Let's Eat Right To Keep Fit

By the Same Author

VITALITY THROUGH PLANNED NUTRITION

LET'S COOK IT RIGHT

LET'S HAVE HEALTHY CHILDREN

Let's Eat Right To Keep Fit

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FOREWORD

Adelle Davis is the only author I know who can present authoritative, accurate information concerning vital, complicated, human nutritional processes in such an interesting and fascinating manner. I could hardly leave the manuscript at my first reading. Even as a physician, especially informed and interested in human nutrition, I learned much from this book, as I have from hearing the author lecture on many occasions.

Each chapter has such a personal impact and meaning for the reader that he will stop and ponder as to how the facts and knowledge gained specifically apply to himself. This happened to me. Many chapters will be reread several times. The book is well documented and is an excellent source of reference material.

Here is the book for the physician and technically trained person as well as for the layman. Non-medical people are constantly asking for more and more reliable technical knowledge expressed in direct yet simple understandable language. This is it as far as food, diet, and human nutrition are concerned. It will serve as a good review for even the physician and will bring the nutritionist up to date.

How I wish I could have read this book before or during my medical school education. In medical college, the students tend to get lost among the trees of technical knowledge. It is difficult for them to grasp the broader perspectives. They are taught the sound principle of specific therapy for the specific disease. In my opinion, we all suffer from malnutritional disease with resultant physical and mental deterioration. However, the human being probably never develops just a single nutritional lack. Only in animals that we place in pens and feed food lacking in a single nutrient can we produce specific nutritional diseases. Can you imagine a diet for the human being which lacks only a single nutrient? It has occurred to me gradually that one nutritional deficiency meant others, and if one tissue was harmed, others were also.

Undoubtedly many vitamins and other food elements have not yet been discovered. Every year new ones are found that are essential for life or health. How many more are there yet to be isolated in the next 10 years; the next 100 years? We cannot get adequate nutrition even to sustain life from synthetic foods and vitamins. They will only help, and they may lull us into a false sense of security. We must get our real sustenance from our food, from good food, as the author explains.

So many factors militate against our receiving the good health that our food should bring us. First, our soils today are mostly mediocre or poor, and hence the plants do not contain proper or frequently even the essential nutrients. The animals that eat these plants cannot have the proper food chemicals in their meat, milk, or eggs. Also, the processing or improper cooking of these foods further deteriorates them. And, finally, there are important psychological deterrents which prevent us from feeding ourselves properly.

There is so much psychology involved in the very act of eating. In the oral, first-year stage of our life the actual foundation is laid for most of our eating habits. Most of these are on a subconscious level, and we are not aware of reasons behind our likes and dislikes. We may overeat because of longing for affection. We may fail to eat or to eat properly because of unresolved hostilities. It is common knowledge to psychologists that we all possess unconscious needs and desires to hurt and injure ourselves, the less neurotic punishing themselves only to a lesser degree. Otherwise why do we "learn to like" so much of the devitalized food we eat? Why do we drink so much alcohol? Why do we smoke so much? Why do we overwork or underwork? In some people only adequate psychoanalytical consultation will remove these self-damaging tendencies.

It is well known that husbands and wives cannot easily sell each other, or their children for that matter, on new ideas or needed changes. This is especially so in regard to eating habits which have been a lifetime in building, when they are so deeply rooted in and forgotten by the subconscious. This book can be much help, for instance, to the mother who feels so helpless in trying to promote good nutrition for her family. At the start she should ask her husband to read only one chapter of this book—the second. In fact, almost any single chapter, read alone, seems to be adequate and complete in itself. Therefore, one can profitably read this book even for fifteen or twenty minutes at a time.

If the principles set forth in this book were followed by most people, I believe a greater advancement in health would result than from any other occurrence in the history of mankind. It surely represents the basis of preventive medicine.

W. D. Currier, M.D.
National Secretary, American Academy of Nutrition

February 15, 1954

PREFACE

Thousands of persons spend their lives doing research in nutrition. This research has only one purpose: to help us build health and thus better to control our destiny. Such research remains valueless until it is applied to human life. Before it can be applied, it must be known and understood. The purposes of this book, therefore, are to report the facts, to make them understandable, and to stimulate their application. Every attempt has been made to report the research accurately. The conclusions, however, are those of the author. In some instances, these conclusions are purposely speculative, drawn in an effort to stimulate the application of adequate nutrition. If such conclusions are eventually shown to be wrong, they will nevertheless have served their purpose in case health has been promoted.

Many persons have aided in the preparation of the manuscript or have offered valuable criticisms. To these generous people, the author wishes to express her sincere thanks and gratitude: Dr. Harry J. Deuel, Jr., Dr. Henry M. Leicester, Dr. C. Edward Havard, Dr. Arthur L. Jensen, Dr. and Mrs. Douglas Gordon Campbell, Dr. Victor Bard, Dr. Everett W. DeLong, Dr. H. M. Benninghoff, Dr. Gordon Orme, Dr. Clarence S. Marsh, Dr. Howard Fenton, Dr. and Mrs. Arthur C. Hicks, Dr. Lester M. Morrison, Dr. Michael J. Walsh, Mr. and Mrs. Walter Lindberg, Mr. Cyril Maire, Mr. and Mrs. Glenn Howe, Mr. and Mrs. D. R. Coleman, Mrs. Martha McGeein, Mrs. Thomas Gentle, Miss Olive Burchfiel, Mrs. Marianne Hix, Miss Freda Donahue, and Mrs. Milton Janes.

ADELLE DAVIS

CONTENTS

Foreword *v*

Preface *ix*

1. Nutrition Can Be a Fascinating Subject 3
   The reasons nutrition is not applied
2. Breakfast Gets the Day's Work Done 9
   Sugar, slowly absorbed, gives a sustained pickup
3. The Stuff You're Made Of 20
   The body structure is largely protein
4. One Trick in Staying Young 26
   Proteins, generously supplied, repair as wear occurs
5. Do Not Underestimate the Familiar 35
   Certain fats are as important as are the vitamins
6. Can We Prevent Being Deluged? 44
   Sugar, sugar everywhere
7. Which Apricot? Grown Where? 48
   It is difficult to obtain adequate vitamin A
8. The Paupers Were Better Off 60
   The B vitamins are largely lost when foods are refined
9. It Is Only an Assumption 67
   The lesser-known B vitamins may be important indeed
10. I'm Afraid To Take the Chance 77
    More B vitamins which are important too
11. Are Blue Mondays Necessary? 90
    Perhaps B vitamin can prevent them

12. Study Yourself in the Mirror 94
Vitamin B_2 deficiencies often show at a glance

13. It Is No More Important Than the Others 100
Vitamin B_1 does not always enrich

14. Foods Taste So Much Better 107
They should be made from fresh unrefined ingredients

15. I Wish I Knew 117
Can vitamin supplements meet our varying needs?

16. A Plea for Caution and Open-mindedness 124
Perhaps the B vitamins can save your life

17. The Two-Hundred-Year-Old Vitamin C 131
Known facts concerning vitamin C are still not applied

18. A Finger in Every Pie 139
Vitamin C can protect the body from many harms

19. The Nicest People I Know 149
Vitamin D can pay rich dividends

20. Let's Apply It, Then Prove It 160
Vitamin E appears to have many functions

21. Your Disposition Tells the Story 175
Calcium helps to relax the nerves and tissues

22. As I See It, There's No Excuse 186
The value of iron and iodine has long been known

23. How Firm a Foundation? 199
Minerals must first be in the soil

24. The Perfection That Is You 214
The health of a cell, multiplied by billions, is your health

25. Let's Not Be Part-smart 222
Sixty or more nutrients make up normal nutrition

26. Personal Rewards of Good Nutrition 239
Normal weight, a happy sex life, and longevity can be such rewards

27. Is Our National Health on the Down-grade? 254
Primitive peoples surpass us in health

28. When Ability Becomes Responsibility 261
What you can do to help build national health

Table of Food Analysis 275

Index 293

Let's Eat Right To Keep Fit

Dedicated

to

The Perfection That Is You

CHAPTER 1

NUTRITION CAN BE A FASCINATING SUBJECT

NUTRITION is a personal matter, as personal as your diary or income-tax report. Your nutrition can determine how you look, act, and feel; whether you are grouchy or cheerful, homely or beautiful, physiologically and even psychologically young or old; whether you think clearly or are confused, enjoy your work or make it a drudgery, increase your earning power or stay in an economic rut. The foods you eat can make the difference between your day ending with freshness which lets you enjoy a delightful evening or with exhaustion which forces you to bed with the chickens. To a considerable degree, your nutrition can give you a coddled-egg personality or make you a human dynamo. In short, it can determine your zest for life, the good you put into it, and the fulfillment you get from it.

Nutrition is the study of how foods, after they are swallowed, make you tick. It is often confused with dietetics, the study of foods which should be swallowed. Nutrition can be fascinating because it is about you. If this knowledge is both personal and fascinating, why does not everyone apply it? There are many reasons. Nutrition is a young subject; it has been kicked around like a puppy that cannot take care of itself.

Food faddists and crackpots have kicked it pretty cruelly. They usually have no scientific training, peddle tremendous amounts of misinformation, make unjustifiable claims, and are often out for commercial gain. They not only put people off by their ridiculous recommendations, they make every thinking person necessarily skeptical of the whole subject.

The followers of the food faddists are usually overzealous people. A friend of mine claims they either get "religion" or nutrition. They can dream up the most amazing concoctions to eat. I know; they have fed such foods to me with what I think is sadistic delight. I have eaten liquefied grass which tastes the way a newly filled haymow smells. The smell used to be good; the taste never is. They seem to believe that unless food tastes like Socratic hemlock, it cannot build health. Frankly, I often wonder what such persons plan to do with good health in case they acquire it. The longer I work in nutrition, the more convinced I become that for the healthy person all foods should be delicious.

There is no sense in your eating any food you do not like. It is good sense, however, to realize that you consider many health-building foods delicious, and still better sense to learn to enjoy foods particularly rich in nutrients your body must have to function normally. It can be done by the nibble method. Probably every person who enjoys coffee or bourbon hated the first sip.

Let us suppose you have certain nutritional deficiencies and think perhaps better food might help. You are offered some nauseating glop; it is so revolting that you immediately lose interest and eat as you are accustomed. Eventually your malnutrition makes you so ill that you are not expected to live. Who almost killed you? It seems to me the near-murderer was the person who gave you the unpalatable food. Had he given you delicious food instead, you would have improved your diet and perhaps felt wonderful. To my way of thinking, there should be two standards for selecting any food: it should taste delicious; it should help build health.

Another reason why nutritional knowledge is not applied is that much of our information concerning food comes from advertising. Commercial interests wish us to buy and eat certain foods. Highly refined foods keep better than do natural foods; they are easier to store and ship. They cannot spoil because they cannot support the health of bacteria, fungi, molds, or weevils; certainly they cannot build human health either. Although the few nutrients remaining in such foods are ballyhooed, the removal of many others during refining is kept strictly quiet: the implication is that such foods have great nutritive value. Why bother to improve a dietary which is already excellent?

An additional reason why people understandably shy away from nutrition is that there is a widespread "should-not" philosophy. For example, I once spoke to a certain "health" organization. Before I was introduced, the chairman ranted with astounding fury about "poison white sugar" killing people. Probably each person in the audience had eaten "poison white sugar"; yet most of them appeared to be alive. Had that been my introduction to nutrition, I would probably have felt a surge of nausea thereafter when the subject was mentioned. It would be more constructive to state that some foods have more to offer than others.

A further reason why nutrition is not valued is that people are so gullible. We live in a culture where a headache is "cured" by an aspirin; therefore an ulcer or other abnormality should be "cured" by a vitamin pill. Millions of people take capsules which "contain everything," believing that these preparations can maintain health. Such a capsule could be made, but it would be the size of a baseball. Why not try it? A python can swallow a pig.

Still another reason why nutrition is not applied is that so much information is inaccurate. For example, people frequently tell me, "I'm eating a high-protein diet." When I check the diets of such persons, I usually find their protein intake to be perhaps one-third of that recommended by the National Research Council. As a result of their thinking that they have knowledge when they do not, they fail to improve their nutrition. In the same category are pseudo-information and misinformation, the amount of which seems endless.

A serious reason why nutrition is not applied—quite alarming to me—is that wives often become interested in the subject before their husbands do. When a husband suffers from nutritional deficiencies, a wife who genuinely loves him tries to move heaven and earth to get him to change his eating habits. Any husband not a hopeless Milquetoast resents such maneuvering. Sometimes the reverse is true. A husband, sincerely trying to prevent medical and dental bills and such problems as fatigue and irritable dispositions, appears to be merely criticizing his wife's selection and preparation of food; this apparent criticism understandably antagonizes her. In either case the two reach a deadlock.

If a good fairy were to grant me a wish concerning this book, my wish would be that families might read it aloud together, stopping frequently to discuss their problems. In case you are the only member of your family to read it, my advice is to apply nutrition as best you can but to do it as quietly as possible. When positive improvement follows, your partner cannot help observing it, and he will want what you have achieved.

Perhaps the most important reason why nutrition is not applied is that eating has emotional connotations: to many people it symbolizes pleasure, pain, reward, punishment, and so forth. The person who suffered from poverty during childhood perhaps had nutritious food, but he may associate it with deprivation; less nutritious food, eaten by wealthy persons, becomes a mark of social standing. White bread and sugar often represent purity and cleanliness just as a white operating room once did. To many persons orange juice means castor oil. A psychiatrist tells me that some persons who think they hate milk actually hate their mothers who tried to make them drink milk; guilt feelings prevent them from hating her outright. We all have emotional reasons for hating certain foods and liking others. For example, my father held stern clean-up-your-plate convictions: once he made me eat meat fat which was nauseating; I still hate fat meat. I used to hate brains because we threw them away when we butchered just as we did entrails; I identified brains with entrails. Theoretically, I hold that we should learn to enjoy all nutritious foods. To put the theory into practice, I once ate a platter of snails in a French restaurant and was violently ill for hours afterward; the snails did not make me ill, but my repugnance to them still makes me squirm. All of us have pleasant or unpleasant associations with food which we do not want to change; even if we tried, it might be impossible. People often think nutrition means giving up those foods we favor emotionally and eating those we hate.

Another factor which prevents nutrition from being applied is that we look to our physicians to guide our health; if the doctor has not revised one's diet, it seems logical to assume that nutrition is unimportant. We often forget that the study of medicine is *a study of medicine*. From the first day of medical school throughout the years of a physician's practice, this study is primarily one of disease rather than health. Many physicians are doing outstanding work in nutrition; their numbers increase yearly. Nevertheless the purpose of medicine is to help the sick person get well or, in the case of serious illness, to keep him alive. The purpose of nutrition is to maintain health and to prevent illness. Few medical schools teach nutrition even now, although they have taught dietetics for years. If nutrition is taught, it is usually limited to the recognition and treatment of severe deficiencies rather than subtle ones.

Physicians are often overworked to the point of exhaustion; yet they must constantly keep up with recent developments in antibiotics, hormones, new surgical techniques, treatments for new diseases and new treatments for old diseases. I have worked with physicians for a quarter of a century. They are wonderful people; I have yet to meet finer. The criticism implied by the remark, "Why didn't my doctor tell me diet was important?" seems to me to be unfair; it is like expecting me to perform delicate brain surgery. You may find the time to study nutrition; probably he cannot.

Lastly, nutrition often is not applied because of the vast gap, perhaps of 20 or 30 years, between scientific and clinical research. In hundreds of laboratories all over the world, scientists feed experimental animals diets deficient in one nutrient or another and study the effects upon their health. These scientists, however, do not study human beings to find the counterpart of the abnormalities they produce in animals. Their research is merely reported each month in hundreds of expensive scientific publications which the busy physician rarely sees, although if he did he might immediately recognize the symptoms described in his patients.

Nevertheless, this knowledge of the means of producing health, gained largely from research with animals, is gradually being found to apply to humans. Regardless of how radiant your health, a thorough knowledge of nutrition and its application can usually bring vast improvement. Such application is your insurance of feeling your best, looking your best, and giving your best. As nearly as possible, it is your hope of making a long, active, and rewarding life a reality.

Let us find out how to keep fit.

CHAPTER 2

BREAKFAST GETS THE DAY'S WORK DONE

SIXTY or more nutrients are needed to build health. Valuable unrefined foods such as milk might supply all 60 of these nutrients, whereas a highly refined food such as sugar supplies only one. Single nutritional deficiencies, therefore, apparently never occur in humans. A person whose diet is faulty suffers from multiple and overlapping deficiencies simultaneously. The symptoms of a single deficiency resulting when animals are given diets adequate except in one nutrient are far simpler than the symptoms found in people. The discussions of single deficiencies in this chapter and the following ones are therefore unavoidably oversimplified and unrealistic. A single deficiency can, however, predominate over other deficiencies. For example, an undersupply for only a few hours of the amount of sugar furnished your tissues can wreck your day.

You determine how you will feel throughout each day by the type of breakfast you eat. You can produce inefficiency in yourself by eating too little food or too much of the wrong kind of food. Your breakfast establishes how readily your body can produce energy that day or, more specifically, the amount of sugar in your blood. Your energy production, which corresponds to the quantity of sugar available, determines how you think, act, and feel. Energy is produced in your body by the burning (oxidizing) of sugar alone or sugar and fat together. Only when the blood plasma contains adequate amounts of sugar can each cell select the quantity it needs. The amount of sugar in the blood is an index of the quantity available to each cell.

Thousands of blood analyses have shown that a normal person who has not eaten for 12 hours has 80 to 120 milligrams of sugar in about ½ cup (100 cc.) of blood. This figure, known as the fasting blood sugar, depends on the kind and amount of food eaten at the previous meal. The average is 90 to 95 milligrams. At this point energy is rather well produced. As the supply of blood sugar is used, energy is produced less readily, and lassitude sets in. When the sugar falls to about 70 milligrams, hunger is experienced, and lassitude gradually becomes fatigue. If the blood sugar drops to about 65 milligrams, a craving for sweets is often noticed and/or "growling" in the intestines. A continued drop in the sugar supply causes fatigue to become exhaustion. Headaches, weakness, and wobbliness often occur; palpitations of the heart may be noticeable; the legs may suddenly give away; nausea and even vomiting are often experienced.

The cells of the nerves and brain can produce their energy only from sugar, never from fat by itself or protein. Even when the amount of sugar available to the cells decreases only slightly, thinking becomes slowed and confused, and nerves become tense. The person whose blood sugar falls below normal becomes progressively more irritable, grouchy, moody, depressed, and unco-operative. Since the brain derives its energy only from sugar, blackouts or fainting may occur if the supply drops dangerously low.

On the other hand, if your food intake is sufficiently adequate to cause your sugar to increase above the fasting level, energy is easily produced; you feel wonderful and full of drive. Your thinking is quick and clear. You have no desire to eat; sweets seem distasteful. Your disposition is at its best; your attitude gracious, cheerful, and co-operative. At this level, life is good.

Many studies have been made of the factors influencing the level of blood sugar. In one such study,[1] for example, 200 volunteers ate various types of breakfasts; each individual's blood sugar was determined before the meal and hourly for three hours afterward. After black coffee alone, the blood sugar decreased, and the volunteers experienced lassitude, irritability, nervousness, hunger, fatigue, exhaustion, and headaches; the symptoms became progressively worse as the morning wore on. Two doughnuts and coffee with sugar and cream caused a rapid rise in blood sugar, but the amount fell within an hour to a low level, again resulting in inefficiency and fatigue. A basic breakfast was selected because it was typical of the morning meal eaten by millions of Americans: a glass of orange juice, two strips of bacon, toast, jam, and coffee with cream and sugar. The blood sugar rose rapidly but fell far below the pre-breakfast level within an hour and remained below normal until lunch time. The next breakfast was the same except for the addition of a packaged cereal; again the blood sugar rose, fell quickly, and remained below normal all morning. A fifth breakfast was the basic one plus oatmeal served with sugar and milk; the blood sugar rose rapidly but fell more quickly and to a lower level than after any other breakfast studied. Then 8 ounces of whole milk fortified with 2½ tablespoons of powdered skimmed milk was drunk with the basic breakfast of orange juice, bacon, toast, jam, and coffee. After this meal the blood sugar rose above normal and stayed at approximately 120 milligrams throughout the morning; unusual well-being was experienced. Two eggs were then served instead of fortified milk; again a high level of efficiency was maintained. The last breakfast was the basic one with eggs or fortified milk and larger amounts of toast and jam; efficiency stayed high once more.

[1] E. Orent-Keiles and L. F. Hallman, "The Breakfast Meal in Relation to Blood Sugar Values," U. S. Department of Agriculture, Circular No. 827 (1949).

These scientists then studied the effect of the different breakfasts on the well-being of the volunteers throughout the afternoon. Persons who had eaten the different breakfasts were given lunch: a cream cheese sandwich on whole-wheat bread and a glass of whole milk. Blood samples were taken at hourly intervals. In all cases the blood sugar increased soon after lunch. Persons who had eaten eggs or fortified milk for breakfast showed a high blood sugar all afternoon. When the breakfast allowed blood sugar to be low during the morning, the increase after lunch rose to the level of cheerfulness and efficiency for only a few minutes; then it fell to a low level which lasted throughout the afternoon. Your selection of food at breakfast, therefore, can prevent or produce fatigue throughout the day.

A similar study was made at Harvard University by Doctor Thorn [2] and co-workers who determined blood sugar levels for six hours after meals high in carbohydrate (sugar and starch), fat, or protein. A high-carbohydrate breakfast consisted of orange juice, bacon, toast, jelly, a packaged cereal, and coffee, both with sugar and milk. The blood sugar rose rapidly but fell to an extremely low level, causing fatigue and inefficiency. A packaged cereal eaten only with whipping cream formed the high-fat breakfast, after which the blood sugar increased slightly, then remained at the fasting level throughout the morning. The high-protein meal consisted of skimmed milk, lean ground beef, and cottage cheese; the blood sugar rose slowly to the high level of 120 milligrams and remained there throughout the entire following six hours. To determine the effect of different types of food on energy production, metabolism tests were taken at frequent intervals. The metabolism, or energy production,

[2] G. W. Thorn, J. T. Quinby, and M. Clinton, Jr., "A Comparison of the Metabolic Effects of Isocaloric Meals of Varying Compositions with Special Reference to the Prevention of Postprandial Hypoglycemic Symptoms," *Annals of Internal Medicine*, XVIII (1943), 913.

increased only slightly after the meals high in fat or carbohydrate. After the high-protein meal, however, the metabolism rose more quickly than did the blood sugar and stayed high throughout the entire six-hour study period.

Studies similar to these have been conducted in many universities. The results have been consistently the same: well-being and the level of efficiency experienced during the hours after meals depend upon the amount of protein eaten; the meals which produced a real zest for living also contained some fat and a certain amount of carbohydrate. It is only when there is a combination of sugar, which is the source of energy, and protein and fat, which slow digestion, that sugar is gradually absorbed into the blood, and energy is maintained at a high level for many hours.

