology at the Harvard School of Public Health and a resident in pathology at the Boston City Hospital. Other members of Harvard's Department of Nutrition—Drs. D. S. Bernstein, Bernard Lown, Robert P. Geyer, George R. Kerr, K. C. Hayes, Phin Cohen, M. G. Herrera, and Jelja Witschi have had a hand in either writing or reading various sections of this Manual.

We all hope that this Manual, which is not a textbook, not a reference book, but a manual on nutrition primarily for medical, dental and other health students, house officers, and practitioners of medicine and dentistry, will teach a little nutrition and stimulate considerable interest in learning more nutrition and its application to problems of contemporary medicine and health.

Introduction



Nutrition is an important factor in health and in the etiology and management of several of the major causes of death and disability in our contemporary society. Atherosclerotic vascular disease, obesity, tooth decay, osteoporosis, and diabetes are common diseases in which nutrition is closely involved.

In the developing areas of the world, malnutrition of early childhood due to protein-calorie deficiencies as well as a host of infectious diseases made worse by poor nutrition, iodine deficiency goiter and blindness due to lack of vitamin A are a few major health problems directly related to inadequate nutrition.

Iron deficiency anemia and dental caries are widespread problems of inadequate nutrition which have neither geographic nor socio-economic boundaries. Even in highly developed societies, there may be large segments of the population in which hunger and undernutrition impair physical and mental performance.

As yet, instruction in the principles and practice of proper nutrition remains almost nonexistent in most of our medical, dental, public health and nursing schools today. The biochemical and physiological basis of nutrition is frequently no longer a part of the pre-clinical sciences. Clinically the major emphasis has been placed more on drugs and surgery than on the nutritional aspects of management and almost no attention is paid to the role of nutrition in the prevention of illness, and the improvement of health.

What is nutrition?

Nutrition is the science of food, the materials or nutrients in food, what they do and how they interact—all in relation to health. Nutrition comes from food, good food that one enjoys (for eating has al-

ways been one of the pleasures of life); from food in variety so that it supplies all of the 50-some known nutrients that are necessary for proper nutrition so as to provide the best of health that one's genetic or hereditary background permits.

Variety in foods consumed is the keystone to proper nutrition because no single food provides all the known nutrients, not even mothers' milk. Consuming no more calories than required to reach and maintain a desirable body weight is also important. This depends in large part on one's physical activities because muscular activities are the only way one has of using up calories beyond those needed for basal metabolism, doing your job well and whatever you do with leisure or spare time.

In the last decade or so, as will be pointed out later in this manual, it has been found that the caloric balance, the type of fat in the diet, as well as the cholesterol content of the diet are important factors affecting the level of cholesterol in the blood. The latter is one of the factors, and a most important one, in affecting susceptibility to coronary heart disease and cerebral hemorrhage. The higher the level of cholesterol (and also other fats) in the blood, the greater the chances of developing these common causes of death, particularly when it is in association with other conditions such as an elevated blood pressure, family history of death before life expectancy, diabetes, cigarette smoking, overweight, lethargy or infrequent physical activity.

Nutrition as a science can be divided into six main categories—protein, carbohydrate, fat, minerals, vitamins and water. The first three categories are the only ones that provide calories; that is, protein, carbohy-

drate and fat. Four calories per gram are provided by both protein and carbohydrate. Fat provides slightly more than twice as much, 9 calories per gram.

Alcohol is not considered a foodstuff but from time immemorial it has been consumed by man in various fermented and distilled beverages and it does supply about 7 calories per gram so it must be considered in evaluating one's total caloric intake.

Minerals and vitamins provide no calories but function in the many metabolic processes whereby one obtains and utilizes energy from foods, builds and then maintains body tissues. Minerals also function as vital constituents of many body tissues such as the iron of hemoglobin, myoglobin, the cytochromes and the calcium and fluoride of sound teeth and bones.