The sources of sugar and starch in our American diet are cheap and overabundant; proteins are expensive and scarce. Typical American breakfasts, therefore, consist of fruit or juice supplying natural sugar; cereals, hotcakes, waffles, coffee cake, toast, or other starch quickly changed into sugar during digestion; usually refined sugar is added to cereal and coffee; jam or jelly may be eaten; quantities of sugar pour rapidly into the blood. In a matter of minutes the blood sugar may increase from 80 to 155 milligrams. Any rapid increase stimulates the healthy pancreas into pouring forth insulin; the insulin, in turn, causes the liver and muscles to withdraw sugar and store it as a form of starch, or glycogen, or change it into fat, thus preventing it from being lost in the urine. As the digestion of a high-carbohydrate meal continues, however, sugar keeps pouring into the blood. In effect, it calls to the pancreas, "Send more insulin! More! More!" The pancreas obeys; it is overstimulated; because of its efficiency, it sends too much. The tremendous amounts of sugar defeat the purpose for which sugar is needed: to produce energy efficiently. Too much sugar is withdrawn due to the oversupply of insulin; the result, ironically, is fatigue. The more carbohydrate eaten, the greater the insulin oversupply. For example, in the studies mentioned, the largest amount of sugar was freed during the digestion of the breakfast containing oatmeal.

When three high-carbohydrate meals are eaten daily, the pancreas becomes overefficient, or trigger-happy; too much insulin is produced too quickly. Persons eating such meals often produce actual insulin shock in themselves. This fact is emphasized by a diabetic specialist[3] who observed insulin-shock symptoms among his non-diabetic patients. Since American meals are largely carbohydrate, self-produced insulin shock is probably much more common than is realized. The same symptoms, however, can occur whenever the blood sugar drops far below normal because no food has been eaten and/or because exercise has used up the available sugar.

(The cells can store only a little glycogen; any remaining sugar is changed into fat. After digestion is completed, however, the only normal source of sugar is stored glycogen, which is broken down into sugar again; this sugar is soon used up, especially if vigorous exercise is taken. Most of the cells then burn fat alone to supply energy, but fat is not burned efficiently without sugar; it leaves "clinkers" or "ashes" in the form of acetone and two acids, all somewhat harmful to the body. Energy ebbs, and damage is done by the acids. The brain and nerves, however, must have sugar to sustain life; the adrenals send out cortisone, and cells are destroyed so that their protein can be converted in part to sugar. Bad eating habits thus force the nervous system to become a parasite, living off other body tissues. If you allow this destruction to happen often, you will not like the sags and bags you see in your mirror.)

On the other hand, if breakfast has supplied a small amount of sugar and fat and moderate protein, digestion takes place

[3] E. M. Abrahamson and A. W. Pezet, *Body, Mind, and Sugar* (Henry Holt and Company, 1951).

slowly; sugar trickles into the blood, giving a sustained pickup hour after hour. Insulin production is not overstimulated. Glycogen storage proceeds normally; no hated fat is formed. Energy urges the body into activity; warmth is produced as needed, or the cooling system functions with equal efficiency if the weather is hot.

Proteins are measured in grams. For example, an egg supplies 6 grams of protein; a quart of whole milk, 32 grams (see table, pp. 32-3). In the studies mentioned, efficiency for three hours after a meal was produced only when 22 grams or more of protein were obtained. The meal furnishing 55 grams of protein sustained a high level of energy and a high metabolism for six hours afterward. It now appears that the more protein eaten at any meal, the greater is the efficiency and the longer it is maintained. Lunches and dinners must also supply high protein with some fat and carbohydrate if well-being is to be sustained for hours after the meals. Further studies show that blood sugar levels are lower during hot weather, when little protein is eaten, than in winter, when sharp winds whet the appetite.

Another means of maintaining a high blood sugar level, now studied extensively, is to eat between meals. The objections to this procedure are that nutritious foods are frequently unavailable and non-nutritious ones too readily available. Also people often gain too much. The mid-meals found most effective[4] contain protein, fat, and carbohydrate; of mid-meals studied so far, a glass of whole milk with 100 calories of fresh fruit has produced the greatest efficiency.

If we now consider typical American meals with a critical eye, we see innocent stupidity elevated to an art. Breakfast may supply too little sugar to maintain the blood sugar level or so much sugar that insulin is oversupplied. Lunches are

[4] H. W. Haggard and L. A. Greenberg, "Between Meal Feeding in Industry: Effects on Absenteeism and Attitude of Clerical Employees," *Journal of the American Dietetic Association*, XV (1939), 435.

usually sketchy; mid-meals, if taken, are usually coffee, soft drinks, or sweets; thus is inefficiency produced until dinner time. Protein is eaten at dinner but, alas, efficiency does not always follow. The accumulation of the day's fatigue may be too great unless masked by alcohol and/or coffee; so much food may be eaten that drowsiness is induced. The husband may snore in his chair while his wife reflects bitterly that their marriage has gone to pot. If it is a social evening, the time is often passed in desultory, boring conversation. By bedtime, the acetone bodies have been excreted, and the food is largely digested; efficiency is then produced and slept off much as a drunkard sleeps off a binge.

There is nothing new about high-protein breakfasts. For morning meals on our Indiana farm when I was a youngster, we had hot cereal, steaks, ham and/or eggs, huge patties of sausage or fried chicken with country gravy; a large pitcher of milk was regularly on the table. Remember the English novels where buffet breakfasts of fish, meats, eggs, hot cereals, and creamed dishes were described? A friend returning from the Scandinavian countries recently told of having a smörgasbord with thirty kinds of fish, cheese, and meats served at breakfast. Actually, breakfasts need not be large.

You may say you are not hungry in the morning; this remark means, "I overate last night." Hunger sets in only when the blood sugar drops to about 70 milligrams; 12 hours after a typical American dinner the blood sugar is usually 95 milligrams or even higher. To launch a campaign of efficiency, the best technique is to have a mid-meal in the late afternoon. Dinner should be simple and graciously served: a soup or salad so delicious that everyone wants a second helping, meat or meat substitute, perhaps a low-starch vegetable, milk, buttermilk or yogurt, and fruit. Appetites can be satisfied and the meal enjoyed without potatoes, gravy, and dessert, provided the afternoon snack is sufficient. Such a meal is easy to prepare, creates less havoc in the kitchen, and allows you eagerness for breakfast the next morning. The objection to small dinners is that husbands have no time to eat a large meal in the morning or at noon. Why eat a large meal at any time? All meals should be simple, filling, and enjoyable. When hungry, one always finds time to eat. I have yet to meet a red-blooded man who did not enjoy a high-protein breakfast.

Many of our national problems can be traced directly to our faulty eating habits. For example, a third of our population is obese; high-protein breakfast alone would largely correct this problem. Ninety-eight per cent of Americans have tooth decay caused by eating too much sugar; the craving for sweets disappears when the blood sugar is kept high. Lassitude, fatigue, nervousness, irritability, even exhaustion and foggy thinking are widespread indeed. Prevention or remedy are easy; for the essentially healthy person, fatigue can be changed to amazing vitality in a single day. School children are difficult to handle and often learn slowly; thus much school-tax money is wasted. Confused thinking in political, public, and private life is all too common. The greater number of automobile accidents occur when the blood sugar is lowest, when thinking is confused and reactions are slow. Our excessive use of coffee, cigarettes, and alcohol is related to our level of blood sugar; they stimulate the production of adrenal hormones which cause the blood sugar to be increased, thereby producing the needed "lift." Irritability resulting from low blood sugar can be a factor in divorces. It now appears that polio is contracted only when the blood sugar is particularly low; the summer heat decreases the appetite for proteins and increases the craving for sugar-filled iced drinks and ice cream; exercise, such as swimming, uses up the sugar available.

Blackouts or near-blackouts resulting from low blood sugar are not unusual. For example, I was consulted by a woman who blacked out almost every time she went shopping; on each "dollar day" she came to in the nurse's office of some department store. Her meals customarily were largely carbohydrate. She hated breakfast; when she became hungry, she bought a pound or more of candy and ate it on the spot; approximately an hour later she blacked out. Another example was a student too psychologically upset to eat; for a short period she blacked out many times daily and had to drop college. She had had so many accidents and near-accidents that only her friends were driving her new Buick convertible. Still another was a motorman on a streamliner who had blacked out on the job and had become so frightened that he had taken sick leave; he had been eating huge meals almost entirely of carbohydrate. Persons who have blacked out usually know when to expect a recurrence by the pounding of their hearts; several tell me that at such times they have parked their cars only in the nick of time. My advice is that if you value your car and/or your life, you should not drive when your blood sugar is low. Low-blood-sugar driving is almost as dangerous as drunken driving.

Weakness or faintness, legs giving away and/or a blackout, together with a pounding heart, cause many people to believe they are having heart attacks. Within the last few months, four men have consulted me because of "heart conditions"; three had "heart attacks" in the evening. One had been hunting all day, a packed lunch forgetfully left behind. A second owned a garage, had gone to work without breakfast, and had been too busy to stop for lunch. A third was vacationing in the mountains; he had taken a walk before breakfast, decided to climb a mountain, and had exercised all day without eating. The fourth was following a strict reducing diet; his "heart attacks" usually occurred between 3 and 7 A.M. Physicians could find nothing wrong with these men's hearts, but each man was still severely frightened when I first saw him; each was taking as good care of himself as if he were a premature baby; and the life of each family revolved around "Father's heart condition." Certainly a person experiencing such symptoms should see his physician immediately; if the physician can find nothing wrong with the heart, however, a blood sugar analysis should be requested.

When the blood sugar is extremely low, the resulting irritability, nervous tension, and mental depression are such that a person can easily go berserk. If hatred, bitterness, and resentments are harbored, and perhaps a temporary psychological upset causes a person to go on a candy binge or makes it impossible for him to eat or digest food, the stage is set; violence or quarreling can occur for which there may be no forgiving. Add a few guns, gas jets, or razor blades, and you have the stuff murders and suicides are made of. The American diet has become dangerous in many more ways than one.

Our nursery-rhyme thinking of baby-bear-papa-bear meals needs revising. Maximum well-being and efficiency can and should be produced for every hour we are awake. The general rule is to eat breakfast like a king, lunch like a prince, and dinner like a pauper. Your meals, however, should be planned to give efficiency when you need it most. For example, if you are on a swing shift, your meal highest in protein should be eaten before you go to work.

Two of the finest looking and most energetic men I know of, both physicians about sixty, tell me they eat 50 to 75 grams of protein every morning for breakfast. If you eat such a breakfast daily for a week, I guarantee that you will not go back to low-protein breakfasts.

CHAPTER 3

THE STUFF YOU'RE MADE OF

YOUR body is largely made of protein: your skin, muscles, internal organs, nails, hair, brain, and even the base of your bones. Only when protein of excellent quality is supplied can each cell function normally and keep itself in constant repair. Since your muscles contain a greater amount of protein than do other body structures, a glance at yourself in the mirror will give you a rough estimate of the adequacy of your protein intake.

Strong well-nourished muscles automatically hold the body erect. When muscles have not received the food necessary for their repair, they lose their elasticity, like old rubber bands, and posture becomes poor. A mother who says to a child, "Stand up straight," is complaining of her own failure to provide nourishing food. Without conscious effort a healthy person holds his head high, his chest out, his shoulders and abdomen flat; he has only a slight forward curve in the center of the back. The pelvic bone is almost horizontal, supporting the viscera in the way a large salad bowl holds its contents; the feet have well-defined arches; the step is rhythmical.

It is almost unbelievable how quickly faulty posture can improve. Not long ago I planned a nutritional regime for a sixty-eight-year-old woman. A few weeks later she told me that for the first time in her life it was easy for her to hold herself erect; as a young girl her shoulders were so rounded that she had begged her mother to buy her a brace. It had always been impossible for her to hold herself erect except for a few strained moments, but at last her desire had been achieved. Another case which I found astonishing was that of a three-year-old boy: his chest was sunken; he had an enormous pot belly and feet as flat as a table top. Three months later this child had a high chest, beautifully arched feet, and a total absence of protruding abdomen. The rarity of good posture and a rhythmical, graceful stride tells of our widespread protein deficiency.

Since hair and nails are made of protein, this nutrient must be adequate to maintain their health. Like the muscles, hair which lacks elasticity and resiliency and perhaps breaks or refuses to take a permanent will often change to healthy hair after a few weeks of improved nutrition. Nails which break, peel, or crack can likewise change when the diet is improved.

Advantages of an adequate protein intake are that energy is readily produced and sustained, and life is made easier. Although a major cause of fatigue is low blood sugar, there are other causes resulting from protein deficiency which are less quickly corrected: low blood pressure, anemia, and the body's inability to produce the enzymes necessary for the breakdown of foods into energy.

Blood pressure means the push or force of the blood against the walls of the blood vessels. Only when the tissues of the vessel walls are strong can the blood pressure be maintained at its normal level. If these tissues become flabby and weak, they expand, making more room in the vessels. Since the volume of blood remains the same, the blood presses with decreased force against the walls; less blood plasma, carrying all nutrients, is pushed into the tissues. Adequate supplies fail to reach the cells; thus fatigue results. Since relaxation is greatest during the night, the person with low blood pressure finds that he is especially exhausted in the early morning; getting out of bed is a chore, and he is usually irritable and sluggish until his blood pressure has been increased by the stimulus of strong coffee. After a diet has been made adequate, however, low blood pressure usually becomes normal in one to three weeks.

Another cause of fatigue, particularly common among women and children, is anemia, or lack of red corpuscles, which are made almost wholly of protein. Without adequate protein anemia quickly results and persists until the nutrition is made normal. Anemia, however, can result from any number of nutritional inadequacies.

All energy is produced by means of enzymes, organic substances whose principal component is protein. Vitamins are important only because they form part of certain enzymes. When protein is inadequate, however, none of the enzymes can be formed in adequate quantities. Fatigue is only one of many abnormalities which result.

If protein is abundantly supplied and the diet is otherwise adequate, we can expect high resistance to diseases and infections. Although there are many mechanisms which help to protect the body against infections, two are particularly dependent upon the protein intake: antibodies and white blood cells. Under normal circumstances, the liver produces proteins known as gamma globulins, or antibodies, whose purpose it is to combine with and make harmless various bacteria, bacterial toxins, and presumably virus. Studies of persons suffering from almost every type of infection, including polio, show that the gamma globulins of the blood are undersupplied. These globulins might be thought of as a militia guarding your health.

Within recent years, it has become medical practice to take blood globulins from the plasma of healthy persons who have built up immunity and to inject these globulins into malnourished persons; such a treatment has been widely publicized as a means of preventing polio. If your nutrition is adequate, your body can produce all the antibodies it needs and more, but that simple fact is not given publicity. Experimental work has shown that when a low-protein diet is replaced by one high in adequate proteins, the antibody production is increased a hundredfold within a single week.

Another marvelous mechanism which helps to protect our bodies from infections is the production of cells known as phagocytes. *Phago* means to eat; *cyte* means cell. Some of these white blood cells circulate in the lymph and blood. Other phagocytes are stationary and remain in the walls of the blood vessels, in the tiny air sacs of the lungs, and in other tissues where they, like the antibodies, stand constant guard. When bacteria invade the body, the phagocytes mobilize, surround the enemies, and digest them. These valuable cannibals are made of protein and are produced in adequate amounts only when proteins of high quality are obtained in the diet.

Adequate protein is also necessary to maintain normal digestion. Since enzymes, necessary to change food into particles which can dissolve in water and pass into the blood, are made of protein, the stomach, small intestine, and pancreas can pour out enzymes only when adequate protein is supplied. The walls of the stomach and intestine are muscular and, like other muscles, contract and relax alternately, thus mixing foods with digestive juices and enzymes and bringing already digested food into contact with the intestinal wall where it may pass into the blood. Furthermore, the entire digestive system must be held in a normal position to work efficiently. When proteins are undersupplied, muscular walls and ligaments become flabby, and the "internal posture" suffers; the stomach may sag, the transverse bowel, or colon, may coil in snake-like fashion on the pelvic bone; the uterus or urinary bladder may be tipped; and other internal organs may be displaced. The flabby muscles of intestinal walls no longer contract normally; much food remains undigested. This food, on reaching the large bowel, supports the growth of billions of putrefactive bacteria; gas formation and flatulence result. Because flabby muscles are unable to push waste material from the body normally, constipation often occurs. Laxatives or cathartics may be used, causing food to be forced through the body before the protein it contains can be digested; or enemas may be resorted to which further break down the worn muscles. Only when the protein intake is entirely adequate does digestion become normal again.

Proteins help to prevent the body fluids from becoming too acid or alkaline; they can combine with and neutralize either acid or alkaline substances. They are the raw material from which most of the hormones are made. Proteins are also necessary in helping blood to clot. They have almost endless other functions without which life would be impossible.

In still another particular way proteins are immensely important in regulating body processes. A protein known as albumin, produced by the liver provided all the building stones are furnished by the diet, makes urine collection possible. As the blood cruises through the capillary beds, the force of the blood pressure pushes the plasma into the tissues; when the blood thus becomes concentrated, the protein albumin attracts fluids from the cells back into the blood. In these fluids are dissolved the waste materials, urea, uric acid, carbon dioxide, and others from the breakdown of tissues within the cells. These wastes are then carried to the kidneys and lungs.

When the diet is so inadequate that sufficient albumin cannot be formed, waste materials are not completely removed from the tissues. Many weeks or months of mild protein deficiency may occur without the accumulated water becoming noticeable; such a person merely thinks he is overweight and often tries to reduce by cutting down still further his protein intake. If the deficiency becomes more severe, the tissues are noticeably puffy, and the entire body is waterlogged. The ankles swell, especially toward the end of the day; swollen face and hands and puffy bags under the eyes are evident in the morning.

This condition is extremely common in persons of all ages. For example, most reducing diets are now fairly high in protein. It is not unusual for a person staying on 1,000 calories a day to lose 8 or 10 pounds during the first week; 3 pounds of this loss may be fat, and the remainder is usually water held because of previous faulty urine collection. Not long ago a young woman for whom I had planned a reducing diet lost 18 pounds the first week. Two women who came with legs and ankles badly swollen from waste-laden liquids lost 18 and 24 pounds respectively in two months, although neither was given a reducing diet.

Unfortunately, water held in the tissues gives the appearance of chubbiness often associated with health, especially in children; thus this abnormal condition may be looked upon as advantageous. Studies of youngsters suffering from polio and many other diseases show that the blood proteins, both the albumin and the globulins, or antibodies, are low and have been low long before the onset of the disease. Children entering the hospital with diarrhea or various infections or diseases are frequently so waterlogged that they appear to be fat; when a diet high in protein is given them and normal urine collection is resumed, they can be seen to be extremely emaciated.

It is my belief that only when the role of protein in building and maintaining health is understood will persons make the effort to select food with sufficient care to promote health.

CHAPTER 4

ONE TRICK IN STAYING YOUNG

WHEN all parts of the body are maintained by the absorption and utilization of adequate food, health and youthfulness are likewise maintained. Conversely, you grow old on the days your diet is inadequate. Since your body structure is largely protein, an undersupply can bring about aging with depressing speed.

The bodies of animals, like our own, are composed largely of protein; meats, fish, and fowl, therefore, are excellent food sources. Other superior sources are eggs, fresh milk, buttermilk, yogurt, powdered milk, cheese, soybeans, and powdered yeast. Nuts, beans, peas, and grains are fair sources. Plants can synthesize their own proteins; we cannot because certain parts of this substance cannot be made in the body.

Proteins are made of amino acids, all containing nitrogen which other foods lack. Twenty-two different amino acids are known. Just as thousands of words are made from the 26 letters of our alphabet, so are thousands of proteins made from different combinations of amino acids. Not only do the proteins in milk differ from those in soybeans, but the proteins in all parts of your body vary because of different combinations of amino acids which form them. Each protein may contain a combination of several thousand individual amino acids and is thus as complex as would be a word of thousands of letters (heaven forbid).

When proteins are eaten, the digestive processes of a healthy person break them down into amino acids which pass into the blood and are carried throughout the body. The cells select the amino acids they need and use them in constructing new body tissue and such vital substances as antibodies, hormones, enzymes, and blood cells.

Every instant of life, body proteins are being broken down by enzymes in your cells, and if your health is to be maintained, amino acids must be available for immediate replacement. Since the waste products are excreted by the kidneys, the urine can be analyzed for nitrogen which comes only from proteins; the quantity of nitrogen found in the urine shows the amount of body tissue being replaced at any given time. If your diet is adequate, the cells, by the help of enzymes, combine fresh amino acids into new proteins. Food proteins, therefore, are needed continuously from birth until death. If your diet is complete in other respects, you can maintain health whenever all the required amino acids are generously supplied.

When you eat more protein than your body can use immediately, your liver withdraws amino acids from your blood and changes them temporarily into storage protein. As your cells use amino acids, the supply is replenished from the breakdown of stored protein. As long as your diet is adequate, the amount of amino acids in your blood is thereby kept relatively constant. If you ignore your health to the extent of eating insufficient protein, the stored protein is quickly exhausted. From that time on, the less important body tissues are destroyed to free amino acids needed to rebuild more vital structures. Such a process may go on month after month or even year after year. Your body continues to function after a fashion. Unseen abnormalities set in because blood proteins, hormones, enzymes, and antibodies can no longer be formed in amounts needed. Muscles lose tone; wrinkles appear; aging creeps on; and you, my dear, are going to pot.

On the other hand, it is possible, although not probable, that you may eat more protein than your body needs. After the storage depots are filled, the leftover protein is changed by the liver into glucose and fat, the nitrogen portion being excreted in the urine; the sugar and fat may be used immediately to produce energy or may be stored as fat. Proteins are also used to produce energy whenever too few other foods are eaten to meet the calorie requirements, a situation which rarely occurs for the simple reason that protein foods are too expensive to be eaten exclusively.

Most of the 22 amino acids are needed in forming every tissue in the body. All but eight of these acids, however, can be made by the cells from fat or sugar combined with the nitrogen freed from the breakdown of used proteins. The eight which the body cannot make are spoken of as the essential amino acids, a misleading term because all amino acids are essential to health even though it is not essential that 14 of them be obtained from food. These so-called essential amino acids, however, must be supplied in the diet if health is to be maintained; each of them is as important as is any vitamin.

Physicians now use separate amino acids in the treatment of certain diseased conditions; since the names frequently appear in the lay press, you should be sufficiently familiar with them to recognize them as amino acids. The ones which cannot be made in the body are tryptophane, lysine, methionine, phenylalanine, threonine, valine, leucine, and isoleucine.[1] Children usually cannot make enough histidine and arginine to support growth, especially during periods of stress; hence these two acids are at times essential to children. The amino acids which the body can make are glycine, alanine, glutamic acid, proline, hydroxproline, aspartic acid, serine, tyrosine, cystine, hydroxyglutamic acid, norleucine, and di-iodo-tyrosine.

The value of any protein depends on the number and

[1] W. C. Rose, "Amino Acid Requirements of Man," *Federation Proceedings*, VIII (1949), 546.

amount of essential amino acids it contains. Proteins containing the eight essential amino acids in generous amounts are called complete or adequate. If enough of any complete protein, such as milk, is taken alone, it can support health. A protein lacking one or more essential amino acids or supplying too little of an essential amino acid to support health is spoken of as an incomplete or inadequate protein.

Since essential amino acids are supplied in greatest abundance in egg yolk, fresh milk, liver, and kidneys, these foods have the highest protein value. Proteins from muscle meats, used in roasts, steaks, and chops, are complete but contain fewer of some essential amino acids than do glandular meats and are therefore less valuable. On the whole, animal proteins, such as meat, fish, eggs, milk, and cheese, contain more essential amino acids in greater abundance than do vegetable proteins; hence they have superior value. Of the animal proteins egg white and gelatine alone lack essential amino acids.

Proteins from brewers' yeast, certain nuts, soybeans, cottonseed, and the germ of cereals are complete proteins. The proteins of peas, lentils, navy and lima beans, cereals and flour with the germ removed lack some of the essential amino acids; they are therefore incomplete and cannot support life alone. There are many proteins on the borderline between complete and incomplete. For example, the protein from peanuts can support growth and maintenance but not reproduction. Furthermore, the amino acid lysine is harmed when the nuts are roasted or milk is treated with heat during canning or drying, thus changing the protein from a complete to an incomplete form.

If two or more incomplete proteins are eaten at the same meal, one may supply the amino acids lacking in another, and together they may make a valuable contribution to health. For example, most grains lack the amino acids lysine and threonine, whereas beans supply these acids but lack methionine; the proteins of baked beans and brown bread together could supplement each other, and the body could form complete proteins by combining the amino acids of the two. Dr. Cannon [2] has shown, however, that if half the essential amino acids are eaten at a certain time and the other half taken only one hour later, the body does not build protein from them. Formerly it was believed that if cereal and toast were eaten at breakfast, the amino acids from the digested protein would lounge about waiting for the missing amino acids to catch up, perhaps after the next meal. It appears now that the standards of the liver are so high that only complete proteins are held in storage. Since protein food is expensive, it becomes important to obtain all the amino acids at every meal to prevent their being wasted.

A tremendous amount of research is being done with both animals and humans to find the specific symptoms of ill health which occur when certain amino acids are lacking. For example, when the diet of animals or babies lacks tryptophane, methionine, or isoleucine,[3] the liver cannot produce the blood proteins, albumin, and globulin (antibodies), and urine can no longer be collected normally; swelling, known as edema, and susceptibility to infections result. Methionine has been found to be particularly deficient in the diets of children with chronic rheumatic fever [3] and of women suffering from the toxemia of pregnancy.[4] In animals a lack of tryptophane or methionine causes the hair to fall out; a lack of histidine, phenylalanine, or any one of several other amino acids causes the eyes to become bloodshot and/or cataracts to form. An undersupply of arginine causes animals to become sterile and brings about a decrease in the formation

[2] Paul R. Cannon, *Recent Advances in Nutrition* (Lawrence: University of Kansas Press, 1950).

[3] Anthony A. Albanese, "The Effects of Amino Acid Deficiencies in Man," *Journal of Clinical Nutrition*, XLIV (1952), 1.

[4] N. W. Philpot, M. Hendelman, and T. Primrose, "The Use of Methionine in Obstetrics," *American Journal of Obstetrics and Gynecology*, LVII (1949), 125.

and mobility of sperm in men,[6] whereas too little tryptophane causes the animals' testicles to degenerate (atrophy) or females to lose their young. A deficiency of methionine allows fat to be retained in the liver of both animals and humans. Only future research can give an understanding of the role each amino acid plays in building and maintaining the body. It is known, however, that all the amino acids are used together and that taking one or two alone can never build health.

Both the quality (or the number and abundance of amino acids supplied) and the quantity of proteins eaten, determined in grams per day per person, must be considered if health is to be maintained. The greatest hindrance to good health in this respect is ignorance. Many surveys of thousands of persons having enough money to eat as they choose have shown that about 60 per cent get far less protein than is adequate. Since the complete proteins most enjoyed are expensive, persons with low incomes almost invariably suffer from protein deficiency. Yet adequate protein can be obtained even when the budget is extremely limited. It is my opinion that health cannot be built until persons learn the amount of protein they need and the grams supplied by ordinary foods. You should know these quantities so thoroughly that you can estimate in a second your protein intake for the day.

The Food and Nutrition Board of the National Research Council recommends the following amounts of protein, in grams, daily:

Children				Adults	
Under 12 years		*Over 12 years*			
1-3	40	Girls 13-15	80	Men	70
4-6	50	16-20	75	Women	60
7-9	60	Boys 13-15	85	Pregnancy	85
10-12	70	16-20	100	Lactation	100

[6] L. E. Holt, Jr., and A. A. Albanese, "Observations on Amino Acid Deficiencies in Man," *Transactions of the Association of American Physicians*, LVIII (1944), 143.

The National Research Council, however, has attempted to set up standards which they hope will be practical for our entire population, including millions of families whose income cannot buy foods necessary for optimum health. These figures, therefore, are generally considered to be too low. If you wish to maintain your attractiveness, vigor, and youthfulness as long as is humanly possible, it is probably wise to eat considerably more protein than the Board recommends and/or to count only the grams of adequate protein you eat. Whenever the diet has been deficient in protein for some time, an intake of 150 grams or more daily is probably advisable for a month or more. Such large amounts are also needed in the treatment of various disease conditions.

You should thoroughly familiarize yourself with the approximate quantities of protein in ordinary foods listed in the following table.

Sources of proteins	*Amounts*	*Completeness*	*Grams of protein*
soybean flour, low fat	1 cup	com.	60
cottonseed flour	1 cup	com.	60
whole-wheat flour	1 cup	inc.	8 to 12
white flour	1 cup	inc.	6 to 10
wheat germ	½ cup	com.	24
brewers' yeast, powdered	½ cup	com.	50
powdered skim milk	1 cup	inc.	60 to 70
egg	1	com.	6
milk, whole or skim, buttermilk	1 qt.	com.	32 to 35
cottage cheese	½ cup	com.	20
American or Swiss cheese	2 slices	com.	10 to 12
soybeans, cooked	½ cup	com.	20
peanut butter	2 tbsp.	inc.	9
cooked cereals	¾ cup	inc.	10 to 18
prepared cereals	1 cup	inc.	1 to 3
navy or lima beans	1 cup	inc.	6 to 8
macaroni, noodles, rice	¾ cup	inc.	3 to 4
bread or bacon	1 slice	inc.	2

Sources of proteins	*Amounts*	*Complete-ness*	*Grams of protein*
nuts *	½ cup		14 to 22
meat, fish, fowl	¼ lb. or 1 serving	com.	
boned or with little bone or fat †	¼ lb.		18 to 22
with moderate bone and/or fat ‡	¼ lb.		15 to 18
with much bone and/or fat §	¼ lb.		10 to 15

* The protein in certain nuts is complete; in others incomplete.

† Such as liver, tongue, rump roast, round steak, or soup meat; roast leg of lamb; veal chops, cutlets, or stew; boned rabbit or rabbit thigh or breast of chicken or turkey; halibut and other fresh fish; fresh corned beef, canned chicken, tuna, sardines, salmon, or mackerel.

‡ Such as hamburger, rib roasts or steaks, loin steaks or stew meat; lamb chops or shoulder roast; ham or pork chops; one frankfurter; heart or kidney; canned corned beef or shrimps; liver sausage and other luncheon meats; less bony pieces of rabbit, chicken, or other fowl; cod, haddock, lobster, crab, or fresh shrimps.

§ Picnic ham, link sausages, or spareribs; brains or sweetbreads; corned-beef hash; bony parts of chicken or other fowl; herring, clams, oysters, and scallops.

There are, of course, many foods not listed in the foregoing table which supply protein but which, in my opinion, are not worth bothering with. Gelatin, for example, lacks two essential amino acids and is almost entirely lacking in three others; hence its protein value approaches nil. Similarly, many vegetable proteins are so incomplete that it is misleading to emphasize their protein content. Most cereals aside from pure germ are not only deficient in lysine and threonine but often contain almost no protein. For example, rice flakes and puffed wheat supply only one gram of poor-quality protein per cup. Prepared cereals are largely pure starch which is changed into sugar; allowing a child to eat them is like passing him the sugar bowl and saying, "Help yourself." The latter would be less troublesome and expensive.

Until a person knows enough about nutrition to estimate his daily intake by counting protein grams easily and to distinguish between complete and incomplete proteins, he almost invariably believes he consumes a far better diet than he does. Thousands of persons think they get adequate protein from one egg at breakfast and meat for dinner; their actual intake may be 26 grams or less, although their requirement is perhaps many times that amount. Since a quart of milk supplies 32 to 35 grams of protein, one usually finds that the person who drinks a quart daily has a fairly adequate protein intake, whereas the person who avoids milk is almost invariably deficient.

If milk, cheese, or eggs are disliked or unobtainable, getting adequate protein becomes a serious matter indeed. When the complete proteins of wheat germ, soybeans, brewers' yeast, and nuts are eaten, it is possible to obtain sufficient amounts of essential amino acids, provided the diet is planned with utmost care. Some of the world's leading athletes and scholars have been vegetarians. Unless a vegetarian is trained in nutrition, however, he usually becomes an unhealthy vegetarian.

Of all proteins available, the most concentrated and least expensive are brewers' yeast,[6] powdered skim milk, wheat germ, soy flour, and cottonseed flour.[7] The use of these foods makes it possible to obtain protein on an extremely limited budget and can change a diet low in protein to one high in protein with little thought or effort.

To obtain too little protein is a mark of carelessness or ignorance; to obtain too much is foolish and probably impossible; to obtain an adequate amount is to stay young for your years.

[6] See tiger's milk recipe, p. 114.

[7] Hundreds of recipes using these foods are to be found in the writer's *Let's Cook It Right* (Harcourt, Brace and Company, 1947).

CHAPTER 5

DO NOT UNDERESTIMATE THE FAMILIAR

THE THING to remember about nutrition is that each nutrient is equally important. A lack of fat can—and probably does—cause as many abnormalities as a deficiency of any other nutrient. Its principal use is to supply calories, but some 35,000,000 unhappy Americans can testify that obtaining calories is not a problem.

More vitally important is the type of fat used as part of the structure of every body cell. The nerves and brain, to be normal, must be supplied with even larger amounts of certain fats and fat-like substances. The hormones of the adrenal cortex and sex glands are made of particular kinds of fat. Also important to health is fat which must be available to valuable bacteria in the intestinal tract before they can multiply. Any old fat can supply calories; only certain types of fat can serve the foregoing purposes.

When fats are eaten, they are broken down during digestion to glycerin (glycerol) and fatty acids. These acids, each differing from the other, have names, and scientists have pried into their private affairs. Even if no fat is eaten, the body can make most of these acids from sugar. But three of them the body cannot make. One, linoleic acid, is absolutely essential to life itself.[1] Another fatty acid, called arachidonic acid, can pinch-hit for linoleic acid fairly well, and still an-

[1] George O. Burr, "The Role of Fat in the Diet," pp. 62-83 of *Dietotherapy: Clinical Application of Modern Nutrition* (W. B. Saunders Company, 1945).

other, linolenic acid, can pinch-hit to the extent of supporting growth but not health. These three are spoken of as essential fatty acids. The bodies of persons and well-fed animals contain large amounts of linoleic acid. If animals are put on a diet lacking it, this fatty acid cannot be withdrawn from the tissues even when the supply in the blood falls far below normal and the deficiency becomes so severe that it causes death.)One cannot carry sacks of cement from a warehouse after the cement has been used in the structure of the building. It now appears that we must have linoleic acid or one of its pinch hitters to form the sex and adrenal hormones, valuable intestinal bacteria, and the fat-containing portion of every cell's structure.

The principal sources of essential fatty acids are natural vegetable oils. Corn, soybean, and cottonseed oils contain from 35 to 70 per cent essential fatty acids, whereas olive oil furnishes only 4 to 14 per cent.[2] Corn and soybean oils supply approximately 14 times more of these valuable acids than do margarine or hydrogenated cooking fats. Animal fats, such as cream, butter, fish-liver oils, fat meats, and the fat in egg yolk, supply even less. Natural lard is the richest animal source, containing 5 to 11 per cent. Since so many vegetable fats are hydrogenated and animal fats contain little unsaturated fatty acids, the only dependable sources are salad oils and mayonnaise, avocados, nuts, and unhydrogenated nut butters.

Fatty acids are often spoken of as chains; some are long, some short. Just as a charm bracelet may have certain links where the charms can be attached, essential fatty acids have certain links where other substances can easily be added. If oxygen is added, the fat becomes rancid; if hydrogen is added, the fat becomes more solid. It now appears that the body must have these unfilled links of the chains; thus fats

[2] Franklin Bicknell and Frederick Prescott, *The Vitamins in Medicine* (London: William Heinemann Medical Book, Ltd., 1948), 790.

can combine with other nutrients, help to transport them, and, together with them, be used in building cell structure.

When you eat more sugar and/or starch than your body needs immediately, the excess is changed into fat made up only of fatty-acid chains which cannot be added to. These chains make a compact fat, for which we who gain easily can say a hearty, "Thank heavens!" The body, however, as we have seen, cannot produce the fatty acids essential to sustain health. Although sugar can be changed into fat, the fat cannot be changed back into sugar.

According to Dr. George O. Burr, Director of Physiological Chemistry at the University of Minnesota, rats lacking these acids drink water in excessive amounts which is held in the body. The hair of these animals soon becomes extremely dry and thin, and the skin thick, dry, scaly, and scurfy, especially on the face. In females, the ovaries are so damaged that ovulation, reproduction, and lactation are interfered with; males become sterile and refuse to mate. The animals develop eczema. If the deficient diet is given to the young, growth is markedly retarded. The deficiency causes early death, and on autopsy 100 per cent of the animals show damaged kidneys.

The counterpart of these abnormalities in humans has scarcely been studied. Dr. Burr and a co-worker produced eczema in themselves by staying on a diet deficient in essential fatty acids. Numerous physicians have reported eczemas being accidentally produced by low-fat diets; these skin conditions were cured when vegetable oils were given. Persons with eczemas have also been found to have abnormally small amounts of essential fatty acids in their blood.

In my opinion, deficiencies of these acids are more common than is appreciated. For example, babies are rarely given vegetable oils until old enough to eat mayonnaise. I recall a boy of three whom I first saw at eighteen months of age. His father had been an All-American football player and wanted an athletic son more than anything else in the world. Instead, this pathetic child was smaller than most one-year-old children and had been covered with severe eczema since he was three weeks old. The boy was lethargic and seemed dim-witted. A diagnosis of "allergy" had been made, and thousands of dollars had been spent seeking correction. After a few minutes' conversation with the mother, I placed the boy in a high chair and offered him a tablespoon of soybean oil. At the first taste, the child became alive as if electrified. He leaned across the tray, mouth wide open, and even a moment's delay caused him to scream for more. He must have had six or eight tablespoons of oil before his mother, fearing he would be ill, made me stop. I suggested that she give him several tablespoons every hour if he wanted it and seemed to tolerate it well. Within three days, the eczema was almost gone, and in a week his skin was beautiful. After that the child bloomed. His bone development became particularly excellent; he grew muscular and has now achieved normal size and weight. If there is one man in this world willing to die for me, it is probably this boy's father. I strongly suspect that such eczemas, appearing so soon after birth, are caused by mothers avoiding fats during pregnancy, being unaware of their need for linoleic acid.

(Linoleic acid has been shown to help prevent or cure eczemas resulting from a lack of any one of several B vitamins, possibly because this fatty acid stimulates the growth of intestinal bacteria which can produce these vitamins.) Even the stubborn eczema-like condition known as psoriasis usually disappears rapidly when salad oils and lecithin (p. 41) are added to the diet.

From cases I have seen, I believe that deficiencies of essential fatty acids are widespread; I have interviewed many persons who, though adhering to fat-free diets which otherwise appear to be fair, show abnormalities produced in animals lacking linoleic acid. For years I have been puzzled by overweight persons whose ankles, legs, and even thighs remained swollen with edema; yet their intake of adequate protein was high; when two tablespoons of salad oil were added to their daily diet, they lost pounds. Persons on seemingly adequate diets except for oil have reported increased sex interest after dietary improvement; menstrual difficulties have disappeared, and longed-for (as well as unlonged-for) conception has taken place. Only recently a Powers model who had wanted a baby for years conceived soon after oil was added to her diet, an item she had carefully avoided because her work depended on her figure. Time and again I have seen dry, lifeless hair take on a glossy luster and rough, parched, and scaly skin become soft and lovely; the only important addition to the diet was salad oil. If you pet lovers want beautiful animals, do not fail to give salad oil to your dogs, cats, and other pets.

For three reasons, eating too little fat is probably a major cause of overweight. First, many seemingly fat persons are only waterlogged; an adequate diet including salad dressing daily often causes them to lose pounds. Second, it has been proved by what is known as the respiratory quotient that when the essential fatty acids are insufficiently supplied, the body changes sugar to fat much more rapidly than is normal; Dr. Bloor points out that it would seem as if the body were speedily trying to produce the missing nutrients. This quick change makes the blood sugar plunge downward, causing you to be as starved as a wolf; the chances are that you overeat and gain weight. Third, fats are more satisfying than are any other foods. If you forego eating 100 calories of fat per meal, you usually become so hungry that you eat 500 calories of starch and/or sugar simply because you cannot resist them; unwanted pounds creep on.

A certain amount of fat is necessary to stimulate the production of bile and the fat-digesting enzyme, lipase. Only when fat enters the intestine does the gall bladder empty itself vigorously. Without fats, too little bile is formed, and the gall bladder holds its reserve bile. This faulty emptying may be a factor contributing to the formation of gall stones. If a fat-free diet is continued long, the gall bladder eventually shrivels, or atrophies. Yet vitamins A, D, E, and K, as they occur naturally, cannot be absorbed from the intestines into the blood without the presence of fat and bile. Deficiencies of these vitamins can be produced either by fat-free diets or by bile failing to reach the intestine.

Fatty acids cannot pass into the blood without first combining with bile salts. After they enter the intestinal wall, they recombine with glycerin to form neutral fats which are carried as tiny droplets in the blood and lymph. Each of the billions of body cells withdraws essential fatty acids for structural replacement and fat to be used for immediate energy. Some fat is held in the liver to be returned to the blood later as a source of energy. The remainder is stored, usually where you want it least.

A small amount of stored fat is advantageous. Fat around the kidneys supports them. A thin layer of fat under the skin protects the muscles and nerves and helps to maintain body temperature. A reserve of fat becomes a valuable source of energy during illnesses or at any time when insufficient food is eaten. Fat stored in excess is, of course, undesirable.

Mineral oil is sometimes used for frying or making salad dressing or is taken as a laxative. Since this oil cannot be digested, it is not a food. Studies have shown, however, that approximately 60 per cent of the mineral oil reaching the intestine passes into the blood. As this oil circulates through the body, vitamins A, D, E, and K are absorbed into this mineral oil, are held captive, and are later excreted in the feces; thus deficiencies of these vitamins are produced. Although the harm done by mineral oil has been known for over 20 years and medical journals have repeatedly warned physicians not to recommend it, many persons still use it as laxative. I personally would be afraid to use this oil even in baby oils, cold creams, and other cosmetics.

Vegetable oils furnish vitamins E and K in addition to linoleic acid. Such animal fats as butter, cream, and egg yolk are carriers of vitamin A, and fish-liver oils supply both A and D. Animal fats also contain a cousin of the fat family known as cholesterol, which can be produced by the liver. Studies have shown that approximately 800 milligrams of cholesterol are obtained daily from a high-fat diet, whereas a normal adult liver produces 3,000 milligrams or more per day. Cholesterol forms the raw material from which vitamin D, the sex and adrenal hormones, and bile salts are made. The fact that cholesterol is concentrated in such vital tissues as the brain and nerves indicates that it serves valuable unknown functions in maintaining health.

Another cousin of the fat family, lecithin, is supplied by all natural oils and by the fat of egg yolk, liver, and brains. Lecithin is an excellent source of the two B vitamins, cholin and inositol; if health is to be maintained, the more fat eaten, the larger must be the intake of these two vitamins. This substance can be made in the intestinal wall provided cholin, inositol and essential fatty acids are supplied. Lecithin appears to be a homogenizing agent capable of breaking fat and probably cholesterol into tiny particles which can pass readily into the tissues. There is evidence that the major causes of death, coronary occlusion and coronary thrombosis (p. 80), are associated with deficiencies of linoleic acids and the two B vitamins, cholin and inositol, and perhaps with a lack of lecithin itself. Huge particles of cholesterol get stuck in the walls of the arteries; they might be homogenized into tiny particles if sufficient nutrients were available for the normal production of lecithin. When oils are refined or hydrogenated, lecithin is discarded.

All natural fats contain substances known as antioxidants which prevent rancidity. When allowed to remain in the food, these antioxidants prevent the destruction of carotene and vitamins A, D, E, and K and several B vitamins not only in the food itself but also in the intestinal tract. Without antioxidants, serious losses of these vitamins occur before they can reach the blood (ref. 1, p. 35). Unfortunately the antioxidants are lost when fats are refined or hydrogenated.

The eating of rancid fats can induce serious vitamin deficiencies. Vitamin E is quickly destroyed by rancidity whether in food, in the intestine, or in the blood itself. Vitamins A and K and several B vitamins can likewise be destroyed at any of these points. Your first reaction may be that you would never eat rancid fat, but if you watch for it, you may be amazed at how often slightly rancid foods are served. All of us have probably been guilty of serving slightly rancid ham, sausage, bacon, mayonnaise, or butter. The reason children so frequently dislike wheat germ is that mothers unknowingly serve it after it has become rancid. A common source of rancidity results from keeping a can of bacon drippings near the range, often week after week, and using it for sautéing. Packaged piecrust and cake mixes, potato chips, corn chips, popcorn, salted nuts, ground nuts, and similar foods, held too long in markets, are frequently rancid. The nut and popcorn dispensers in public places, kept heated to give the illusion of freshness, are potentially so dangerous that they should be removed from the market.

When fats are hydrogenated, the hydrogen is added to the unfilled chains of the essential fatty acids; thus their health-building value is destroyed. Such fats can supply calories but nothing more. Unfortunately food manufacturers have become hydrogenation-happy. Each year the list grows longer: margarine, hydrogenated cooking fats, processed cheeses, and now peanut butter, formerly such an excellent food for children, and even lard. If lucky, however, you can still find an occasional market where peanuts are put into a grinder, and untinkered-with peanut butter comes out before your eyes. Old-fashioned cheeses and some natural lard are still available. French dressing, mayonnaise, and salad oil appear to be the only good sources of essential fatty acids left. Oils untreated by heat and still containing most of their antioxidants can usually be purchased at health-food stores only.

Since butter contains little essential fatty acids and vitamin A is added to margarine, the two may be equally valuable in most respects. Summer butter, however, if made of unpasteurized cream, contains a vitamin known as the Wulzen factor which prevents an arthritis-like disease in animals.