Water, in addition to making up some 70% of the total body, is essential for the absorption of many nutrients, the elimination of body wastes via the urine and feces, and the maintenance of a normal body temperature via evaporation of water from the lungs and skin. While water provides no calories or vitamins it may provide calcium and magnesium in the case of "hard" waters and when fluoridated, either naturally or artificially, is the only important source of the mineral nutrient fluoride. This mineral nutrient is not only the single most important factor in lessening tooth decay (by 60-70%) but is important in lessening the incidence of osteoporosis in ageing and it may be important in lessening the incidence and severity of soft tissue calcification as for example in hardening of the arteries.

Nutrition is important in modern health and medicine—in improving and maintaining good health and in improving poor health. It is hoped that this manual

will stimulate students of the health professions—medicine, dental, public health and nursing—as well as practitioners of the health professions, to learn more about nutrition and apply it for the benefit of mankind.

How prevalent is malnutrition in the USA?

This depends in part on what we mean by malnutrition. If we mean illness or poor health resulting in part from poor nutrition, it is widespread and among all economic classes. For here we would include tooth decay due to inadequate intake of the mineral nutrient, fluoride, and tooth decay is almost universal. We would include osteoporosis contributed to by lack of fluoride and this is radiologically demonstrable in 50% of adults over sixty years of age.

Related in part to malnutrition is atherosclerosis as manifested by coronary heart disease, cerebral, renal and peripheral artery disease. Essential hypertension can be lessened by decreasing the intake of the mineral nutrient sodium, and may possibly be caused by too much sodium and aggravated by obesity. These cardiovascular diseases are responsible for well over half the deaths in this country. Iron deficiency anemia is certainly prevalent in all societies.

The acute and severe vitamin deficiencies as manifested by the classical nutritional diseases—scurvy, pellagra, beriberi and xerophthalmia—are not common in the USA, but they are prevalent in many parts of the world. Vitamin deficiencies however, are prevalent in a large number of alcoholics in our country.

We have few data as to whether mild deficiencies of these vitamins or other nutrients are prevalent in the USA and particularly if they are responsible for manifestations of ill health.

Extensive nutritional surveys in the USA to evaluate

health in relation to nutrient intake have been completed in ten states.¹ It is important that techniques for such studies be improved, deal with more nutrients, and the studies extended to provide factual data on the extent of malnutrition, not only among underprivileged people but also among privileged, and especially among young children. There should be a continued monitoring of the nutritional status of representative groups of our people. Infant mortality rates in the USA are higher than in fifteen other nations and we do not know the contribution of malnutrition to these deaths, but we do know that the death rates are higher among minority groups whose diets tend to be poor.

That there is something wrong with our food distribution system is clear. In the same city it is quite common to find school meals provided in the affluent suburbs but not in the ghetto sections. Food stamps are sometimes available, but frequently the money to buy the stamps is not. Surplus food distribution has been designed much more to help the producer of surplus foods than the poverty stricken consumer.

We do not know how often an empty belly leads individual Americans into crime or what the contribution of anxiety is to violence and rioting among people having insufficient food. We do not yet know the role that malnutrition plays in mental and behavioral development of children.

We do know that all is not well nutritionally in this most affluent of nations. Improved nutrition allied with other measures of health and social justice can make America a better place for all her citizens. It can solve the problems of overnutrition—of too many cal-

1. Ten-State Nutrition Survey 1968-1970, DHEW Pub. No. (HSM) 72-8134, 1972. CDC, Atlanta, Ga. 30333.

ories, of too much saturated fat—in the affluent and of nutritional deficiencies and varying degrees of starvation in the poor, the alcoholics, the aged, the senile, and the dejected.

Interest in nutrition as an important environmental factor in the health of man is increasing and rapidly. This stems from many directions, such as the realization that tooth decay, one of our most prevalent diseases, can be reduced by half or more via the adjustment (usually upward) of the mineral nutrient fluoride in community waters, a process known as fluoridation; that lowering the cholesterol level of the blood lessens the chances of developing coronary heart disease or a stroke; that essential hypertension can frequently be treated simply by a modest loss of weight and a generous decrease in the intake of sodium; that iron deficiency anemia is prevalent in about one-fourth of our total population. It is a noted fact that obesity is widely prevalent in our country and that while by itself and when only moderate it may not be a health hazard, yet it seldom exists by itself and then it is a real hazard to health; and finally the knowledge that undernutrition as a partner of poverty is far more prevalent than had been expected.