Aside from obvious sources of fat, there are many more or less hidden fats: cheese, egg yolk, bacon, avocados, nuts, peanut butter and "lean" meats, fish and fowl. No one knows the amount of fat needed by any individual; it varies with activities, size, climate, and many other factors. The person who enjoys salad dressings and whose weight is normal is likely to obtain all he needs. Persons who intentionally restrict their fat intake probably get too little of the essential fatty acids to sustain health. Other persons who dislike salads but may eat large amounts of fat in the form of tender steaks or pastries made of hydrogenated oils may be equally deficient in linoleic acid. High-fat diets, such as those often recommended for gaining or for treatment of ulcers or diabetes, increase the need for inositol and cholin; unless these B vitamins are generously supplied, such diets may be extremely dangerous (p. 81).

A few general rules might be followed: If you want to maintain your weight or reduce, eat at least two tablespoons of vegetable fat daily. If you should want only calories, any old fat will do; if you want health, use only natural fats and keep them refrigerated at all times. If a fat is treated so that it cannot become rancid, do not buy it; if it does become rancid, throw it away.

CHAPTER 6

CAN WE PREVENT BEING DELUGED?

I WAS recently taken to a famous restaurant in a city famous for its restaurants. The meal consisted of salad, steak, potatoes, lima beans, hot biscuits, honey, coffee, and a choice of French pastries. The salad was small. The steak would have been flattered by an estimated 15 grams of protein; it was perched on toast to give a misleading elevation. A deluge of sugar was supplied by the starch from potatoes, toast, lima beans, biscuits, pastry, and the sugar itself of the honey and dessert; one might have added more to coffee. Our group planned to work during the evening; yet no one could be on the beam after such a meal. Three of us trained in nutrition ate the steak and salad, nibbled at the other food, and ordered a glass of milk each.

Our American diet has become largely one of sugar. To me it seems that the survival of every person unaware of nutrition is at stake: caught in this tide, the innocent victim is flooded by waves of sugar every time he entertains or is entertained, every time he eats at a restaurant, and often at every home meal and mid-meal. Sugar is an essential nutrient just as is water, but an ocean is too much. This situation is not usually realized because many sugars are hidden. Persons may consume one or even two cups of sugar daily and still believe they have eaten "no sugar at all."

Besides the obvious sugar added to such foods as cereals, coffee, and fruits or consumed in candy, jam, or jellies, as much as one or two tablespoons or more of granulated sugar is obtained in each small glass of fruit ades, ginger ale, cola drinks, cider, Manhattans, and highballs; every serving of cake, pie, gelatin dessert, ice cream, pudding, custard, or canned fruit with juice; or even a single cookie.

Almost every food we eat supplies natural sugar or potential sugar in one form or another. For example, all fruits contain fructose, or fruit sugar; sucrose, or ordinary table sugar; and glucose, the type of sugar in blood. Honey and the solid part of grapes are almost entirely fructose and glucose. These sugars are also found in sweet potatoes, fresh corn, beets, onions, and other vegetables. Dates contain 78 per cent sugar, and raisins 64 per cent, whereas a chocolate bar may be only 54 per cent; the sugar in dried fruits adheres to the teeth more than the sugar in candy and therefore may cause them to decay more quickly.

Glucose and fructose both pass into the blood unchanged and can even be absorbed through the stomach wall. The sugar from orange juice, for example, when taken at breakfast, reaches the blood within three or four minutes after it is swallowed. There are two other sugars, galactose and mannose, which pass into the blood unchanged but which must be converted into glycogen before they can be used for energy.

The most valuable sugar is lactose, which occurs only in milk. It digests less readily than other sugars and apparently sometimes not at all; for this reason lactose is not fattening. If absorbed, it is first broken down into glucose and galactose. Babies fed breast milk are rarely fat, whereas infants given formulas containing an equal amount of other sugar often become flabby butterballs. Powdered skim milk is 56 per cent lactose; powdered whey, about 95 per cent. Lactose serves as food for valuable intestinal bacteria, which change it into lactic acid. Too much milk sugar, however, can be harmful to persons who eat no fat (p. 99).

Ordinary table sugar, sucrose, occurs naturally in many fruits and vegetables, such as apples, pineapples, carrots, and peas. The sugar in maple and cane syrups and molasses is largely sucrose. Commercial sugar has at times been prepared from apples, grapes, ordinary beets, and a number of other foods. The overcooked substance amusingly known as "raw sugar" is sucrose together with a few molecules of iron and other minerals. It has all the disadvantages of refined sugar in that it can cause tooth decay, overstimulate insulin flow, and ruin appetites. Perhaps it builds mental health by instilling a sense of virtue in its users, but I personally prefer the first-to-thine-own-self-be-true philosophy.

During digestion, table sugar is changed into glucose and fructose. A similar sugar, maltose, is obtained from malt. During the digestion of starch, maltose is formed momentarily in the intestine and broken down still further to glucose.

Starch is our major source of hidden sugar. Ample starch to meet our needs could be obtained from fresh fruits and vegetables such as bananas, apples, corn, peas, lima beans, yams, potatoes, and squashes. Instead we are deluged at almost every meal by sugar coming from cheap, starchy foods: refined cereals, breads, and every variety of breadstuffs; macaroni, noodles, or spaghetti; dried beans, lentils, peas, rice, or tapioca; and cake, pies, cookies, and other varieties of pastry. If you doubt that such starches can deluge you, try eating at a school cafeteria for a few weeks and see how vigorous you feel. In case you wish to curtail your sugar intake, visualize all refined starchy foods as servings of sugar.

There are still other sources of sugar. Since animals store sugar as the starch, glycogen, we obtain sugar in this form from liver and other meats, fish, scallops, and abalone. Like any starch, glycogen is changed into glucose during digestion. All fats are approximately 10 per cent glycerin, which can be converted into sugar in the body. Citric acid from orange juice, lactic acid from buttermilk, and malic acid from apples can be changed into glycogen in the body and later used as sugar.

Sugar is a body requirement equal in importance to any vitamin. It has, however, only one purpose: to be used to produce energy when a supply of energy is demanded. Otherwise it may be stored as fat for the duration of your life. It cannot build body tissue or improve general health and attractiveness.

CHAPTER 7

WHICH APRICOT? GROWN WHERE?

ONE COULD define vitamins as chemicals essential for the normal function of cells. Usually they cannot be made by the body. Vitamin A is a colorless substance found only in animal foods. It is formed in the animal or human body from a yellow pigment, carotene, found in carrots, apricots, yams, all green vegetables, green pasture crops, and seaweeds, the quantity roughly paralleling the intensity of the color. We get vitamin A itself from such animal foods as liver and fish-liver oils; egg yolks, butter, and cream supply both carotene and vitamin A.

Mild deficiencies of vitamin A are so common that you have probably experienced them. A slight deficiency impairs vision. A substance containing vitamin A, visual purple, is formed in the eyes; any light reaching the eyes breaks down part of the visual purple, and the products of this purposeful breakdown set up nerve impulses which tell the brain what the eyes see. More visual purple is formed and again destroyed. This cycle of regeneration and breakdown continues through life. Vitamin A is therefore somewhat like the film in a camera in that it photographs what you see but the "film" is used up.

Both day vision and night vision require vitamin A, but night vision depends on the vitamin-A mechanism entirely; therefore a subtle vitamin-A deficiency first causes difficulty in seeing in the dark. You can test your vitamin-A adequacy any time you drive at night. The lights of on-coming cars destroy vitamin A in your eyes; if your ocular fluid contains ample vitamin, you can see again almost immediately; if you are deficient, you will be blinded, the length of time depending on the severity of your deficiency. Tests have shown that persons having auto accidents at night are pathologically deficient in this vitamin. When better lighting of highways results in fewer accidents, it is because day vision rather than night vision is used and vitamin A is less relied upon.

There are varying degrees of night blindness. The person with a mild deficiency believes his vision to be normal but sees more efficiently in daylight. With a slightly greater deficiency, he experiences eye fatigue after watching television, for example, but he usually assumes that others have similar difficulty. If his need for vitamin A is still greater, he may suffer pain in his eyes, especially after long use, and experience nervousness, headaches, and visual fatigue. A severe deficiency can cause such discomfort and eyestrain that he may refuse to drive at night.

Such a person is sensitive to bright light during the day and feels more comfortable wearing dark glasses; thus less light reaches his eyes and less vitamin is destroyed. The majority of people who wear dark glasses eat too little vitamin A to allow normal vision (see p. 95). I recently interviewed a woman whose eyes were so sensitive to light that she wore dark glasses even in the house; a month after dietary improvement she experienced no discomfort in intense sunlight.

People who work in bright light, which destroys vitamin A quickly, or dim light, which requires night vision entirely, use relatively more vitamin A than do persons working in moderate light. Typists and bookkeepers who face the glare of light on white paper frequently suffer from eyestrain preventable by diets richer in vitamin A; persons who sew, read, or watch television a great deal, miners working in dim light, welders facing flashing fire, photographers working both with bright lights and in darkrooms, and people living on the desert or beach where the sunlight is reflected by white sand often have visual difficulties because their need for vitamin A is unusually great. Perhaps no glare is so destructive to the vitamin A in the eyes as sunlight on clean snow; trappers, hunters, and skiers are often too familiar with this vitamin deficiency.

When the lack becomes severe, burning, itching, and inflamed eyelids, eyestrain, perhaps severe pain in the eyeballs themselves or frequently occurring sties are experienced in addition to nervousness and exhaustion. Mucus may accumulate in the corners of the eyes; ulcers or sores sometimes appear on the covering of the eye, or cornea. Severe deficiencies of this vitamin have been thought to occur only in such countries as India or China, but a survey of low-income families in New York City [1] revealed corneal ulcers in almost half of the cases studied.

Although eye symptoms may be the first to be noticed in a mild vitamin-A deficiency, even earlier changes take place in the skin. Cells in the lower layers of skin die and slough off. They plug the oil sacs and pores, thus preventing oil from reaching the surface; the skin may become so dry and rough that the entire body sometimes itches. The pores plugged with dead cells cause the skin to have the appearance of "goose pimples" although they are unaffected by temperature changes. This roughness usually occurs first on the elbows, knees, buttocks, and back of the upper arm. Pores enlarged by an accumulation of dead cells and oil are spoken of as whiteheads or blackheads. If these cells become infected, pimples may result. The skin is likewise susceptible to such infections as impetigo, boils, and carbuncles. These abnormalities can usually be corrected by increased amounts of vitamin A, provided the diet is adequate in other respects.

[1] H. D. Kruse, "The Ocular Manifestations of Avitaminosis A." *Public Health Reports,* LVI (1941), 1301.

Through the years I have been consulted by dozens of girls whose faces are covered with pimples; often they tell me they have never had skin trouble until recently. Invariably I find they are doing office work, usually under fluorescent lights, and the continuous use of their eyes, together with the glare and reflection from white paper, has greatly increased their need for vitamin A. I can often tell them how long they have been in their jobs—approximately four months previous to the onset of the pimples.

When vitamin A is undersupplied, the hair becomes dry and lacks sheen and luster. Dandruff usually accumulates on the scalp. The nails may be affected and peel easily or become ridged.

Simultaneously with the visual difficulties and the changes in the skin, a vitamin-A deficiency allows abnormalities to occur in the tissues spoken of as mucous membranes. These tissues line the body cavities such as the throat, nose, sinuses, middle ears, lungs, the gall bladder, and the urinary bladder. If the diet is adequate in vitamin A, these membranes continuously secrete a liquid, or mucus, which covers the cells and prevents bacteria from reaching them and also cleanses the surface. Furthermore, bacteria cannot live in mucus Worn tissues are digested by enzymes, and the wastes are removed; therefore healthy tissues contain no accumulation of dead cells. Because of substances known as antienzymes which counteract the effect of the enzymes produced by bacteria, live cells can protect themselves from bacterial destruction. Millions of bacteria find their way to these healthy tissues but cannot reach the cells because of the mucus covering or are made ineffective by the mucus; they are offered no food and/or are rendered harmless by the antienzymes. Since they cannot get a foothold, no infection occurs.

Individuals deficient in vitamin A allow conditions ideal for bacterial growth to be set up in their bodies; bacteria can grow only when they are provided with warmth, moisture, and food. Dr. Wolbach of the Harvard School of Medicine points out that during vitamin-A deficiency the cells of the mucous membranes grow more rapidly than usual but quickly die. These cells are crowded forward by other rapidly growing cells which likewise die until there accumulates a cheesy-like surface of layer upon layer of packed, dead cells. Since dead cells cannot secrete mucus or produce anti-enzymes, their surface is no longer washed and their self-protective mechanisms are gone. Heat, moisture, and a continually replenished food supply combine to set up conditions ideal for bacterial growth; bacteria themselves are ever present. Infections are usually the result.

Changes in the mucous membranes occur early in the bronchial tubes and lungs, where air sacs may be completely plugged with dead cells, and in the middle ears, sinuses, kidneys, urinary bladder, and prostate gland. What has been described as an "accumulation of profuse debris" may cause irritation or obstruct narrow ducts, such as those from the salivary gland or the pancreas; the mouth may become dry; the pancreatic juices may fail to reach the intestine. Dead cells from the uterus and vagina may slough off, causing leucorrhea, often accompanied by profuse menstruation. Cysts may be formed around the accumulated dead cells in almost any part of the body.

Studies have been made of the mucous membranes of animals fed different amounts of vitamin A. It was found that harmful bacteria were always present. The animals deficient in this vitamin had millions of bacteria feeding off their dead cells, however, and 98 per cent showed infections; those fed adequate vitamin A harbored few bacteria and showed no infections. Microscopic studies of the mucous membranes of hundreds of humans dying from accidental death or infection show similar correlations; there is freedom from an accumulation of dead cells and from infections; or the number of dead cells parallels the severity of the infections. Furthermore, the liver tissue of adults meeting accidental death has been found to average 20 times more vitamin A than that of persons dying from infections or infectious diseases.

The absorption of adequate vitamin A will correct deficiency symptoms, the length of time depending on the amount of vitamin given, the severity of the deficiency, and the tissues affected. Studies have shown that improvement in mild eye symptoms has occurred in as little as one hour after 50,000 to 100,000 units of vitamin A have been given. On the other hand, when the deficiency is severe and the vitamin dosage small, normal night vision may not be recovered for weeks or even months. In correcting mild visual abnormalities, the vitamin need merely be absorbed into the blood and carried to the ocular fluid. Recovery from corneal ulcers or changes which have occurred in the skin and mucous membrane, however, means that new tissue must be grown to replace the unhealthy tissue produced during the deficiency. It has been reported that the dryness of skin has disappeared and the lubricating oils have returned in as short a time as two weeks after dietary improvement; it has been my experience, however, that a longer interval is needed for recovery.

Some years ago a physician referred to me a woman whose face was covered with hundreds of large warts. A number of reports had pointed out that warts often disappeared when the diet was made adequate in vitamin A. I therefore planned a nutrition program for her, making it as adequate in all nutrients as I possibly could, and suggested that she take 100,000 units of vitamin A daily. When her skin showed no change after four months, we both became discouraged. A week later she came to see me, greatly excited. Not a wart remained, nor has one returned since then. This case convinced me that it takes approximately four months for unhealthy tissue to be replaced by healthy tissue, although probably wide individual variations should be expected.

Aside from helping to maintain normal vision and resistance to infections, adequate vitamin A is essential to the development of bones and the tooth enamel, good appetite, normal digestion, reproduction, lactation, and the formation of both red and white blood corpuscles. It appears to delay the onset of senility and to promote longevity. Vitamin A also has a profound influence upon development before birth.[2]

The National Research Council has recommended that an adult have 5,000 units of vitamin A daily to maintain health. A table of food analysis would show that the richest sources of carotene, averaging about 12,000 units per serving (100 grams), are green leaves such as chard, kale, spinach, and other greens. Even one serving of string beans, broccoli, carrots, yellow squash, apricots, sweet potatoes, or yams would supply 5,000 units, all one supposedly needs for a day. A serving of tomatoes, peas, unbleached celery, lettuce, and asparagus averages nearly 2,000 units. Except for apricots, most yellow fruits offer little more than 400 units per serving. Vegetables which have lost their color or have never been green lack this vitamin.

Such a table would show that liver may be extremely rich in vitamin A and that kidneys and sweetbreads contain appreciable amounts. Since this vitamin is not stored in muscles, such meats as roasts, chops, and steaks lack vitamin A. Eggs and butterfat contain it, the amount depending upon the animals' food. Whole milk varies from 500 to 7,000 units per quart but usually averages 2,000 units. Most of the vitamin A may be destroyed by oxygen when milk is homogenized, although this problem appears not to have been studied. Winter butter, produced when the cows are given dry feed, may contain only 2,000 units per pound, whereas summer butter averages 12,000 units. Butter substitutes usually have 12,000 units of the vitamin added per pound.

[2] *Let's Have Healthy Children, op. cit.*

Fish-liver oils are the richest commercial sources of vitamin A. The vitamin content of livers, however, depends on the animals' food and age. Aside from polar-bear liver, the richest source ever determined was the liver oil of a python estimated to be 100 years old when killed in a London zoo. Halibut-liver oil is richer in vitamin A than is cod-liver oil because halibut is elderly when marketed, whereas cod is a mere adolescent; the halibut has had more years to eat green sea algae. For the same reason beef and mutton liver usually contains more vitamin A than do calf and lamb liver.

Scientists as well as laymen have been led to the conclusion, from studying tables of food analysis, that we easily obtain all the vitamin A we need from foods. Surveys in which thousands of persons have kept records of foods eaten for a month or more, however, show that three-fourths of our population obtain only about 2,000 units of vitamin A daily. In these surveys the assumption has been that all the vitamin A obtained from food is absorbed into the blood.

Unfortunately, there is many a slip between the lip and body cells. Vegetables analyzed in a laboratory perhaps grew on excellent soil and received the optimum amount of rain and sunshine; possibly they contained a hundred times more vitamin A than those grown under less ideal conditions. Carrots, for example, have been analyzed which contain no carotene whatsoever. Losses of the vitamin occur during shipping, storage, freezing, canning, and cooking. Milk from cows feeding on a luxuriant growth of alfalfa has been found to lack vitamin A; the alfalfa, when analyzed, was found to contain no vitamin E, necessary to prevent the destruction of vitamin A in the body. The liver you perhaps ate, believing that you were obtaining vitamin A, may have come from an animal whose only food for months was dried hay.

Even if vegetables are rich in carotene, there is no insurance that it will be absorbed. The carotene in vegetable foods is held inside cell walls made of cellulose, a substance which cannot be digested by humans. Carotene cannot dissolve in water; therefore it cannot pass through these walls. Only when the cell walls have been broken by cutting, chopping, cooking, or chewing is it freed to pass into the blood. Approximately 1 per cent of the carotene from raw carrots has been found to be absorbed,[3] whereas cooking increases the absorption from 5 to 19 per cent.[4] Studies show that the absorption of carotene from most vegetables averages from 16 to 35 per cent; the softer the texture, the larger the amount of carotene which reaches the blood. Presumably all the carotene is absorbed when vegetables are liquefied or juiced, but if the juice is not drunk immediately, much of the vitamin is destroyed by oxygen.

In the small intestine, both vitamin A and carotene must combine with bile salts before they can pass into the blood. If the diet is low in fat, little or no bile reaches the intestine, and 90 per cent of both carotene and vitamin A may be lost in the feces. Not all the carotene which reaches the blood is changed into vitamin A. Unless the vitamin-E intake (p. 160) is adequate, any vitamin A reaching the blood is destroyed, and any already stored is quickly used up. Vitamin A cannot be stored if the B vitamin, cholin, is undersupplied. When one considers all of these points, one wonders how people have obtained enough vitamin A to stay alive.

If you plan carefully, however, you can probably buy 50 times more vitamin A with the same amount of money this week than you did last; some of it will certainly be absorbed, and there may even be an excess for storage. Select your fruits and vegetables for their yellow or green color. Serve liver, kidneys, cheese dishes, or an egg soufflé more often than roasts, chops, and steaks. Use storage butter and eggs

[3] H. C. H. Graves, "The Vitamin A Value of Carotene in Vegetables," *Chemistry and Industry*, LXI (1942), 8.

[4] M. Kreula and A. I. Vitranen, "Absorption of Carotene from Carrots in Humans," *Nutrition Abstracts and Reviews*, X (1940-41), 394.

rather than winter products. Grow carotene-rich vegetables in your garden and freeze them for winter.

Since carotene and vitamin A dissolve in fat, and since fat can be stored in the body, this vitamin is stored, provided an excess is absorbed and not destroyed. The vitamin is stored largely in the liver; the amount can be doubled if the intake of vitamin E is adequate. This stored vitamin A can be called upon to meet your needs whenever your diet is inadequate. Experimental animals, given an excess of the vitamin A, store a hundred times more than is necessary to produce all appearances of good health. Analysis of human livers indicates that the same is true of people. Animal experiments show that a generous storage of vitamin A is advantageous during both health and disease.

Toxicity to massive doses of this vitamin has been reported when halibut-liver oil has been taken by tablespoon rather than by drops. The toxic amount appears to be approximately 10,000 times the daily need. Physicians have frequently recommended curative doses of 200,000 units daily for months, and children have been given 300,000 units daily [5] over long periods without apparent harm. Even when toxic doses are taken, the damage can be prevented or corrected by an increased vitamin-C intake (ref. 2, p. 36). The only food known to contain a toxic amount of this vitamin is polar-bear liver. (If you are served polar-bear liver, watch yourself.)

There is little if any evidence that vitamin-A deficiencies can be more quickly overcome by taking amounts larger than 100,000 units daily; much research indicates that no more than 50,000 units per day can be well utilized. The addition of vitamin E in amounts of 100 units (not milligrams) daily has been found to double the curative effect of vitamin A.

[5] E. Lehman and H. G. Rapaport, "Cutaneous Manifestations of Vitamin A Deficiency in Children," *Journal of the American Medical Association*, CXIV (1940), 386.

Doses of vitamin A are also more effective if taken in small amounts twice or three times daily rather than at one time. The Council on Pharmacy and Chemistry of the American Medical Association [6] has approved the following therapeutic doses: 25,000 units three times daily for prolonged or chronic deficiency; 25,000 units twice daily for two months for general treatment. They have not approved any single dose larger than 25,000 units.

The amount of vitamin A needed by healthy persons varies widely with each individual. Adults require more vitamin A than do children because the vitamin is needed in proportion to body weight; men usually require more than do women. Aged persons often utilize their food less well and therefore appear to need more of most vitamins than do younger adults. The requirements also vary with intensity of light, use of eyes, season, source, amount absorbed, and intake of vitamin E. One individual may thus require two or three times more than another of the same weight and degree of health. Moreover, when the vitamin is supplied by carotene, twice as much is needed as when it is supplied by vitamin A itself. Obviously no exact rules can be laid down. Since an excess can be stored to great advantage and only massive doses are toxic, it seems wiser to err by obtaining slightly too much rather than too little.

Dr. Henry C. Sherman, when at Columbia University, carried on experiments to determine the amount of vitamin A used advantageously by animals. A certain quantity of the vitamin allowed the animals all the appearances of good health. When that quantity was doubled, tripled, and quadrupled, signs of greater health, greater resistance, and greater vigor were evident, and with each increase the life span was lengthened. Beyond that point, increases brought

[6] Council on Foods and Nutrition, "Vitamin Deficiencies, Stigmas, Symptoms and Therapy," *Journal of the American Medical Association*, CXXXI (1946), 666.

no further improvements. Based on these experiments, Dr. Sherman recommends 20,000 units of vitamin A daily for adults, or four times the amount which usually gives the appearance of good health.

Considering that the vitamin-A content of foods varies widely and that the absorption is undependable, I see no way by which one can be reasonably sure his vitamin-A intake is adequate without taking a supplement. I believe that recurring symptoms of vitamin-A deficiency can be expected in the majority of persons who fail to take this precaution. Any fish-liver-oil concentrate should be taken immediately after the meal containing the largest amount of fat. Capsules of vitamin-A acetate are now available which can be absorbed without the presence of fat; these may be superior to other forms. The amount of vitamin E needed to prevent the destruction of vitamin A is not known; I have recommended 50 units of vitamin E as mixed tocopherols for each 25,000 units of vitamin A. I usually recommend capsules of fish-liver-oil supplying 25,000 units each; they are economical and can be taken daily, every other day or even every fifth day, depending on the amount of vitamin needed. You alone must make the choice, depending upon how high your ideals for health are.

In many books on nutrition including my own, there are tables of food analysis, giving quantities of nutrients in standard servings. Years ago I read a criticism of such tables; the writer held that they should not be published because foods grown on different soils and under different conditions, harvested, handled, and processed by different methods contained different amounts of nutrients. At the time I disagreed violently with the writer; now I agree as violently with him. When I read the statement that apricots or other foods are rich in such nutrients as vitamin A, iron and copper, my only reaction is: Which apricot? Grown where?

CHAPTER 8

THE PAUPERS WERE BETTER OFF

THE 15 or more B vitamins are so meagerly supplied in our American diet that almost every person lacks them. Dr. Norman Jolliffe has pointed out that a few generations ago even the paupers received a diet rich in these vitamins. They were better off than the wealthiest are today.

The reasons for this drastic decrease are numerous. Formerly every bite of bread, cereal, and foods prepared from grain supplied B vitamins. Since there was no refrigeration or canning and there were few fruits and vegetables, the mainstay of the diet was breadstuffs. In 1862 machinery was invented which refined grains in such a way that most of the nutrients were discarded. Molasses, rich in certain B vitamins, was once the only sweetening. No refined foods and few sweets of any kind were available. Now the consumption of sugar has increased tremendously; all the original nutrients are discarded; it quickly destroys the appetite and greatly augments the need for certain B vitamins. Whereas no nutrients were formerly discarded, two-thirds of our calories are now supplied by foods from which the original nutrients are largely or wholly discarded. Furthermore, we lead such sedentary lives that our food intake is small compared with that of our grandparents. Seventy years ago, men consumed approximately 6,000 to 6,500 calories daily; women 4,000 to 4,500. Today the average is 2,400 to 2,800 for men and 1,800 to 2,200 for women.

The advantage of using whole-grain breads and cereals was shown during World War I when shortages caused the Danish government to forbid the milling of grains; nutrition in Denmark was so improved that during the war years the death rate fell 34 per cent. The incidence of cancer, diabetes, high blood pressure, and heart and kidney diseases dropped markedly, and evidences of positive health greatly increased. Much the same improvement occurred in England during and after World War II when grains were only slightly milled. Although the English diet was deficient in many respects, surveys showed that the national health did not suffer during this period.

Now that our breadstuffs are refined, no food rich in the B vitamins is ordinarily eaten daily. In fact, there are only four good sources of these vitamins: liver, brewers' yeast, wheat germ, and rice polish. A few foods are high in one or two B vitamins, but to obtain our daily requirement of all of them from such foods is impossible.

A source of B vitamins perhaps more important than any other is that synthesized by valuable bacteria in the intestine; the amount from this source cannot be easily measured. Studies of B vitamins found in the blood and urine of persons on diets lacking these vitamins show that intestinal bacteria can produce large amounts of certain B vitamins, which disappear from the blood and urine if the bacteria are destroyed. For reasons not understood, other persons on a B-vitamin-deficient diet have been found to have little or none of these vitamins in their blood and urine.

It appears that these bacteria grow best on milk sugar and cannot grow unless fat is supplied them; milk-free and/or fat-free diets, therefore, may be dangerous. The taking of sulfonamides and antibiotics, such as streptomycin and aureomycin, completely destroys these valuable bacteria; symptoms of multiple B-vitamin deficiencies may quickly appear unless food which promotes the growth of desirable intestinal bacteria, such as yogurt, is eaten. This food, sometimes spoken of in America as a fad, has been eaten for centuries in countries from Turkey to Lapland, Iceland to China. A study made by Dr. Seneca[1] of the College of Physicians and Surgeons of Columbia University points out that when yogurt is eaten over a long period, no other bacteria except those from yogurt are found in the stools.

The B vitamins appear to be needed equally by every cell in the body. For example, if a well-fed animal is killed and its tissues are analyzed separately, these vitamins are found to be evenly distributed throughout the tissues. Conversely when animals are kept on a deficient diet, then killed, and separate tissues are analyzed, each tissue is uniformly deficient. Most of the other vitamins are needed more by certain tissues than by others. Dr. Roger J. Williams (ref. 1, p. 35) has pointed out that because these vitamins are needed equally by all cells, a deficiency can produce severe damage before the condition can be noticed. The damage is nevertheless real. Instead of one organ showing abnormalities, as do the eyes during a vitamin-A deficiency, the entire body degenerates into a one-hoss-shay collapse. This overall abnormality is difficult to recognize in an adult, but severely stunted growth makes it markedly noticeable in the young.

Dr. Williams also points out that only when the deficiency becomes quite severe does one group of cells show greater damage than another. For example, when a person feels below par, he automatically decreases his activity and may spend much time sleeping; thus most of his cells do less work, and their need for B vitamins decreases. The heart, however, works continuously from birth until death; even though the deficiency is already severe and every cell has been equally damaged up to this point, the first deficiency signs may now appear in the heart.

[1] H. Seneca, E. Henderson, and A. Collins, "Bactericidal Properties of Yogurt," *American Practitioner and Digest of Treatment,* I (1950), 1252.

It has become increasingly clear that since the B vitamins occur together in food, no person is deficient in any one B vitamin without being deficient in all of them. There are, however, as many degrees and variations of B-vitamin deficiencies as there are different individuals. Formerly the disease beriberi was thought to be caused by a deficiency of vitamin B_1, and pellagra by lack of the B vitamin, niacin. When human volunteers have stayed on diets lacking vitamin B_1 or niacin, however, neither beriberi nor pellagra has been produced. These diseases actually result from multiple deficiencies of all the B vitamins, the lack of vitamin B_1 or niacin being only more prominent.

In a general way you can tell how adequate your intake of B vitamins has been by looking at your tongue.[2] It should be moderate in size, an even pink in color, and smooth around the edges without coating or indentations showing where it has rested against your teeth. The taste buds should be uniformly small and cover the entire surface and edges. If you can find a healthy child, you may see what the normal tongue should look like.

When the B vitamins are undersupplied, many changes take place in this organ. The first change appears to be enlargement of the buds at the front and sides of the tongue. Later these buds become small or even disappear, making the tip and sides smooth, whereas the buds farther back will progressively enlarge. These buds have a flat appearance, like button mushrooms. As the deficiencies of these vitamins become more severe, clumps of taste buds fuse and grow together, pulling apart from other clumps and thus forming grooves or fissures. The first groove usually forms down the center of the tongue. In a severe B-vitamin deficiency, the tongue may be so cut by grooves and fissures that it looks like a relief map of the Grand Canyon and the surrounding

[2] *Clinical Nutrition*, edited by Norman Jolliffe, F. F. Tisdall, and Paul R. Cannon (Paul B. Hoeber. Inc.. 1950).

territory or a flank steak run through a tenderizing machine.

When the deficiencies are still more severe, the taste buds literally disappear. First the tip and edges become smooth and shiny; then the buds disappear progressively from front to back. This extreme condition is found most often in elderly persons whose diets have been inadequate for years; they complain that their food has little flavor. In some cases such tongues are intensely sore. In other cases, persons having extremely abnormal tongues are surprised to find that they differ from normal.

The size of the tongue also indicates deficiencies of these vitamins. The tongue may be large, beefy, and full of water (edematous). Often such a tongue shows scallops around the edges where it has rested against the teeth. The beefy tongue is so named because it has the appearance of beef and is usually an intense deep red. On the other hand, it may become too small, or atrophied. Other tongues may have a purplish, or magenta, cast, and still others may be a brilliant red. Often the tongue shows a combination of colors with perhaps a red tip and a magenta center. The color and texture vary depending upon which B-vitamin lack is most prominent. For example, a magenta tongue (the color seen most often) *indicates that a deficiency of vitamin B_2 predominates* over the other B-vitamin deficiencies. A beefy tongue is thought to show that pantothenic acid is particularly undersupplied. When deficiencies of vitamin B_{12} and folic acid are most prominent, the tongue becomes strawberry red and smooth at the tip and sides; it is often shiny and not coated. If the deficiency is predominantly the B vitamin, niacin, the tongue may be fiery red at the tip and may appear to be either too small or too large and so coated that it is fuzzy with debris. The heavy coating is caused by the growth of undesirable bacteria; it usually indicates much putrefaction in the intestine. Since valuable bacteria in the intestine produce B vitamins, such coating probably never occurs if bacteria growth is normal.

I asked a professor in medical school if he thought it wise to include a description of abnormal tongues in this book; I feared that people would worry excessively about their tongues. To my amazement he answered, "You never see them anyway. I'd omit it." He does not see them because he does research, but I have examined hundreds of tongues and have found only three normal ones in two years. I still chuckle every time I remember an occasion when, lecturing before a small group, I was requested to examine the tongue of everyone present; not one normal tongue had come to the lecture. The group sat like so many panting collies, astonished at each other's deficiencies. When the diet is made adequate, however, the tongue gradually becomes normal again, the recovery time depending upon the severity of the deficiency and the completeness of absorption.

Studies indicate that 60 to 100 per cent of the persons showing severe tongue changes are unable to produce sufficient amounts of hydrochloric acid in their stomachs; their output of digestive enzymes is far below normal. In such cases, digestion is so faulty that unless tablets of hydrochloric acid and digestive enzymes are taken temporarily (p. 233), much gas, flatulence, digestive disturbances, and discomfort may be experienced. In fact, if your digestion is so faulty that you have intestinal gas after you add foods rich in the B vitamins to your diet, you can be sure you have been deficient in these vitamins.

All the B vitamins dissolve in water and for this reason cannot be stored in the body. Just as a sponge can be slightly moist or dripping wet, however, so can the cells hold little or much of each B vitamin, depending on the amount offered. To maintain ideal health, the offering of B vitamins should be sufficient for each cell to take all it can use to advantage. Any B vitamins not needed are excreted in the urine.

It appears that all B vitamins work together; this cooperation is called the synergistic action of the B vitamins.

The taking of one or more B vitamins increases the need for the others not supplied, probably because any one B vitamin alone can increase the activity of each body cell. The group in its entirety can be obtained only from such foods as liver, yeast, and wheat germ.

To discuss the deficiencies of the B vitamins separately is as unrealistic as to believe in men from Mars. Such deficiencies exist only in an experimental laboratory. A deficiency of one, however, often predominates over others. If the first symptoms of that deficiency are recognized, they can serve as a warning that unless your nutrition is improved, greater deviations from health can be expected.

CHAPTER 9

IT IS ONLY AN ASSUMPTION

SO MUCH is known about the B vitamins that entire volumes are written about them. If the known facts were universally applied, the improvement in world health would probably be beyond imagination. Yet knowledge of many of these vitamins is so limited that it can only be described as a state of ignorance.

This group of perhaps 20 or more vitamins is called the vitamin-B complex because it is complex. Every month or two a new substance is separated from liver, yeast, and/or wheat germ. One, pangamic acid, spoken of by some investigators as vitamin B_{15}, promises to be important in energy production. Another, lipoic acid, is being written about. Vitamins B_{13} and B_{14} are now reported. Others can be expected.

The last three B vitamins to be well established are variously called the antifatigue, antitoxic, or antistress vitamins. These three appear to be unnecessary under normal conditions or to be needed in such small amounts that they can be made in the body or perhaps by bacteria in the intestines. Even though a diet contains all previously known nutrients and is adequate to support health under normal conditions, it can still be inadequate during conditions of stress unless these antistress vitamins are supplied. Stress is anything which puts an extra load on the body. Conditions of stress are produced by drugs, chemicals, infections, surgery, noise, excessive fatigue, psychological upsets, resentments, hatreds, and hundreds of other factors. It now appears that all nutrients are needed in larger amounts during stress than under normal circumstances.

When animals on seemingly adequate diets are submitted to stress, widespread damage occurs in their bodies. If these animals, however, are given fresh or dried liver or a crude liver concentrate, little harm is done. For example, when the strength of animals was tested by making them swim in ice water, the animals on "normal" diets could swim only three to ten minutes before drowning; animals given the same diet fortified with liver swam two hours or longer and lived to swim again.

When liver is given, the harmful effects of such stressor agents as atabrine, excessive amounts of the thyroid hormone or milk sugar, extreme heat or cold, lack of oxygen, X-rays, and various drugs have been prevented or decreased. Animals subjected to stress but not given liver often die unexpectedly, apparently of heart failure,[1] although they may have all the outward appearances of good health. Liver of all varieties appears to be the richest source of the antistress vitamins; kidney, soybean flour, and brewers' yeast contain some.

A number of other B vitamins have been so little studied that their distribution in foods is largely unknown, the amount needed is a mystery and, if deficiencies of them commonly occur, they are not recognized. Since the deficiencies produced experimentally are not recognized in humans, the assumption is that these vitamins are amply supplied by food or by intestinal bacteria, an assumption which I believe is not always true.

The richest source of the B vitamin, biotin, is yeast. Animals lacking this vitamin develop eczema, or dermatitis; their hair falls out; they are particularly susceptible to heart abnormalities and lung infections. If cancers are transplanted,

[1] Benjamin H. Ershoff, "Comparative Effects of Liver and Yeast on Growth and Length of Survival of the Immature Thyroid-fed Rat," *Archives of Biochemistry*, XV (1947), 365.

they grow rapidly in biotin-deficient animals. Growth is extremely stunted in young animals; adults become emaciated; death comes quickly to both.

A substance in egg white, avidin, can combine with biotin in the intestinal tract and prevent it from reaching the blood. Dr. V. P. Sydenstricker of the University of Alabama studied biotin deficiencies produced in human volunteers on adequate diets containing egg white. The first symptom noticed was mental depression. In time the subjects developed dry peeling skin, extreme fatigue, muscular pain, nausea, and distress around the heart. The mental depression became intensified to what Dr. Sydenstricker described as "panic." All the symptoms disappeared in three to five days after biotin was added to the diet.

I know a physician, too overworked to follow nutritional research, who tells mothers to add beaten raw egg to their baby's formula, starting at the third month. I have seen nine of these children covered with severe eczema which promptly cleared when the egg was withdrawn, and yeast and yogurt were added to the diet. The many recipes calling for uncooked egg white should be discarded. Eggs should be cooked until the white is firm, especially for persons "allergic to eggs."

Through the years I have been consulted by persons so depressed that they were panicky; sometimes they could think of little except a desire to destroy themselves. On their records I have often written, "Problem definitely psychological." Later they came in so cheerful that I was amazed and puzzled, wondering what had brought about such a change. Since biotin deficiencies have been produced in volunteers, I ask panicky persons if they ever wished to commit suicide. The stories I have been told are so incredible that I hesitate to write them. A minister's wife cried heartbrokenly, repeating again and again, "I'm a Christian, Miss Davis. I would never take my life," but her words showed her underlying fear. One young girl had a compulsion to commit suicide so great that she felt safe only around people; since she was ashamed to discuss her problem with her family or friends, she spent most of her time in a cafeteria sitting at tables with strangers. Another was a father who sobbed out his fear that he would kill not only himself but his three children. Still another was a wealthy woman who kept crying, "Why? Why? Why?" Between sobs she explained that she had a marvelous husband, wonderful children, and everything to live for.

Each of these persons and several not unlike them I have known for at least three years. Although most had suffered from depression for months, in no case did the depression return after their nutrition was improved. Their histories, however, show several interesting facts. In most cases they had been given antibiotics which had destroyed valuable intestinal bacteria, perhaps their only source of biotin. Several were taking mixed vitamin preparations; the other B vitamins may have increased their need for biotin, which was not supplied. Some were taking raw eggs beaten into orange juice, thus preventing biotin from being absorbed. Multiple nutritional deficiencies they certainly had, but panic was their outstanding symptom. Improved nutrition apparently gave them strength to cope with their psychological problems. It is said that there are no biotin deficiencies in America; I wonder every time I read of a suicide in the newspaper.

Inositol is another B vitamin about which too little is known. The assumption is that we get all of this vitamin we need from food. In addition to liver, yeast, and wheat germ, its sources are whole-wheat bread, oatmeal, and corn. The richest source is blackstrap molasses. This vitamin is a by-product of cornstarch manufacture; tons of it are added to the gray paint used by our Navy. Since inositol is not cheap, this paint may account for part of our high taxes.

When animals are put on a diet lacking inositol, their hair falls out. If the vitamin is then added to the diet, their hair grows in again. Male animals lose their hair twice as quickly as do females, indicating that the male requirement is higher than that of the female. A deficiency also causes constipation, eczema (dermatitis) and abnormalities of the eyes. Inositol is particularly concentrated in the lens of the human eye and in the heart muscles, perhaps indicating that it plays some role in normal vision and in heart action. A hundred times more inositol than any other vitamin except niacin is found in the human body.

Dr. Gustav Martin and co-workers at the Warner Institute of Therapeutic Research studied the effects of different B vitamins on the intestinal tract. Separate vitamins were given with barium, and contractions of the stomach and intestines were studied by fluoroscope. Only inositol caused a marked increase in the movements; poor appetites became normal, and previously existing constipation was relieved. Greater activity in the intestine is known to increase absorption. Blackstrap molasses is certainly more laxative than any other food. The millions of dollars spent annually on cathartics in America may result from inositol deficiency.

A few years ago I became interested in the possibility that a lack of inositol might be one cause of baldness in men. For a time I recommended inositol together with other sources of B vitamins to all the bald men who consulted me. In almost every case they soon reported that their hair was no longer falling out. Wives or mothers particularly mentioned that, whereas loose hair had formerly covered pillows and washbasins, they now had no loose hair to clean up. In some cases new hair growth was obvious in a month. One man of forty-eight, who had been bald for years, grew hair so thick that it looked like rabbit fur; surprisingly enough, he was extremely proud of it. One white-haired man of sixty-five had a bald spot far back on his head; the entire spot filled in with black hair, and a distinguished streak of black hair in the white appeared above his forehead. One man, who had been bald since he was twenty, grew so much hair that no bald spot remained. Some of the men, however, grew not one encouraging wisp.

Loss of hair often occurs in animals deficient in any one of several B vitamins or certain amino acids. Since I recommended for baldness a teaspoon of pure inositol daily added to a quart of tiger's milk (p. 114) unusually rich in all these vitamins and proteins, new hair growth may have been brought about by increased amounts of nutrients other than inositol. At each meeting of the American Academy of Nutrition I am impressed that most of the doctors who have been active in the organization for years have healthy luxuriant hair, in marked contrast to the sparse strands of younger men whose diets are less adequate. Hereditary tendencies and other causes of baldness undoubtedly exist. Family albums showing our elderly forefathers with luxuriant hair growth makes me suspect, however, that baldness is becoming more common and is developing at a younger age than it did a hundred years ago.

Para amino benzoic acid, or PABA, is another B vitamin about which little is known. Deficiencies recognizable in humans have resulted only from the administration of sulfanilamide. This drug prevented PABA from being used as an enzyme; the deficiency thus produced causes extreme fatigue, anemia and a skin rash, or eczema. These PABA-deficiency symptoms were often so severe that the use of sulfanilamide was discontinued in favor of less toxic antibiotics.

A man whom I have seen over a period of 10 years has suffered from recurring eczema which disappears whenever his diet is adequate. At one time he was given sulfanilamide; a day later eczema covered his entire body and was so severe that his ears were swollen to twice their normal thickness. The condition cleared like magic when he took PABA. I have, therefore, often recommended this vitamin for eczemas similar to his. The number of cases which have shown improvement leads me to believe that deficiencies of this vitamin are not unusual.

PABA has been publicized as an antigray-hair vitamin; black animals lacking it become gray. Dr. Benjamin Sieve studied the hair of persons given PABA; some hair was restored to natural color in 70 per cent of the cases. Several women who had wanted children for years conceived after this vitamin was added to their diets. Dr. Sieve also reported that persons whose skin lacked pigmentation developed normal skin color and that heavier spots of pigmentation faded during the experiment. To date these findings have not been confirmed, and further research is needed.

Deficiencies of at least four B vitamins, PABA, biotin, folic acid, and pantothenic acid, appear to affect hair color. One scientist who had conducted years of research on these B vitamins and has repeatedly produced gray hair in dark mice, rats, silver foxes, and black dogs even states that all gray hair is probably a symptom of multiple nutritional deficiencies.

I have never seen the color of any person's hair restored by the taking of synthetic B vitamins. I have, however, seen a dozen or more cases of persons whose hair color has been remarkably restored after they began to take adequate diets unusually rich in these vitamins. One was a fairly young woman whose hair was white; she became so enthusiastic in applying sound nutrition that a year later she had almost no gray hair. Recently I saw a man of 76 whose hair had been white for years; after he followed a good nutrition program for a decade, his hair is black. An elderly woman told me not long ago that her hair had changed so much that her friends accused her of dyeing it. The most remarkable restoration I have seen was in a man of 65 who had thick white hair. His arms were covered with a heavy growth of white hair. After only three weeks we could not find one white hair on his arms, and the hair on his head was salt and pepper color.

This man, however, soon reverted to faulty eating habits, and his hair is again white.

Little is still known about two other B vitamins, folic acid and vitamin B_{12}; both help to promote general health and to prevent certain types of anemia. Judging from experimental work with black animals, a deficiency of folic acid appears to be the major cause of the graying of hair. At the present writing, however, no studies have been made with people. Folic acid is produced by intestinal bacteria, which presumably supply all the folic acid we need, whereas vitamin B_{12} comes largely from foods. That either source is adequate for all persons is only an assumption.

Liver is the richest source of both vitamins, but yeast, wheat germ and kidney are also good sources. Although folic acid is found in green leaves, 97 per cent is destroyed by heat when vegetables are cooked. Fortunately, it is retained when yeast, liver, and kidney are heated.

When deficiencies of these vitamins predominate, the tongue becomes bright red around the edges; if the deficiency is chronic, the taste buds largely disappear, making the tongue smooth, clean, and shiny. The entire mouth may become extremely sore. Changes take place in the bone marrow where the red corpuscles are produced. The lack of folic acid results in a certain type of anemia (macrocytic anemia), which is fairly widespread and not correctable by iron. The anemias often associated with pregnancy, sprue, celiac disease, and pellagra clear up when this vitamin is given, as do the blood abnormalities of pernicious anemia.