But here too progress has been made in recent years (and months) stemming largely from the White House Conference on Food and Nutrition. This conference was held in Washington, D.C., in early December, 1969, and incidentally, was organized and chaired by a member of Harvard's Department of Nutrition, Professor Jean Mayer. Among the conference recommendations that have in varying degrees been carried out are the following:

Liberalization of the Food Stamp Program: the amount allowable per family has been increased. The cost of stamps has been decreased (down to nothing

for families with no resources). The coverage has gone up from about 2 million persons in 1969 to 13 million in 1972.

Improvement of the Commodities program: the number of commodities given every month used to number often no more than 5 or 6; the average is now 18, which permits a more balanced diet.

Meals-on-Wheels and Community Meals for the Elderly: a federal program now finances state, local, and private programs in both of these areas.

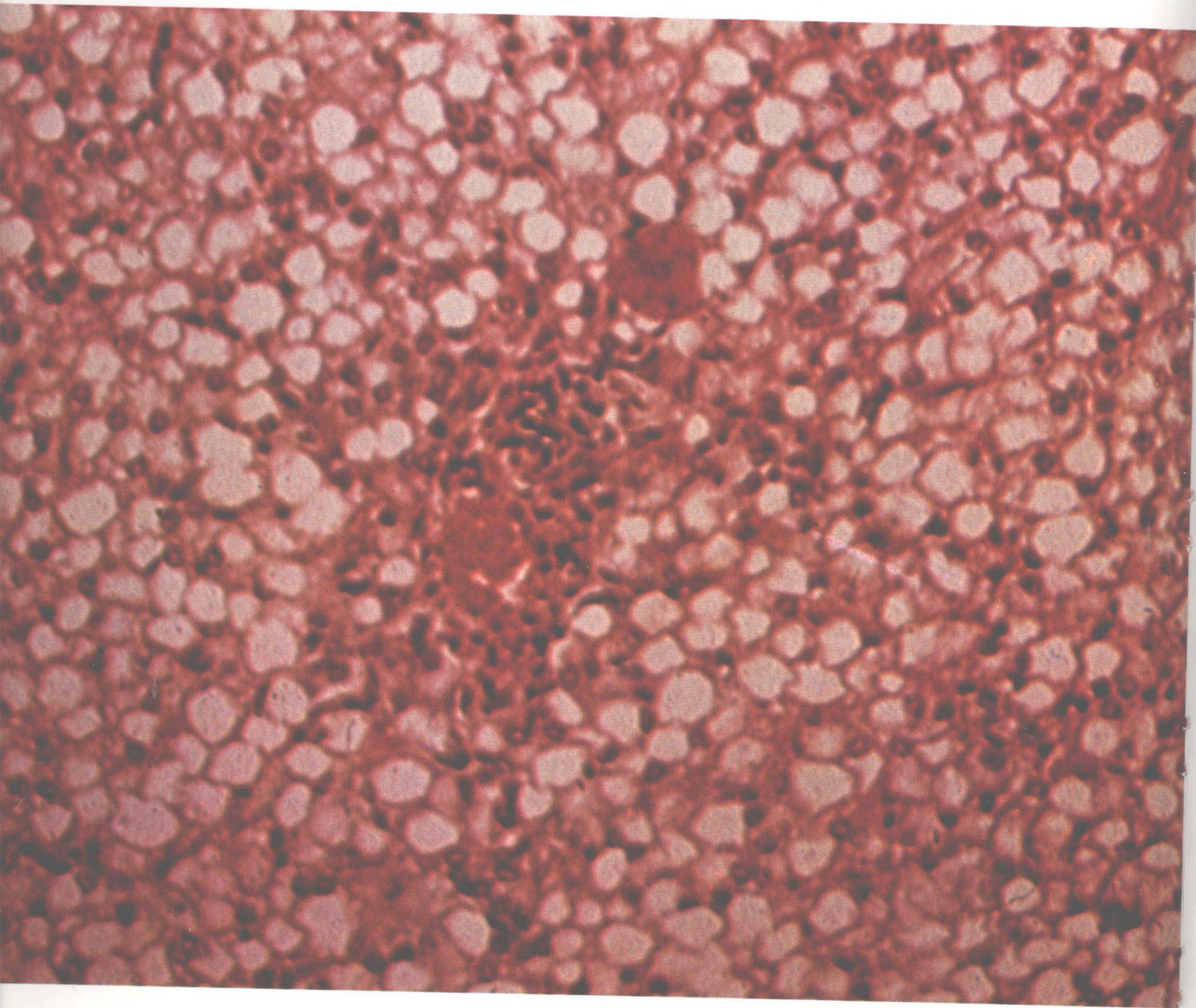
Enlargement of the School Lunch Program: about 8.5 million poor children now receive free school lunches (as compared to 4 million in 1969). Several hundred thousand free school breakfasts are also served daily.