A subtle lack of folic acid prevents the stomach from producing adequate hydrochloric acid; in a severe deficiency, none of this valuable acid can be produced. Without hydrochloric acid, protein digestion cannot occur in the stomach; minerals such as iron and calcium do not dissolve well enough to be absorbed; and the vitamins which are acids are largely destroyed before reaching the blood. Since this acid protects the body by destroying harmful bacteria obtained through food, a person lacking folic acid is susceptible to intestinal parasites and attacks of food poisoning. When folic acid is given to persons lacking it, the tongue and mouth heal, and the bone marrow becomes normal; except in pernicious anemia, the production of a stomach acid is resumed.

Persons suffering from pernicious anemia have damaged nerve cells, especially in the spinal chord. Such damage causes difficulty in walking, a spastic or jerky gait, swaying of the body, muscular spasms, lack of co-ordination, and loss of a sense of balance, position, and elevation. These symptoms can be corrected by giving vitamin B_{12}, but if folic acid is given alone, such conditions become markedly worse.

Children whose growth is stunted often grow rapidly after vitamin B_{12} is given them, a fact indicating that this deficiency exists and may be widespread. Almost 30 years ago Dr. Agnes Fay Morgan of the University of California showed that giving children two tablespoons of wheat germ daily in the form of a luncheon roll brought about superior growth, fewer behavior problems, and improved mental alertness. These 30-year-old facts can hardly be called findings hot off the medical griddle, although the wide publicity given to the growth-promoting quality of vitamin B_{12} would indicate as much. Recently a mother told me that her fifteen-year-old son, whose growth had been stunted, not only showed a rapid spurt of growth after taking three tablespoons of yeast daily but had raised his grades from a D to almost a straight A average.

Since an undersupply of vitamin B_{12} causes a lack of muscular co-ordination, I often wonder if a deficiency of this vitamin is responsible for the awkwardness and jerkiness one sees frequently in children. Last year a teacher and I were watching a group of six-year-olds skipping rope; we were discussing a child whose nutrition was markedly superior to the others. "Watch him as he runs," the teacher remarked.

"He's as graceful as a deer." By comparison, the other children showed a pitiful lack of muscular co-ordination. Particularly at adolescence, when vitamin requirements are tremendously increased by rapid growth, awkwardness becomes a problem embarrassing to parents and children alike. I suspect an undersupply of vitamin B_{12} is partly the cause. Only future research will show how valuable these vitamins actually are.

CHAPTER 10

I'M AFRAID TO TAKE THE CHANCE

SOMEWHAT more is known about cholin, vitamin B_6 (pyridoxin), and pantothenic acid than of the B vitamins already discussed; compared with what must still be learned, however, little is known about them. The best sources again are liver, yeast, wheat germ, and rice polish.

Cholin is another B vitamin found particularly in liver; wheat germ is also rich and contains more cholin than does yeast. Brains, kidneys, and egg yolks are excellent sources, but the amount per egg is small. A similar substance, betaine, found especially in sugar beets, liver, wheat germ, and certain fish, can pinch-hit for cholin in the body, but most people obtain even less betaine than cholin. The amino acid, methionine, can be changed into cholin in the body; a deficiency of cholin, therefore, can be produced when too little protein is eaten.

Cholin is needed to help the body utilize fat. If health is to be maintained, the more fat eaten, the larger must be the intake of cholin. Animals lacking cholin have abnormally large deposits of fat in their livers. This vitamin is thought to be part of an enzyme which combines fat and phosphorus, a combination necessary before fat can be carried into the tissues. Even a small accumulation of liver fat prevents the liver from functioning normally. For example, the vitamins which are usually stored there can no longer be stored efficiently, and less glycogen can be held in the liver cells.

If a cholin deficiency becomes severe, the liver cells degenerate, and clumps of dead cells are found; the muscles of the heart are damaged; hemorrhages are found in the kidneys and throughout the heart tissues; severe hemorrhages occur in the adrenal glands; and stomach ulcers are frequently apparent.

In young animals, a cholin deficiency causes particularly severe hemorrhages to occur in the kidneys; the tiny tubes (tubules), which carry urine, degenerate and become filled with "casts," or dead cells; nephritis and nephrosis can thus be produced. Dr. Charles H. Best of the University of Toronto Medical School has shown that young animals, kept on a diet low in cholin, later developed high blood pressure; the height of the blood pressure is proportionate to the severity and duration of the early cholin deficiency.

Cholin appears to play some role in the transportation or utilization of cholesterol in the body. When certain experimental animals, particularly rabbits, are put on a diet lacking cholin, large amounts of cholesterol are held in the walls of the arteries, causing a condition apparently analogous to that spoken of as hardening of the arteries, or arteriosclerosis. Atherosclerosis is the medical term for this abnormality. Experimental atherosclerosis produced in animals can be prevented or cured by giving either cholin or lecithin [1] separated from soybean oil. Lecithin contains cholin and essential fatty acids and is produced by the liver, provided these raw materials are supplied.

Heart attacks known as coronary occlusion and coronary thrombosis are the result of atherosclerosis. This disease is not only the first cause of death in America but also the first cause of sickness; it is responsible for more invalids than any other illness. Autopsies [2] of hundreds of men indicate that the

[1] H. D. Kesten and R. Silbowitz, "Experimental Atherosclerosis and Soya Lecithin," *Proceedings, Society for Experimental Biology and Medicine,* XLIX (1942), 71.

[2] Lester M. Morrison, "Arteriosclerosis, Recent Advances in the Dietary and Medical Treatment," *Journal of the American Medical Association,* CXLV (1951), 1232.

American male has advanced atherosclerosis by the age of forty-nine, that the condition becomes progressively worse up to the age of fifty-eight or sixty and then appears to be stationary or to decrease in severity. It is also known that the cholin requirements decrease with age because of decreased activity.

Dr. Lester M. Morrison,[3] working at the Los Angeles County Hospital, has studied 600 patients who survived attacks of coronary occlusion or coronary thrombosis. Alternate patients were given cholin but no medication; their diets were inadequate in many respects. Later they were allowed to work if they chose. The other patients were given standard medical treatment, such as phenobarbital, digitalis, nitroglycerin, and, when it seemed expedient, bed rest. Patients given cholin reported a feeling of well-being and general improvement in health; many returned to work. The amount of cholesterol in their blood decreased. Among the cholin group there were fewer recurring heart attacks and fewer deaths than in the medical-care group.

Dr. Morrison,[4] realizing that the action of all the B vitamins is synergistic, or "co-operative," extended his studies by giving the cheaper and less toxic betaine together with cholin, inositol, vitamin B_{12}, and a liver concentrate supplying all the B vitamins. His results were far better than when cholin was given alone. Patients reported a marked decrease or absence of shortness of breath and pain around the heart and an increase in sex interest, morale, and general well-being. The patients who had been invalids before treatment returned to work or to their normal activities, many saying they had "never felt better in their lives." Blood cholesterols dropped.

[3] Lester M. Morrison and W. F. Gonzales, "Results of Treatment of Coronary Arteriosclerosis with Cholin," *American Heart Journal,* XXXIX (1950), 729.

[4] Lester M. Morrison, "Results of Betaine Treatment of Atherosclerosis," *American Journal of Digestive Diseases,* XIX (1952), 381.

Few patients suffered recurring heart attacks. In spite of the fact that many of these patients were elderly, deaths were reduced to one-third the number expected for the age groups studied.

A later report [5] tells of 40 patients suffering from coronary thrombosis, their average age fifty-six years, who were given the B vitamins and compared with a control group receiving standard medical care. Not only did they experience great physical improvement, but no deaths occurred during a year's observation; deaths took 25 per cent of the group which Dr. Morrison describes as receiving "treatment by neglect," the method "currently in use by various fatalistic physicians."

Medical treatment for atherosclerosis has now run the gamut of diets containing no eggs, no liver, almost no fat, and no cholesterol to diets supplying all the calories from vegetable oils [6] (the latter so unappetizing that they had to be given by stomach tube), high in liver, eggs, and even cholesterol. In a study at the Alameda County Hospital, patients were given fat from egg yolks equivalent to 36 eggs daily, and in no case did the blood cholesterol rise above normal; this fat supplied cholin, lecithin, and cholesterol. Each form of treatment has resulted in a drop in blood cholesterol but not always in a drop in death rate. It is to be hoped that diets adequate in every respect, especially in all the B vitamins, lecithin, and linoleic acid, will soon be recommended to persons suffering from this form of heart disease.

There is still much to be learned concerning the relation of cholin to the utilization of cholesterol in the body. An undersupply of this vitamin, however, appears to be responsible

[5] Lester M. Morrison, "The Therapeutic Action of Betaine-Lipotropic Combinations in Clinical Practice," *Geriatrics*, VIII (1953), 649.

[6] Laurance W. Kinsell, "Effect upon Serum Cholesterol and Phospholipids of Diets Containing Large Amounts of Vegetable Fat," *Journal of Clinical Nutrition*, I (1953), 224.

for dim vision resulting when arteries in the eyes become so plugged by cholesterol that circulation can no longer be normal. Circulation to the legs and feet may be so decreased by cholesterol being deposited in the blood-vessel walls that pain and leg cramps occur. In diabetics, where a high-fat diet without cholin or any good source of B vitamins may be adhered to for years, cholesterol deposits may shut off circulation to the legs so completely that gangrene and death occur. "Senile softening of the brain" is probably the result of decreased circulation caused by cholesterol deposits in the blood vessels in the brain. Studies have shown that men put on high-fat diets (unintentionally lacking in B vitamins) because of diabetes, stomach ulcers, or a desire to gain weight [7] often develop fatal coronary occlusion or thrombosis in so short a time as three months; some of the men studied were only thirty-five years old. Persons kept on high-fat diets because of diabetes have been reported dying from atherosclerosis when as young as eighteen years of age. Atherosclerosis, therefore, is not a disease of the aged only. Cirrhosis of the liver in humans, or so-called fatty degeneration of the liver, has been treated successfully with cholin. This disease is also becoming increasingly common [8] as our national diet becomes increasingly deficient in cholin.

The assumption is that we get all the vitamin B_6 we need from our diets too. Only recently have vitamin-B_6 deficiencies been produced in humans.[9] Hospital patients, given a diet adequate except for vitamin B_6, developed mental depression, sore mouths, lips, and tongues and, in time, insomnia, extreme weakness, nervousness, dizziness, nausea,

[7] William Dock, "Predilection to Atherosclerosis of the Coronary Arteries," *Journal of the American Medical Association*, CXXXI (1946), 875.

[8] S. A. Portis and S. Weinberg, "Medical Treatment of Cirrhosis," *Journal of the American Medical Association*, CXLIX (1952), 1265.

[9] A. W. Schreiner, W. Slinger, V. R. Hawkins, and R. W. Vilter, "Pyridoxin Deficiencies in Human Beings Induced with Desoxypyridoxin," *Journal of Clinical Investigation*, XXIX (1950), 193.

and vomiting. The most striking abnormality, however, was eczema (seborrheic dermatitis) which appeared first in the scalp and the eyebrows, around the nose, and behind the ears. One patient, already suffering from eczema, rapidly became worse. When vitamin B_6 was given these patients, their condition quickly became normal. The investigators were then surprised to discover that similar eczemas had appeared in other patients during their hospitalization, while they were eating the "adequate" hospital diet. Since vitamin B_6 is known to be part of enzymes necessary for the utilization of both fat and protein, these investigators suggest that eczema appears because the oil glands of the skin cannot function normally without the vitamin.

When experimental animals have been kept on diets adequate except for vitamin B_6, eczema does not occur readily unless the diet is also deficient in linoleic acid. However, the animals do develop anemia, extreme irritability, nervousness and insomnia; they often have convulsions not unlike epilepsy. Many animals develop tremors and have difficulty in walking; if the diet is not improved, they eventually become paralyzed. When vitamin B_6 is given early enough, health is regained; if not, nerve damage occurs, and the tremors, convulsions, or paralysis cannot be corrected. On autopsy, the heart muscles of these animals are found to be severely damaged.

Dr. Tom D. Spies studied a group of patients who had been given vitamins B_1, B_2, and niacin but still complained of extreme nervousness, weakness, excitability, insomnia, irritability, and difficulty in walking. The relief was dramatic when vitamin B_6 was given. The patients felt unusually relaxed; they slept soundly; their strength so increased that several, formerly unable to walk more than a few steps, walked a mile or more the day the vitamin was given. Persons with anemia which had not responded to iron, adequate protein, or the B vitamins already given showed marked improvement in five days.

Since animals develop tremors and epileptic-like seizures, physicians have given vitamin B_6 in the treatment of paralysis agitans (popularly called palsy), epilepsy, and chorea, or St. Vitus' dance. Excellent results have been obtained in some cases, despite the fact that epilepsy and paralysis agitans have been considered incurable. In other cases, especially when vitamin B_6 has been given without a dependable source of the remaining B vitamins, the results have been disappointing. Chorea, however, has been completely cured, the seizures of epilepsy have decreased, and palsy has been corrected except in cases where irreparable nerve damage appears already to have been done.

I have yet to see eczema which has not cleared up when the diet was made adequate and especially rich in linoleic acid and all of the B vitamins. A most spectacular case was that of a man fifty-three years old who had suffered from eczema since he was twenty. His entire body was covered; the eczema was so sore and weepy that, on the extremely hot day when I first saw him, he not only wore long underwear, but his arms and legs were wrapped in yards of gauze, like a mummy. I planned an adequate diet for him and asked him to take a heaping tablespoon of yeast with each meal and between meals. Two weeks later, his skin had completely cleared; in the 10 years since that time, the eczema has not returned.

Cases of epilepsy are sometimes equally spectacular. A few months ago I first saw a delightful little boy of five who had epileptic seizures daily and, although he was being given large doses of barbiturates and dilanton, it seemed impossible for him to relax a single moment. Now that his diet contains vitamin B_6 and the natural sources of these vitamins, he is amazingly calm and has had few seizures despite the fact that the drugs were discontinued.

The relief to persons who have nervous tics or tremors is so dramatic that it is tempting to write dozens of case histories. For example, I was giving a lecture series recently where a woman, sitting in the front row, suffered from a tic which caused her mouth to draw up, her cheek to contract, and one eye to wink. To the next lecture I brought vitamin B_6 and asked her if she would take it; she did, and by the time the lecture was over, the tic had stopped; it has not returned. Late one afternoon a girl of seven was brought to me who winked both eyes every few seconds, her shoulders simultaneously jerking forward in a convulsive movement. This child had been thus afflicted for two years. I gave her 150 milligrams of vitamin B_6 immediately and asked her to eat nothing except foods rich in the B vitamins for a few days. The mother phoned at two o'clock the following day to say that the convulsive movements had stopped; the tic has not returned. Another case was that of an extremely alert high-school boy who had convulsive movements of his entire face, his eyes simultaneously rolling upward. His mother told me the condition had been noticed at birth, even in the delivery room. In spite of such a history, the condition was relieved when vitamin B_6 was given together with an adequate diet.

Cases in which tremors have been almost instantly relieved are equally dramatic: the high-school girl who was unable to write or type and, although popular, refused to date for fear the boys would notice her trembling hands; a photographer who was giving up his livelihood because he could no longer hold a camera without a tripod; an engineer who felt he must seek a new occupation because his hands were too unsteady for drafting; a man of seventy-six who told me his hands had trembled for 40 years; the accountant who, every time I saw him, brought samples of his work before and after taking vitamin B_6; the minister whose lower lip and chin trembled to the extent that it distracted his congregation. Each of these persons was immediately relieved by an adequate diet supplemented with vitamin B_6.

Never shall I forget a little woman of seventy-eight who had been bedridden for three years with paralysis agitans. After taking only brewers' yeast as a source of this vitamin, she walked into my office still shaking in every muscle, her step faltering, but a glow on her face as though she were walking as rhythmically as a dancer. In every case these persons tell of feeling tremendously relaxed and of experiencing a sense of peace and tranquillity together with soundness of sleep such as they had not enjoyed in years. Medical journals have often reported failure in treating such cases with vitamin B_6; it is my experience that results cannot be expected unless generous amounts of all the B vitamins are given, together with a completely adequate diet (p. 203).

Such cases are fortunately rare. Almost every person, however, experiences tension, nervousness, and irritability; a large per cent of our population is unable to sleep without drugs. I strongly suspect that these abnormalities are, in part at least, subtle deficiencies of vitamin B_6. Surely a nutrient which can sometimes bring relief to such serious conditions as epilepsy, paralysis agitans, and chorea must play an important role in maintaining nerve and muscular relaxation. The extent of that importance is still to be learned.

Another B vitamin, pantothenic acid, undoubtedly plays an important role in maintaining health, although deficiencies in humans are not recognized, and little is known about the quantity needed daily.

When black animals are given a diet adequate except for pantothenic acid, their hair turns gray; anemia and eczema (dermatitis) develop; even though the animals are young, they have the appearance of extreme age. Autopsy frequently reveals stomach and duodenal ulcers; hemorrhage in and damage to the heart muscles; pathological changes in liver, kidneys, the thyroid and sex glands; and, most striking by far, severe destruction of the outside (cortex) of the adrenal glands which is associated with adrenal deficiency found in cases of stress and/or adrenal exhaustion. Death is apparently brought on by heart failure.

At the University of California I saw a colony of black cocker spaniels whose diets were identical except for pantothenic acid. The well-fed animals were beautiful creatures with sleek fur and boundless energy; although fully grown, they were like pups which could not be trusted with a bedroom slipper. Their litter mates without pantothenic acid appeared to be miserable old animals of extreme age; their hair was coarse and gray; their heads drooped, eyes half-closed. When pantothenic acid is given to such animals, the normal color and texture of hair are restored, and the appearance of youth is to some extent regained.

In addition to liver, yeast, rice polish, and wheat germ, pantothenic acid is found in kidneys, soybeans, and peanuts; egg yolks and whole grains are fair sources; muscle meats contain little; the vitamin is lost in refining of flour. The richest sources are adrenal glands and royal jelly, the food of the queen bee.

Years ago royal jelly was analyzed in an attempt to find why the queen bee was sexually superior to worker bees and had a life span many times longer. This jelly was proved to be tremendously rich in pantothenic acid, vitamin B_6, and nucleic acid, another nutrient found most abundantly in yeast and liver. The life span of animals was increased by approximately a third in each case when they were given only one of these nutrients in larger than normal quantity; when all three nutrients were given in generous amounts, the life span was increased by almost a half. Perhaps the fountain of youth is to be found after all in liver and yeast.

Some evidence indicates that humans suffer from deficiencies of pantothenic acid. In the opinion of many investigators a beefy, furrowed tongue indicates that a deficiency of this vitamin predominates over the lack of other B vitamins. A few studies have been made of gray-haired persons who were given this vitamin; the restoration of the natural color has sometimes occurred, but results have been inconsistent. During World War II, American prisoners in the Orient developed painful, burning feet; the pain became increasingly more severe toward evening and was almost unbearable after days of forced labor. When the men were liberated, American physicians gave injections of various B vitamins which brought no relief until pantothenic acid was given; the relief was then immediate and marked. This condition has been frequently reported [10] over a 50-year period and is known to be associated with multiple deficiencies of the B vitamins.

I am convinced that this symptom of pantothenic-acid deficiency is extremely common. For a time I became so enthusiastic about gardening that I spent hours daily doing hard physical work; 5 milligrams of pantothenic acid per day was then considered adequate, whereas my requirement was probably nearer 50 milligrams daily. For weeks on end my feet hurt, the pain often excruciating. A friend suggested that I was deficient in pantothenic acid, which I felt was impossible; when I took 100 milligrams of this vitamin, however, the pain magically disappeared. Since then I have found this symptom in most persons showing multiple B-vitamin deficiencies. Time and again they have reported that pain was relieved when pantothenic acid and foods naturally rich in B vitamins were obtained. Persons who stand or walk a great deal, such as dentists, postmen, or anyone doing hard physical work, often become aware of this symptom. If your feet hurt, my advice is to take pantothenic acid; your corns, calluses, and bunions may be less painful than you think.

[10] E. K. Cruikshank, "Painful Feet Syndrome," a chapter in *Vitamins and Hormones* (Academic Press, Inc., 1952).

Eczemas caused by a pantothenic-acid deficiency predominating over the lack of other B vitamins is apparently not unusual (ref. 10, p. 87). When eczemas occur in persons who complain of painful feet and have large beefy tongues, pantothenic acid taken with foods rich in all the B vitamins seems to speed recovery. Such eczemas occur first around the genitalia. In men it may cover the entire scrotum; itching is extremely severe. If the eczema becomes serious, it is usually found also on the hands, face, and ears.

Since animals deficient in pantothenic acid frequently develop duodenal ulcers and inflammation of the intestines and stomach, a study[11] was made of the completeness of digestion and absorption in humans with and without added pantothenic acid. Their diets appeared to be adequate in all the B vitamins; when pantothenic acid was given, however, it was found that digestion was improved by 51 per cent and absorption by 37 per cent. Pantothenic acid has been found to relieve the pain of neuritis which had not responded to other B vitamins; such patients also reported increased energy, an ability to think more clearly, and a marked improvement in memory.

Damage done to the outside of the adrenal glands during pantothenic-acid deficiency is thought by some investigators to be the cause of Addison's disease. Dr. Gordon[12] points out that this disease is rapidly increasing. Addison's disease is characterized by extreme fatigue, early aging, and dark pigmentation of the skin. In severe cases, patients have been kept alive only by injections of adrenal-cortex hormones. This disease has been considered incurable.

About a year ago a woman in her thirties consulted me because she frequently blacked out. She was suffering from

[11] R. J. Williams, "Chemistry and Biochemistry of Pantothenic Acid," *Advances in Enzymology*, III (1943), 253.

[12] E. S. Gordon, "Pantothenic Acid in Human Nutrition," in *Biological Action of Vitamins* (University of Chicago Press, 1942), 168.

Addison's disease and looked prematurely old. Her hair was almost white, her skin wrinkled and her complexion a deep olive. She told me that prior to her illness she had been fair but that since her illness Mexicans often stopped her on the street and spoke to her in Spanish. She suffered such extreme fatigue that she had been forced to give up her work. Her physician told me that her blood sugar tests, taken repeatedly, had been no higher than 40 milligrams at any time, whereas it should be at least 90.

Since this woman's adrenals were known to be damaged, she could be expected to produce little or no cortisone. The purpose of cortisone is to form sugar from body tissues when glucose is not supplied from other sources; blackouts occur when the blood sugar drops too low. I concluded, therefore, that the blackouts might be prevented if this woman were maintained on a diet which supplied a steady source of sugar at all times. Her diet was made extremely rich in foods supplying pantothenic acid, cholin, and other nutrients known to be needed by the adrenals. To keep the blood sugar normal, I recommended high protein and moderate fat to slow down the absorption of natural sugars.

After she began this diet, she suffered no more blackouts. In time her fatigue was replaced by unusual energy, and her blood sugar increased to normal. I did not see her again for perhaps eight months. This time I did not recognize her. She seemed 20 years younger; her skin was fair, her wrinkles had disappeared, and her hair had regained much of its natural color.