Supplementary feeding program for pregnant and nursing women.

Consumer programs: a variety of measures have been undertaken or are being extensively tested. These include open dating of perishable commodities, unit pricing, nutritional labelling and a review of procedures on the safety of additives.

Education programs: a number of education measures ranging from nutrition education programs conducted by various food industries to the introduction of bills to support a Chair of Nutrition in every U.S. medical school.

This manual is not a textbook of nutrition. Several areas of medicine where nutrition is of importance such as diabetes, have been omitted because there already are excellent manuals on the nutritional aspects of these subjects or good chapters in standard medical texts. This is simply a manual on nutrition designed to interest the medical student and others interested in nutrition about the health of man today.



Fatty infiltration of the liver in kwashiorkor.
Michael C. Latham, M.D.

Recommended Dietary Allowances of Nutrients

This manual has been prepared primarily for use by medical students and physicians in the United States. Following is part of the introduction to the publication, *Recommended Dietary Allowances*,^{1a} which is a report of the Food and Nutrition Board, National Academy of Sciences — National Research Council of the United States. This publication provides the recommended daily dietary allowances of nutrients and gives an explanation of how these allowances are estimated.

"Since 1940, the Food and Nutrition Board has developed formulations of daily nutrient intakes which were judged to be adequate for the maintenance of good nutrition in the population of the United States. These formulations were designated 'Recommended Dietary Allowances' in order to indicate that they were value-judgments based on the existing knowledge of nutritional science and subject to revision as new knowledge became available. The allowances are intended to serve as goals toward which to aim in planning food supplies and as guides for the interpretation of food consumption records of groups of people. Actual nutritional status of groups of people or individuals must be judged on the basis of physical, biochemical, and clinical observations combined with observations on food or nutrient intakes. If the recommended allowances are used as reference stan-

dards for interpreting records of food consumption, it should not be assumed that food practices are necessarily poor or that malnutrition exists because the recommendations are not completely met.

"The first edition of *Recommended Dietary Allowances* was published in 1943. The allowances recommended are those which, in the opinion of the Food and Nutrition Board, will maintain good nutrition in essentially *all* healthy persons in the United States under current conditions of living.

"The physiological and biochemical bases for the recommended allowances of each specific nutrient are described in the text. For proper understanding, application, and interpretation of the recommended allowances, it is necessary to appreciate how the allowances are related to estimates of average physiological requirements.

"The allowances are designed to afford a margin of sufficiency above average physiological requirements to cover variations among essentially all individuals in the general population. They provide a buffer against the increased needs during common stresses and permit full realization of growth and productive potential; but they are not to be considered adequate to meet additional requirements of persons depleted by disease or traumatic stresses. On the other hand, the allowances are generous with respect to temporary emergency feeding of large groups under conditions of limited food supply and physical disaster.

1a. *Recommended Dietary Allowances*, 7th Edition, NAS-NRC, Publication 1694, Washington, D.C., 1968. It is anticipated that the 8th Edition of this very useful publication will appear late in 1973 and that any changes from the 7th Edition will be minor.

"The margin of sufficiency above normal physiological requirements is different for each nutrient because of differences in the body storage capacity, in the range of individual requirements, in the precision of assessing requirements, and in the possible hazard of excessive intake of certain nutrients.

"Patterns of food consumption and food supplies in the United States permit ready adaptation to and compliance with the recommended allowances. The final objective of the recommended allowances is to permit and to encourage the development of food practices by the population of the United States that will allow for greatest dividends in health and in disease prevention."