It appears that adequate pantothenic acid can offer rewards of positive health and perhaps can help to extend youthfulness. Yet some people think that enough of all of these vitamins can be obtained from ordinary foods. I, for one, am afraid to take the chance.

CHAPTER 11

ARE BLUE MONDAYS NECESSARY?

IT MAY not be mere happenstance that one person is gay and another grumpy. The grumpy one may have far more to be happy about but may be unable to enjoy his potential happiness because of a niacin deficiency. This B vitamin is variously known as niacin, niacin amide, or nicotinic acid. Pellagra, which has caused the death of thousands of Americans, results predominantly from a lack of this vitamin; hence severe deficiencies have been thoroughly studied. Far less is known about mild deficiencies, but there are telltale signs which are indicative.

The sources of niacin are not only yeast, liver, and wheat germ but also fish and kidneys, which are particularly rich. Nuts and eggs are fair sources. Aside from these foods, niacin is difficult to obtain. None occurs in milk, for example. For this reason, niacin deficiency is extremely common in babies and may cause severe diarrhea. Frequent diaper changing can often stop within a day after niacin amide is given. A wise mother saves herself a great deal of work merely by adding yeast or desiccated liver to her baby's formula or drinking water.

When volunteers have stayed on a diet adequate in all respects except in niacin, the first symptoms noticeable are psychological. The entire personality changes. Persons who were formerly strong, courageous, forward-looking, and unafraid of life become cowardly, apprehensive, suspicious, and mentally confused. They worry excessively and are emotionally unstable, moody, forgetful, and unco-operative. Such persons become depressed; their depression may range from "blue Mondays" to the point where they feel it is impossible to carry on. They lose their ability to keep going when the going is tough. In fact the effect of this vitamin upon personality caused it to be labeled for a time the "morale" vitamin. Fortunately these experimentally produced unpleasant personalities can be eliminated within a few hours after niacin is added to the diet, but such is not the case outside the laboratory. Whenever I hear of the petty politics not unusual in P.T.A.'s and Women's Clubs, I long to pass a bottle of niacin amide tablets. Would you care to offer some to your neighbors or in-laws?

In a mild niacin deficiency the tongue is usually "strawberry tipped," or bright red at the tip. Even in social conversations these days I find myself watching tongues; if I am stuck with a person lacking charm, a strawberry tip makes me somewhat more tolerant and understanding. Farther back, the tongue is most often coated with bacterial growth. In fact, a coated tongue probably indicates a mild niacin deficiency. The tongue may be so covered with bacterial debris that the mouth has an unpleasant odor. The mouth often becomes sore, the gums are swollen and painful, and the inside of the cheeks is red and raw. Canker sores and small ulcers may appear on the cheeks or under the tongue, but these ulcers may be so covered with the coating of bacteria that they cannot be seen. Such a person is susceptible to Vincent's disease, or trench mouth. In a study made in a Boston hospital, it was found that trench mouth was cleared up more quickly by niacin amide than by any other of several dozen treatments tried. Although this infection was formerly considered to be quite contagious, no infection resulted when attempts were made to transmit it to mouths of persons whose diets were adequate.

Even in a mild deficiency of niacin, abnormalities occur in the digestive tract. Too small amounts of digestive juices are secreted; the stomach fails to produce enough hydrochloric acid or perhaps can secrete none at all. Many digestive disturbances result (p. 65). Since the lack of hydrochloric acid prevents the absorption of calcium and iron, nervous disorders and anemia often occur. Whenever the digestion is faulty, food cannot be well absorbed; putrefactive intestinal bacteria live on the undigested food, causing gas and flatulence. Constipation is most often an early symptom, but as the deficiency becomes more severe, constipation and diarrhea may alternate; eventually only diarrhea occurs and may become extremely severe. A niacin deficiency can thus cause psychological disturbances and diarrhea simultaneously; the diarrhea is usually thought of as a result of the psychological upset itself, which indeed it may be. The conclusion that nutrition plays no part in these disturbances, however, is not justified until the diet is made completely adequate and every possible step is taken to assure complete absorption.

In a more advanced deficiency, the entire intestinal tract becomes sore and inflamed; such inflammation may be most noticeable in the rectum and vagina and around the anus. Persons undersupplied with niacin often suffer from a feeling of strain and tension, insomnia, dizziness, nervousness, irritability, and frequently recurring headaches. When niacin in the form of yeast is given to such persons, their intestinal inflammation clears, and digestion is normalized; they become noticeably relaxed, and their sleeping habits improve within a few days.

If the deficiency is allowed to become more severe, mental dullness, depression, hostility, or suspicion may grow in intensity. Sometimes such a person feels like crying frequently without knowing what he is crying about. In pellagra, these symptoms gradually give way to actual violence, disorientation, and delusions, such persons often becoming violently insane. In one of the mental hospitals in the South, every incoming patient must eat a completely adequate diet for two months before being put into a general ward. During this time a large per cent of the patients recover completely and are sent home.

Niacin is a vitamin which can be made in the body from the amino acid, tryptophane, provided adequate protein and other B vitamins are generously supplied. It is known that an enzyme containing vitamin B_6 (deaminase) is necessary for the conversion of tryptophane to niacin. Babies suffering from severe nutritional diarrhea, for example, are usually tiny ones who can drink little milk, whose formulas are mostly sugar and water, and/or who are given no source of vitamin B_6. The reason thousands of persons in our Southern states have died from pellagra is that the diet of the poorer people has been and still is notoriously deficient in adequate protein as well as B vitamins. Cornmeal, their principal food, lacks tryptophane.

Brewers' yeast has been used successfully in treating pellagra since the early 1920's; often ½ cup or more is given daily. Few persons, regardless of how healthy they consider themselves, can take this amount of yeast without noticing a marked pickup in both cheerfulness and well-being. If already deficient in the B vitamins, however, they will probably blow up with gas.

The fact that food cannot be efficiently digested when a niacin deficiency has existed means that recovery is usually slow. Yogurt, which supplies valuable acid, hard-working bacteria, and predigested protein, is probably the best food to take in large amounts at first. Yeast, liver, and other sources of niacin should be added gradually.

There is great personal value in keeping the diet adequate in niacin. No one enjoys irritable, unpleasant persons; we probably dislike ourselves even more when we are irritable and unpleasant. Conversely, there is great satisfaction in the buoyant feeling of "Come what may, I can take it."

CHAPTER 12

STUDY YOURSELF IN THE MIRROR

VITAMINS B_1, B_2, and niacin have long been made synthetically and are the cheap B vitamins. Liver is the richest natural source of vitamin B_2, or riboflavin; yeast runs a close second. Since these foods are rarely eaten, for all practical purposes milk is the most reliable source. This vitamin is found in leafy vegetables but can be absorbed only after they are cooked; it is not available from salads.

According to many authorities, a lack of vitamin B_2 is the most widespread deficiency in America. Dr. Henry Borsook, studying workers in defense plants during World War II, found approximately 60 per cent showing advanced deficiency symptoms. It has been my experience that symptoms of this deficiency are to be found in almost every person who drinks less than one quart of milk a day.

The symptoms of vitamin-B_2 deficiency are fairly well understood; studies have been made of human volunteers living on diets adequate in all nutrients except this vitamin. The most universal sign is a magenta or purplish tongue, caused by stagnant blood held in the taste buds. Changes in the lips, however, usually occur earlier, the lower lip apparently being affected first. Perpendicular lines or tiny wrinkles may be seen; later these disappear, and the lip becomes crinkled and rough, often feeling as if it were chapped; tiny flakes of skin may peel from it. All too often these symptoms can be seen merely by studying yourself in the mirror.

When the deficiency becomes acute, the corners of the mouth split or crack. These cracks do not heal readily and repeatedly break open; although they do not bleed, they become quite sore. They may extend half an inch into the outer cheek and an equal length or more on the inside of the mouth. These cracks appear or disappear depending upon the vitamin-B_2 intake.

In case the deficiency continues, wrinkles appear radiating from the mouth in much the same direction as is seen when the mouth is puckered for whistling. These wrinkles, which I call whistle marks, may extend half way to the nose. Lipstick gradually creeps up these whistle marks, giving an irregular and ridiculous appearance. Since most of us are vain enough to smile pleasantly at ourselves in the mirror, whistle marks are rarely noticed by the individual who has them; they are visible only when the face is relaxed.

If the deficiency is slight but of long standing, cracks may never appear; instead, the upper lip becomes progressively smaller. In many cases, the upper lip practically disappears. Women with this symptom usually wear their lipstick far above their upper-lip-line. The disappearance of the upper lip is common among elderly persons, who invariably blame their false teeth; persons having their own teeth, however, show the same symptoms. I see whistle marks and atrophied upper lips daily, often in persons thirty years of age or even younger.

An early symptom of vitamin-B_2 deficiency is that the eyes become sensitive to light; like persons deficient in vitamin A, such people usually feel more comfortable wearing dark glasses. If the nutrition is adequate in vitamins A and E, a person's night vision will be normal, but his vision in dim light or twilight is faulty; he feels confused in dim light. If he comes into a room where others are enjoying the twilight, he usually demands irritably, "Why are you sitting in the dark?" and quickly snaps on the lights. Even though his eyes are sensitive to bright light, he cannot work or write with ease unless the lights are bright. As the deficiency becomes more severe, his eyes may water, the lids may itch and burn, and he occasionally feels as if grains of sand are under the lids or particles of dirt are in his eyes. You can notice such a person frequently rubbing or wiping his eyes.

If the eyes are severely strained, they become bloodshot. Enzymes containing vitamin B_2 normally combine with oxygen from the air to supply the cells in the cornea, or tissue covering the eye; when this vitamin is inadequate, the body forms tiny blood vessels in this tissue, thus supplying it with oxygen. After these blood vessels are formed, the blood will drain from them when vitamin B_2 is adequate and they are not needed, but the blood vessels remain; hence blood can quickly enter them again whenever a deficiency recurs. The person whose eyes have once been bloodshot, therefore, often suffers quick recurrences whenever his diet becomes deficient.

A condition similar to bloodshot eyes frequently occurs in the skin of the cheeks. Tiny blood vessels are formed in the outer layers of skin which normally would not contain blood vessels. Such blood vessels can be seen on close examination with the naked eye, and even at a distance they give the cheeks a high color. This abnormal coloring, called acne rosacea, may occur high in the cheeks under the eyes, over the lower jaw or far back on the face in the lateral line near the ears. In severe cases, most often seen in alcoholics, these blood vessels form in the skin over the nose and sometimes the entire face.

These symptoms disappear when the nutrition is completely adequate, the length of time depending upon the severity of the condition, the amount of vitamins given, and the completeness of absorption. I have seen severely bloodshot eyes appear normal again in 24 hours. The tiny blood vessels in the cheeks usually become invisible within two to four weeks after dietary improvement, but they are sometimes maddeningly persistent.

When volunteers have stayed on diets lacking vitamin B_2, the skin of the nose, chin, and forehead has taken on an oily appearance; tiny fatty deposits, like whiteheads, have accumulated under the skin. Cracks and fissures, like those formed at the corners of the mouth, have sometimes appeared in the corners of the eyelids; the lashes may stick together with an oily secretion, particularly on waking in the morning. Cracks and oily scabs may form at the base of the nose. I have rarely seen these symptoms or perhaps have failed to recognize them.

Such widely different animals as dogs, ducks, rats, chickens, monkeys, geese, and even fish, when put on diets lacking vitamin B_2, develop cataracts. If the vitamin is given early enough, the cataracts disappear. When the deficiency is allowed to progress until it becomes severe, however, the damage can be arrested but not repaired. Blindness results if no vitamin is given. Whether or not an undersupply of vitamin B_2 causes cataract in humans is controversial. Dr. Sydenstricker of the University of Alabama Medical School studied cataracts and opacities in the eyes of persons showing symptoms of multiple vitamin-B deficiency. When vitamin B_2 was given in generous amounts together with an adequate diet, the eyes became normal, usually in about two weeks.

Bloodshot eyes and lip and tongue abnormalities, characteristic of vitamin-B_2 deficiency, have been produced in persons deficient in any one of several amino acids (ref. 3, p. 30) or in vitamin B_6 (ref. 9, p. 81). Animals lacking any one of these nutrients develop cataracts. These conditions can be corrected by supplying, not vitamin B_2, but the missing nutrient. At first these facts were puzzling indeed. It must be remembered, however, that vitamin B_2 in itself is of no importance; it is merely part of the structure of a number of enzymes. These same enzymes are largely protein made of essential amino acids, the lack of any one of which can limit their production. It is now known that vitamin B_6 is necessary to help combine the amino acids into the protein part of these enzymes. The reason symptoms usually disappear when vitamin B_2 is given is that this vitamin is more often lacking than is adequate protein; vitamin B_6 is usually given with the vitamin B_2. Conversely, if the symptoms do not disappear after vitamin B_2 is made adequate, deficiencies of protein and/or vitamin B_6 should be suspected. The deficiency symptoms are caused by a lack of enzymes rather than of any single nutrient. Such is the intricate relationship of many nutrients in the body and of multiple overlapping deficiencies. Milk or yogurt, supplying vitamin B_2, also furnishes vitamin B_6 and essential amino acids; the yogurt offers protein in predigested form and a "factory" of hard-working bacteria willing to produce B vitamins for future needs.

I have had many persons report that, after their nutrition was improved, their glasses seemed no longer suited to their needs. On going to an oculist, they have been told that their eyes were much stronger than formerly. Such an improvement can be brought about only by a completely adequate diet, although vitamin B_2 undoubtedly plays an important role. Good nutrition, however, cannot correct conditions for which glasses are needed.

Among elderly persons visual difficulties caused by multiple nutritional deficiencies are almost the rule rather than the exception. In all probability, such deficiencies are often responsible for failing vision so frequently accepted as an inevitable part of growing older. I gave a series of lectures at a Women's Club where most of the audience consisted of women sixty to eighty years old. On several occasions I tried without success to find one person in the audience who did not show symptoms of vitamin-B_2 deficiency. In this group was a sweet old lady of eighty whom I shall remember; her lower eyelids were so swollen that there appeared to be a half teaspoon of tears poised on each. She had given up reading, sewing, movies, and even television. Only two days after she improved her diet, she could read the newspaper. Later her delight at being able to sew for her grandchildren was touching.

It is important to realize that eyes can be improved during the later years when many activities are denied elderly persons. Under no circumstances should dim vision be accepted without making every effort to keep the nutrition adequate. Years ago Dr. Spies made a study of children whose families were too poor to buy milk. He found marked "old-age" symptoms including watery and burning eyes and failing vision which cleared quickly when the nutrition was made adequate and milk was supplied. The worst case I have seen was that of a three-year-old who had been given only soy milk. These visual symptoms are usually corrected in young and old alike by an increased intake of yogurt and/or milk, yeast, and liver. In cases of severely bloodshot eyes, it may be wise to ask your physician about taking vitamin B_2 temporarily. Milk sugar, or lactose, appears to increase the need for vitamin B_2 unless fat is adequate in the diet (p. 45). If a fat-free diet must be adhered to, the use of powdered milk and especially powdered whey should be restricted, particularly when symptoms of a vitamin-B_2 deficiency occur.

The signs of multiple nutritional deficiencies, perhaps most often caused by lack of vitamin B_2, should not be taken lightly. The woman who may be proud of such high color that she need not wear rouge would be wise to inspect herself carefully in the mirror. Probably she should improve her diet with all possible speed.

CHAPTER 13

IT IS NO MORE IMPORTANT THAN THE OTHERS

I AM afraid to write about vitamin B_1. Writing an enthusiastic treatise on the value of arsenic in the diet might be safer. The synthetic form of this cheap vitamin is tossed promiscuously into many of our foods to "enrich" them. Thousands of people take tablets of vitamin B_1 or of a few mixed B vitamins, believing that they receive far more than they do. *The action of all the B vitamins is synergistic.* One alone or several together increase the need for the B vitamins not supplied. Deficiencies of the unsupplied vitamins may produce abnormalities which can do more harm than the vitamins obtained can do good.

It is impossible to write about vitamin B_1 without saying that an adequate intake aids in producing energy. What is to prevent a tired reader from taking tablets of this vitamin because "Adelle says it will help"? My readers have done that before. Yet the most exhausted woman I have ever seen still walking around had been taking massive doses of vitamin B_1 daily for two years.

She was a seamstress, thirty-eight years old, although she appeared to be fifty-five or sixty. Her eyes were bloodshot; she believed they were strained by her work. Her upper lip had completely disappeared; small open cracks cut downward from the corners of her mouth. Such fatigue showed in every line of her face that I wanted to tuck her into bed saying, "There. Don't move a muscle for six months." Most of her hair had fallen out during the past year, she told me; the thin, scraggly remainder was white. She had other abnormalities: her nerves were taut and jumpy; she suffered from insomnia; she worried excessively and felt depressed; the back of her lap was so covered with eczema that she could scarcely sit down; yet she was too exhausted to stand up.

It was only after much questioning that I found the cause of her trouble. She used to be so tired, she said. She had heard that vitamin B_1 prevented fatigue and had found on taking it that at first she did feel better. When the effect "wore off," she asked the druggist for the highest-potency B_1 tablet he had, and when this tablet had not helped, she had gradually increased the amount to four tablets daily. I had difficulty in convincing her that the vitamin B_1 was at fault. She was afraid to give it up. I have seen dozens of cases *in which the multiple deficiencies of other B vitamins* had been caused by taking vitamin B_1. Fortunately no other cases have been as severe as this one. A little knowledge can indeed be a dangerous thing. If a vitamin has been insufficiently supplied, a pickup is experienced when it is added to the diet; increasing the amount over that needed by the cells cannot produce a further pickup. It can only produce deficiencies of other B vitamins still undersupplied, as it did in this case.

The richest sources of vitamin B_1 (thiamin) are wheat germ and rice polish; liver is not particularly rich. This vitamin is necessary before seeds can sprout; therefore it is found in all cereal grains, nuts, dry beans, peas, soybeans, and lentils, and in unrefined foods prepared from seeds, such as peanut butter, breads, and cereals. Among animal sources, kidneys, heart, and pork rank highest.

A "bird's-eye view" of the difficulties you may avoid by keeping your diet adequate in this vitamin is shown by experiments in which vitamin-B_1 deficiency has been produced in volunteers. Dr. Norman Jolliffe, of the New York University School of Medicine, studied men living on a diet adequate except for vitamin B_1. After only four days they noticed pain around their hearts, palpitation and shortness of breath on exertion. They became constipated, unusually fatigued and mentally depressed, the symptoms becoming progressively more severe as they continued the diet. Dr. Jolliffe, studying the hearts by fluoroscope and electrocardiograms, found them to be enlarged and sufficiently abnormal as to be diagnosed as heart disease. When adequate vitamin B_1 was given, the symptoms disappeared in three to six days.

In a similar experiment at the Mayo Foundation, volunteers were given a diet containing the amount of vitamin B_1 found in surveys to be that consumed by the general population of our country (0.22 mg. per 1,000 calories). Their report states,[1] "The foods were exclusively those which commonly appear on the American table." The diet consisted of white bread, beef, corn flakes, potatoes, polished rice, sugar, skim milk, cheese, butter, gelatin, egg white, canned fruits and vegetables, cocoa and coffee. To make sure the diet was otherwise adequate, these persons were given brewers' yeast to supply the vitamins of the B group but with the vitamin B_1 destroyed by heat. The diet was supplemented with iron, calcium, and phosphorus and with cod-liver oil to furnish vitamins A and D. Such a diet, therefore, was superior to that eaten by millions of Americans.

All of the volunteers showed personality changes. They became irritable, quarrelsome, unco-operative, inefficient, forgetful, mentally sluggish, and depressed. (Do they sound like anybody you know?) These symptoms gradually became more exaggerated. In time the volunteers developed extreme fatigue, sleeplessness, constipation, and sensitiveness to noise; their hands and feet frequently became numb. They developed low blood pressure, anemia of moderate severity, and

[1] R. D. Williams, H. L. Mason, B. F. Smith, and R. M. Wilder, "Induced Thiamin (Vitamin B_1) Deficiency in Man," *Archives of Internal Medicine*, LXIX (1942), 721.

low basal metabolic rate (see p. 13). They suffered from heart palpitation and shortness of breath; electrocardiograms showed that their hearts were abnormal and, in several cases, enlarged. Their capacity to work, measured by an exercising machine, fell progressively as the diet continued; all symptoms were made more severe both by exercising and by cold weather. In time, they became unable to work because of exhaustion. Pain (neuritis) developed in the calves of their legs. It was found that they had little hydrochloric acid in their stomachs, and in some cases this valuable acid was completely absent. By the twenty-first week, they experienced such severe headaches, nausea, and vomiting that the experiment had to be stopped.

Vitamin B_1 was then given; within a few hours the volunteers became cheerful, the fatigue left them, and they reported a feeling of mental alertness and unusual well-being associated with marked stamina and enterprise. Other symptoms disappeared more slowly. The flow of hydrochloric acid became normal in 12 days; their hearts in 15 days.

Despite the fact that these abnormalities are numerous and varied, vitamin B_1 appears to have only one function. As part of an enzyme, it helps to change glucose into energy or fat. During the breakdown of sugar to produce energy, pyruvic and lactic acids are formed. By the help of enzymes containing vitamin B_1, pyruvic acid is quickly broken down still further into carbon dioxide and water; lactic acid is rebuilt into glycogen. If the vitamin is undersupplied, these changes cannot take place, and the acids remain in the tissues; they accumulate, especially in the brain, nerves, heart, and blood; eventually they are thrown off in the urine. The production of energy from sugar slows down, coming only from half-burned sugar or from fat; the acids irritate the tissues. Since energy cannot be produced efficiently from fat alone, the result is fatigue, lassitude, and a general laziness throughout the body.

When people deficient in vitamin B_1 are supplied with it, the relief of fatigue is often dramatic. Frequently they exclaim in amazement, "I can work twice as hard without getting tired!" In an experiment, subjects were given a minimum amount of vitamin B_1 daily; then that amount was doubled and tripled, and their work capacity was tested by weight lifting; it was found they could work twice and then three times as long without tiring. The first thing I do when I employ help to work in the garden or house is to feed them B vitamins; they not only work three times as hard for the same amount of money but work three times as cheerfully.

The reason for personality changes and such symptoms as mental depression, confused thinking, and forgetfulness which occur when vitamin B_1 is undersupplied is twofold: first, brain cells derive their energy only from sugar, and glucose cannot be converted into energy without this vitamin; second, the accumulation of pyruvic and lactic acids in the brain cells is somewhat toxic. At a Philadelphia hospital persons who had eaten foods inadequate in the B vitamins were given a battery of psychological tests before dietary improvement, after vitamin B_1 was given, and again after all the B vitamins were supplied. When vitamin B_1 was injected, clarity and quickness of thinking, ability to remember, foresight and judgment somewhat improved. The improvement was far more marked when all the B vitamins were supplied by natural foods. Unfortunately, intelligence as such remained the same under all three conditions.

A deficiency of vitamin B_1 causes digestive disturbances in a number of ways. Energy production is so faulty that muscular contractions of the stomach and intestinal walls slow down; food can no longer be well mixed with digestive juices and enzymes; and the already digested food cannot be brought into frequent contact with the absorbing surface where it can pass into the blood. A partial or complete lack of hydrochloric acid allows several vitamins to be destroyed, proteins to be incompletely digested, and many minerals to stay insoluble. Gas pain and flatulence are inevitable. If the nutrition is not improved, more serious deviations from health can be expected.