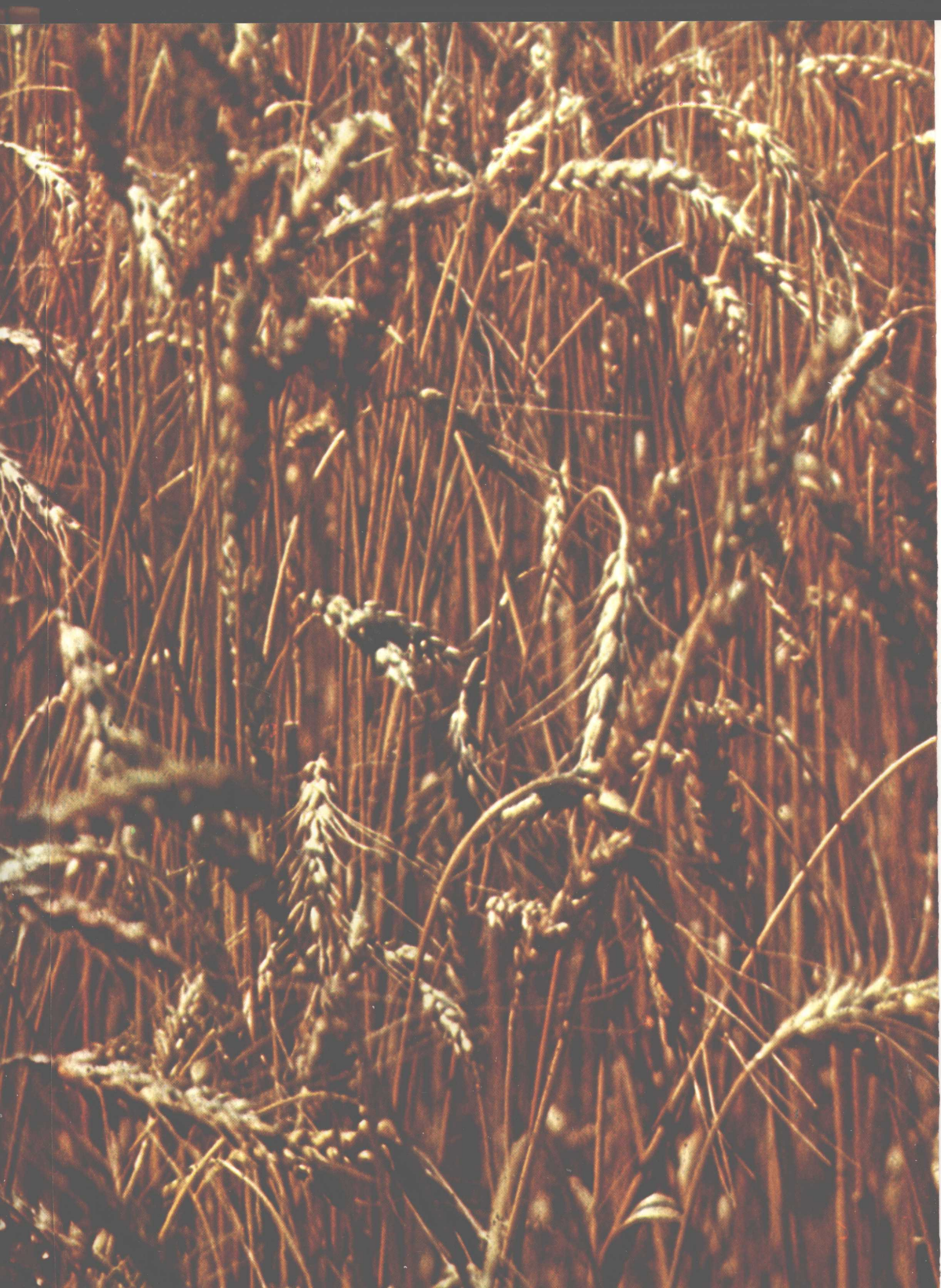
The recommended dietary allowances therefore provide guidelines for the evaluation and development of diets for people in the United States. It should be clearly understood that the values presented are not requirements since many individuals are known to consume smaller amounts than those listed and still enjoy good health. On the other hand it is recognized that the actual requirement is not precisely known for any nutrient and the experimental estimates of requirements always show rather large differences in different experiments and in different individuals. The cause of these variations is generally unknown. No doubt they are partially explained by technical differences or errors of measurement and partly by actual differences in requirements among individuals which may be of genetic origin. When the

true requirement is unknown, there is safety in recommending levels of nutrient intake above the estimated minimal need. The recommended dietary allowances therefore must not be considered actual requirements but rather levels of intake which should be entirely adequate for essentially all members of the population. This kind of dietary guidance seems appropriate in an affluent country such as the United States. It may not be appropriate in many parts of the world where more urgent problems exist and where food and money are more limiting factors for many people.

The presentation of one figure as a recommended intake for a particular group as in table I is likely to be somewhat misleading and often misinterpreted. The publication from which it is taken² provides explanations and justifications for values presented. The text should be consulted by those who are using the table.

It should be pointed out that the Recommended Dietary Allowances in the various editions are not the same, and never have been, as the Minimum Daily Requirements set forth by the Food and Drug Administration. The latter were usual many years ago in an attempt to try and actually maintain minimum daily requirements. They are now completely out of date, with no evidence to justify their continued use.

2. *Recommended Dietary Allowances*, 7th Edition, NAS-NRC, Publication 1694, Washington, D.C., 1968.



Special Medical Problems with a Nutritional Component

Nutritional Concepts in Heart Disease

I. THE USE OF NUTRITION IN THE PREVENTION OF ATHEROSCLEROTIC CARDIOVASCULAR DISEASE

Atherosclerotic vascular disease involving the coronary and cerebral circulation is the leading cause of death in the United States today. The disabilities among survivors of myocardial and cerebral infarction comprise problems of enormous magnitude to the socio-economic and medical aspects of individual care. Coronary heart disease is, in fact, becoming more frequent among men in the fourth and fifth decades of life. The magnitude of the problem of atherosclerosis, beginning in the second decade of life in over-nourished societies, and the premature mortality associated with coronary heart disease demand large scale preventive measures to reduce overall incidence and death rates.³ Current medical practice cannot significantly mitigate morbidity and mortality from these causes.

Present concepts of atherosclerotic vascular disease suggest that a number of environmental influences interact with host factors in the progression and ultimate clinical manifestations. It is quite apparent that this disease is not the inevitable consequence of either age or of hereditary tendencies *per se*. Comprehensive evaluation of the evidence from clinical, pathological, epidemiological, and experimental animal studies suggests multifactorial causation. Diet, through its influence on lipid metabolism and circulating lipids, is an important environmental element. Other factors associated with coronary heart disease are hypertension, cigarette smoking, adiposity and

physical inactivity. The latter two are clearly interrelated. Resolution and understanding of the contributions and interactions of these factors as related to accelerated, premature clinical manifestations of atherosclerotic vascular disease have proved unhappily difficult. Even the extensive descriptive population studies cannot provide all the answers. Ultimate cellular and biochemical mechanisms are obscure. An adequate experimental animal model for the investigation of atherosclerosis and its clinical sequelae in man is not available.

Of all the basic regulating factors known to be associated with the disease which can be realistically manipulated to prevent or at least retard the atherosclerotic process, nutrition stands out. Elevation of blood lipids, particularly the induction of hyper beta-lipoproteinemia, is mandatory for the production of atherosclerosis in experimental animals. Dietary manipulation is the easiest way to achieve experimental atherogenesis. The extraordinary differences in blood lipids among peoples of various areas of the world are correlated with cardiovascular disease mortality. Differences in lipid distributions are related to dietary practices. The association of accelerated development of atherosclerosis and coronary heart disease with metabolic disorders in which circulating lipids are elevated has long been recognized. It has been a major contribution of the large, descriptive, epidemiologic study to demonstrate a quantitative association between lipids and the subsequent incidence of coronary and thrombotic cerebrovascular disease. The relationship shown in Chart 1a is typical of the association found in population studies.

To demonstrate relationships between factors and

3. Report of Inter-Society Commission for Heart Disease Resources. *Circulation* 42:53, 1970.