Interference with energy production so limits the contractions of the walls of the large intestine that waste material remains in the large bowel longer than it should. The purpose of the large intestine is to conserve water by absorbing it back into the blood; the longer the wastes remain, therefore, the harder and drier the stools become. This condition is constipation. Poor elimination can be corrected by a diet adequate in the B vitamins. Except in cases of diarrhea or severe psychological disturbances, your elimination is a fair index of your energy production. Whenever energy is not produced as it should be, constipation occurs; when energy is readily produced, elimination is usually normal.

Heart abnormalities are also caused by the body's inability to burn sugar efficiently without vitamin B_1. Since the heart must work from birth until death, it must be continuously supplied with energy. In a mild deficiency a resting pulse may drop to 50 or even 40 beats per minute instead of the normal 72. As the vitamin deficiency becomes progressively more severe, the pulse alternates between slow during relaxation and rapid during exertion. Eventually it remains rapid, sometimes reaching 180 beats per minute or more. Irritation of the heart muscles by the accumulated lactic and pyruvic acids is believed to cause both the rapid beat and the enlarged waterlogged heart. I recall a sixteen-year-old girl, suffering from exophthalmic goiter, whose resting pulse dropped from 180 to 80 beats per minute during the first week after she added yeast to her diet. If adequate B vitamins are not given, the condition can increase in severity; the almost complete lack of vitamin B_1 can quickly result in death.

Neuritis frequently develops when vitamin B_1 is inadequately supplied. Like the brain cells, the nerves are particularly affected by this deficiency because they are exclusive sugar burners. Neuritis, which may take the form of trifacial neuralgia, shingles, sciatica, or lumbago, is characterized by a sliding scale varying from a dull ache to excruciating pain following the nerve channels. Such pain is thought to result first from the accumulation of acids and later from actual damage to the nerve cells. Headaches and nerve irritation which bring about nausea and vomiting may likewise be caused by these acids.

Neither persons nor experimental animals undersupplied with vitamin B_1 show all the symptoms of the deficiency. Symptoms of any deficiency vary in endless degrees among individuals and even in the same person from day to day. These same symptoms, however, occur again and again in both people and animals.

Any woman who reads about the experiments conducted at the Mayo Foundation must surely come to the conclusion that it is selfish wisdom to see that her family is given daily foods rich in the B vitamins; if she does not, she herself must be too deficient in these vitamins to think clearly.

CHAPTER 14

FOODS TASTE SO MUCH BETTER

YOU MEN can skip this chapter unless you want to learn how to spring like a tiger or are one of those creatures who enjoy fooling around a kitchen.

At first it may seem complicated to get your B vitamins from natural foods. Perhaps I can help you most by telling you how I have solved the problem in my family. I have had no white flour in the house for perhaps 20 years. All my flour is stone-ground whole wheat;[1] usually it is "organically grown," that is, grown on soil rich in humus, without commercial fertilizers. Such flour has a flavor infinitely more delicious than that of ordinary varieties. The machinery which grinds ordinary flour creates such heat of friction that the flour is precooked; its flavor is comparable to last night's chops reheated. So-called "enriched" flour is my idea of outright dishonesty; at least 25 nutrients are largely removed during refining, and one-third the original amount of iron, vitamin B_1, and niacin may be replaced. Such flour is "enriched" just as you would be enriched by someone stealing 25 dollars from you and returning 99 cents.

[1] If there is no health-food store in your community, you can purchase stone-ground flour from El Molino Mills, Alhambra, California; Paule Keene, Walnut Acres, Penn's Creek, Pennsylvania; Great Valley Mills, Ivyland, Bucks County, Pennsylvania; Elam Mills, Chicago, Illinois; Wight's Grist Mill, Old Sturbridge Village, Sturbridge, Massachusetts; Stone Buhr Milling Company, 3509 Evanston Street, Seattle, Washington; Whole Grain Flour Mills, 2611 North Jones Street, Chicago 47, Illinois; Huni Health Products, 207 East 87th Street, New York City; The Vermont Country Store, Weston, Vermont.

I frequently make my own bread, always with wheat germ added. Bread-making, I believe, is a creative art which will give satisfaction to the soul of any woman who masters it. To my way of thinking, the smell of bread baking is one of the joys of home life. The only argument against making it is that such bread is so delicious that one can easily eat too much. I get the flour from a health-food store or have the miller send it to me the day it is ground; then I make many loaves of bread the next day. Any bread not needed immediately and any flour left over I keep in the freezer; if either is left at room temperature, vitamin E and flavor may be destroyed. Flour, I believe, should be treated as a perishable commodity; I see no more reason for buying a quantity of flour now to be used next month than to buy milk today to be drunk 30 days hence.

The only other bread we have in the house is a wheat-germ bread made by a baker.[2] I buy many loaves of this bread at a time and keep it in the freezer. Children, given genuinely good bread, eat tremendous quantities of it.

I use stone-ground, whole-wheat-pastry flour for thickening gravies and making wheat-germ waffles, hotcakes, muffins, cookies, etc. I hold that no one has ever tasted delicious waffles until he eats them made with wheat germ and bakers' yeast (ref. 7, p. 34). I serve them frequently for suppers with creamed tuna, ham, or chicken.

All wheat germ should be refrigerated. If a fresh, sweet-smelling wheat germ cannot be obtained, the toasted kind is preferable. You can toast your own by spreading it on cookie sheets and putting it in the oven at 250° F. until slightly brown.

Wheat germ I use in dozens of ways. Brownies made entirely of wheat germ are delicious. My favorite dessert for guest dinners is walnut tort made by using wheat germ and

[2] The recipe for this bread is given on p. 273 of *Let's Have Healthy Children, op. cit.*

no flour. Recently a friend's husband wired me, "Loved your party loved your guests especially loved your dessert." I suspect that persons who think delicious foods cannot be prepared with whole-grain flours have never tasted genuinely good food. A friend who serves only health-building foods told me of entertaining guests intolerant of nutrition. One guest remarked on leaving, "Such delicious food could be prepared only by loving hands."

I rarely serve cereals because they contain so much starch. If used, they should be the whole-grain cereals. When I do use them, I cook them in milk and add generous amounts of powdered milk and wheat germ. I buy prepared cereals at health-food stores. My youngsters also enjoy toasted wheat germ mixed with powdered milk and fresh cream.

Rice polish (the bran removed when rice is polished) is about half as potent in most B vitamins as is wheat germ. Except in making cookies, I find it difficult to use. Brown rice is preferable to white. "Converted" rice is now available, so treated that the vitamins are carried into the center of the rice before milling; I use it almost entirely. I purchase whole-wheat macaroni, spaghetti, and noodles, from health-food stores and keep them under refrigeration; or I buy these same foods prepared for diabetics from the wheat protein (gluten) after the starch has been removed. The flavor in both cases I find superior to that of the usual varieties. Soy flour, which supplies protein, cholin, inositol, and some anti-stress vitamins, I use in tiger's milk (p. 114) and the best hotcakes I have ever tasted. It is good in breads, if you do not object to a heavy texture, and in cookies. Every effort should be made to see that your supplies are fresh. Nothing is so revolting as rancid wheat germ, weevily flour, or lumpy powdered milk.

Any of these supplies can be purchased from a health-food store. One cannot recommend such stores without qualification. A few of these stores are run by persons who have gained an amazing knowledge of sound nutrition; their stores are excellent, and their prices are fair. The percentage of food faddists, however, runs high among the store owners. I know of one who recommends vegetable-juice diets, spiritualism, and high colonics in the same breath. On the other hand, such a store is often the only outlet for stone-ground whole-grain breads and cereals, unprocessed oils, unheated nuts, raw nut butters, perhaps fertile eggs, and "organically" grown fruits and vegetables; they usually sell desiccated liver, tablets of vitamin D, enzymes, and hydrochloric acid at lower prices than do most drugstores. Go into some health-food stores, however, with your brain alert, your sales resistance high, and your tongue in your cheek.

I make my own yogurt which I enjoy more than any commercial variety I have tasted. My favorite recipe is to blend 2 cups water, 1½ cups powdered skim milk, and yogurt culture [3] or 3 tablespoons of either commercial yogurt or of the last batch of yogurt made. Then I add 1 quart water and 1 large can evaporated milk; after mixing well, I fill 8 glasses holding 8 ounces each. I set the glasses in a yogurt maker [3] or a pan of warm water coming to the brim of the glasses, cover the utensil, and keep the temperature at 105 to 120° F. for three hours, or until it becomes the texture of a pudding. If it takes more than three to five hours to become solid, you probably have sour milk, thickened by lactic-acid bacteria which cannot live at body temperature; hence it cannot make B vitamins for you.

Yogurt will keep well in the refrigerator for a week or more, its bactericidal qualities improving up to eight days after it is made (ref. 1, p. 62). We eat it plain or served with berries, pineapple, or other fruit, blended into applesauce, apricot purée, or salad dressings, made into sherbet or—my

[3] Available from International Yogurt Company, 8478 Melrose Place, Los Angeles 46, California.

favorite—into a maple-syrup sundae. Yogurt is a food which people usually either hate or love. Learn to enjoy it by the small-bite method, and do not expect fast results. Many persons I know eat an entire quart daily.

I serve kidneys frequently; kidney creole (ref. 7, p. 34) is hard to beat. Brains I bake in bacon rings, steam and then cream with ham or tuna, or serve liquefied in milk and added to scrambled eggs and soups; I have finally discovered they can be delicious. When liquefied, they have a texture similar to that of whipping cream and are amazingly palatable in ice cream and eggnogs. Unhydrogenated peanut butter and other nut butters are good old stand-bys; the untoasted varieties obtained from health-food stores are nutritionally superior to others. I keep peanuts, almonds, cashew nuts, and walnuts in the house at all times for children's lunches and afternoon snacks; they are excellent if the budget can take it. The cumulative amounts of B vitamins obtained from all of these foods is worthwhile indeed. Many of them are too high in calories, however, for those of us who are forced to lead sedentary lives.

If I am working under pressure, which seems to be most of the time, I eat liver daily for breakfast. Fortunately it is my favorite meat and has become the children's favorite, too. I sauté it, using the least fat possible to keep it from sticking, sear it on both sides, then turn off the heat, and let it cook slowly, uncovered, from the heat in the pan. If the liver is not the best, I roll it in flour or wheat germ before cooking it or eat it covered with catsup so that I cannot taste it. Raw liver is nutritionally superior to well done because enzymes, which can help you digest it, are not destroyed; I prefer mine medium well and rationalize that I can produce my own enzymes. Every type of liver, be it rabbit, lamb, pork, beef, or giraffe, supplies B vitamins.

If you are one of those people who hate liver yet truly desire the best health you can obtain, desiccated liver, dried under vacuum at below body temperature, is available; not by the farthest stretch of the imagination, however, could one call it palatable; 2 heaping tablespoons are equivalent to one serving, or ¼ pound, of fresh liver. I often tell people about it, saying they might try it if they want to. I have been surprised at the number of people who not only take it daily but claim it makes them feel so much better that nothing could make them give it up. I use it, stirred into water or tomato juice, when I cannot get fresh liver. Tablets of dried liver are expensive; 30 tablets are usually equivalent to a serving, or ¼ pound, of fresh liver. Concentrates of liver or yeast are available but have not been tested for the antistress vitamins; certainly none contains the marvelous protein of powdered yeast or fresh or desiccated liver.

For all practical purposes, brewers' yeast is the cheapest and best source of the B vitamins for a person not under stress. In fact, more nutrients are more concentrated in yeast than in any other known food. The use of yeast alone could correct the majority of the world's nutritional problems: the proteinless meals of China and India; the B-vitamin needs in the Orient and the tropics; the iron starvation of women the world over; and the trace-mineral deficiencies of both sexes of all ages of every nationality. Yeast can be grown in a few hours without acres of land or sweat of a laborer's brow, its nutritive value increased by the touch of a chemist's hand. It is said that three hundred years have been required to introduce most new foods, for example, potatoes and tomatoes. Perhaps by the year 2250, yeast will save our overpopulated planet from famine.

Yeast contains almost no fat, starch, or sugar; its excellent protein sticks to your ribs, satisfies the appetite, increases your basal metabolism, and gives you pep to work off unwanted pounds. If any food could be said to be "reducing," yeast is that food. Powdered yeast is preferable to flaked yeast which usually has a lower vitamin content, weight for weight. Moreover, 1 tablespoon of powdered yeast is the equivalent of 5 to 9 tablespoons of the light flaked. Yeast tablets are quite all right; 90 tablets are equivalent in mineral, protein, and vitamin content to 1 heaping tablespoon of powdered yeast. Uncooked bakers' yeast grows in the intestine, grabs the B vitamins supplied by other foods, and refuses to give them up; it is dangerous to take.

Just as you may not have enjoyed your first taste of coffee, you may not enjoy your introduction to yeast. The best way for a beginner to take it is to add no more than 1 teaspoon to a large glass of fruit juice; increase the amount very gradually as you become accustomed to it. I must warn you, however, that there are yeasts and yeasts. Some taste so bad that no human being should be expected to swallow them. If you dislike the yeast you have, feed it to the cat and/or dog, and buy a different brand. Some varieties, to one who is used to yeast at least, are quite palatable. The flavor is, of course, a matter of personal preference.[4]

One reason for taking yeast in small amounts at first is that, in case your digestion is faulty, yeast may blow you up like a zeppelin. Since faulty digestion is usually the result of inadequate B vitamins, the more gas you get from yeast, the more deficient you can know that you are in B vitamins, and the more you need the yeast. You might eat sugar by the cup and get no gas because it cannot support the growth of bacteria. Yeast is an excellent food, however; hence bacteria thrive on it. If you lack hydrochloric acid in your stomach or produce too few digestive enzymes, much of the yeast re-

[4] Your health food store, market, or grocer can obtain brewers' yeasts from Anheuser Busch, St. Louis, Missouri; Standard Brands, New York, N. Y.; Red Star Yeast Company, Milwaukee, Wisconsin; and Plus Products, Los Angeles, California. I have used them all, but I now use "Balanced-B" yeast from Plus Products (see footnote, p. 118).

mains undigested, and your intestinal bacteria have a feast; they form the gas. The healthy person digests the yeast completely and has no gas or feeling of fullness from taking it.

A method of taking yeast which will give you many times the pickup of yeast mixed in juice is taking it in a drink I call tiger's milk. Years ago a small boy named this drink, imagining it to be milk from a tiger which had given Tarzan his strength. If you once acquire a taste for yeast and make your tiger's milk properly, it can be delicious. The ingredients of tiger's drink are:

1 quart milk, preferably certified whole
1 teaspoon to ½ cup brewers' yeast, depending on whether you are a beginner or a veteran
¼ to ½ cup powdered skim milk or soy flour
½ can frozen orange juice or ½ cup apricot nectar or grape juice or ½ banana or 3 or 4 tablespoons chunk pineapple or frozen berries or any strong flavored fruit or 1 tablespoon blackstrap molasses

The trick in mixing it is this: pour approximately 2 cups milk into a liquefier or blender, start the motor, then add the dry ingredients and the juice or fruit; drink 1 glass diluted with ½ glass of milk, and pour the rest into the quart bottle containing the remaining milk. Keep in the refrigerator. It can be made with an egg beater or electric mixer, but either way is splattery, and the resulting tiger's milk is usually lumpy and unpalatable. In my opinion, a liquefier is worth buying just for use in making tiger's milk.

There are endless recipes for tiger's milk; the point is to find one you actually enjoy. I have been served this drink made with cocoanut milk, boysenberry juice, maraschino cherries, cranberry sauce, Hawaiian punch, yogurt, or buttermilk; or made into a milkshake by freezing milk into cubes and then liquefying them with the other ingredients. It is, however, important that tiger's milk be made with fruit or molasses to supply natural sugar, the potential energy which gives the pickup.

A number of health-building ingredients can be added to tiger's milk; 1 or 2 tablespoons of salad oil (it cannot be tasted if the oil is fresh); 1 teaspoon or more of calcium gluconate or powdered bone (p. 181); 1 tablespoon or more of soybean lecithin; several tablespoons of wheat germ; or, in case digestion is faulty, lemon juice or dilute hydrochloric acid (10 per cent solution). If either lemon juice or the acid is used, however, the amount should be too little to cause curdling; that, in turn, will depend upon the amount of yeast, powdered milk, or soy flour used. The acid, neutralized by the protein, will not change the flavor or harm the teeth as long as no curdling occurs. On the other hand, the more acid you can add without curdling, the more complete digestion will be.

In case you have difficulty in getting started, perhaps you would find comfort in knowing that others have had rough going too. Last year a young man consulted me because of extreme fatigue; he was finishing his doctorate at the University of California, but his fatigue was such that he feared he could neither face nor pass his comprehensive examinations. I suggested that temporarily he eat a half-pound of liver daily for breakfast. Apparently the ink did not take; he believed that I intended him to eat two pounds of liver each morning. He did his best but sent me the following complaint:

> My dear Adelle it is plain hell to follow your directions;
> But I do try hard, avoid all lard and all the fine confections.
>
> There is much to encourage and much to intrigue,
> So much to be grateful for this lack of fatigue.
>
> With devotion to you and in spite of my pride . . .
> One thing that I can hardly abide

Is rising each morning at the clang of clocks
  and facing the white vastness of the icebox
I withdraw with fright and begin to shiver
  on seeing that mountain of slippery liver.

But once it is down, my eyes open wider,
And I can drink deep of the milk from the tiger.

CHAPTER 15

I WISH I KNEW

PERHAPS a hundred times each year I am asked, "Is it all right to take tablets of B vitamins?" I simply do not know the answer. I wish I did.

There are times when such tablets are of value; I have recommended their use for short periods and have taken them myself. No one knows the harm they may do, however, when used as the only source of B vitamins, especially if continued over a long period. When they are taken together with liver, yeast, wheat germ, yogurt, and the most carefully selected diet possible, they probably do little or no harm. In this case they may not be needed unless your requirements are unusually high.

Such tablets generally contain a day's requirement of the cheap vitamins B_1, B_2, and niacin; a small amount of pantothenic acid and just enough vitamin B_6 to permit a statement of its content on the label. A vitamin catalogue reveals the reason: vitamin B_1, $3.50 per kilogram; vitamin B_6, $55.00 per kilogram. A few other B vitamins may be included but usually are not. Misleading labels often state that such tablets contain 200 to 500 milligrams of liver or yeast; one serving of liver, or less than 1/4 pound, is 100,000 milligrams; a heaping tablespoon of yeast is approximately 45,000 milligrams. What earthly value could 500 milligrams, or 1/50 ounce, of either be?

The proportions of each vitamin found in animal and human tissues and the amounts of each excreted daily in the urine of a healthy person on an adequate diet have been carefully studied. These proportions should apparently be maintained if health is to result. In case you take a tablet of mixed B vitamins, examine the label for the following: if your tablet supplies 2 milligrams of vitamin B_1, it should also contain equal amounts, or 2 milligrams, of vitamins B_2, B_6, and folic acid; 10 times more pantothenic acid and niacin than B_1, or 20 milligrams of each; approximately 20 times more PABA, or 40 milligrams; 500 times more inositol and cholin, or 1,000 milligrams of each of these two. I know of no studies of the amount of biotin required. Only 1 to 3 micrograms of vitamin B_{12} appear to be needed daily and possibly even less of the antistress vitamins. Does your tablet contain these proportions? I have never seen one which did.[1]

I believe that these preparations are dangerous unless they are taken only temporarily and with foods naturally rich in these vitamins; even then they should be recommended for you by a person who is thoroughly trained in nutrition. If you take one or more B vitamins, you increase your need for all the other vitamins in the B group. The increased need for the ones you do not take may cause you to develop deficiencies of them; these deficiencies may cause far more harm than the vitamins which you take can do good. For example, during World War II when defense plants were selling tablets of cheap B vitamins and urging workers to take them, dozens of persons with eczema consulted me. Invariably these persons were interested in their health and figured that if one tablet daily was good, three or four would be better. I told them to discontinue the tablets immediately. Usually it took a few days before they purchased the foods I recommended, and in this interval the eczema often cleared up. I became convinced that the B vitamins they were taking had increased their need for pantothenic acid, vitamin B_6, PABA, and/or biotin, a lack of any one of which could have caused the eczema. These people not only suffered from

[1] Since the publication of this book, such B complex tablets (Formula 49) have been prepared. A yeast ("Balanced B"), having these proportions, has also been developed for the first time. Both can be obtained from Plus Products, 2302 East 38th Street, Los Angeles 58, California.

eczema but also from fatigue, constipation, and multiple symptoms which these very tablets are supposed to prevent.

The problem of obtaining adequate amounts of all the B vitamins largely from natural sources when living in a hotel or traveling is a challenging one. I travel a fair amount and often must live in hotels. At such times my requirements for these vitamins are unusually high because I am lecturing or rushing from one engagement to the next or interviewing patients for physicians, often talking 10 hours without a break. For me, fatigue prevention at such times is paramount. I carry tablets of mixed B vitamins; wooden spoons, yeast and/or desiccated liver or yeast mix [2] which I take stirred into water before leaving the hotel room in the morning and perhaps again at noon and/or in the evening. At most hotels, liver and yogurt are available; if not, I ask the *maitre d'hôtel* to order them for me. Wonderful people from coast to coast simplify my travel problem by inviting me to their homes. I doubt that there is another person in this entire United States who is served such marvelous meals of nutritious and delicious foods, although one hostess told me recently that the thought of my coming made her as nervous as if she were entertaining Socrates. Had she known that I washed my face in a granite wash pan until I was nearly old enough to vote, she might have relaxed.

The question of the quantity of B vitamins which should be taken daily is impossible to answer. The foods themselves vary widely. No two people have the same requirement, and every individual's requirement changes from day to day. For these reasons, the daily allowances suggested by the National Research Council have been purposely omitted from this book.

[2] Obtained from Lindberg's Nutrition Service, 3951 Crenshaw Boulevard Los Angeles 8, California, or from Plus Products, 2302 East 38th Street, Los Angeles 58, California. Any nutritional supplement mentioned in this book can be obtained at reasonable cost from either of these sources.

Since all the B vitamins appear to be needed by every cell in your body, the amount required depends on how many cells you have. If you are small boned and short, you have relatively few cells, and your B-vitamin needs are probably moderate. Stored fat, of course, has no nutritional requirements. Your need for these vitamins, therefore, is in proportion to your ideal weight rather than to your actual weight. The larger your body structure and especially the more pounds of actual muscle you have, the larger the quantity of these vitamins you need.

Vitamin B_1 is used in changing sugar into energy or fat; hence the more starches and sugar you eat, the more of this vitamin you need. Similarly, if your diet is high in fat, you need more inositol and cholin. In one way or another, all B vitamins appear to be concerned with the utilization of foods. The person who eats large amounts of food, therefore, needs far greater quantities of these vitamins than do persons with small food intakes.

Since these vitamins are concerned with the production of energy, the more exercise you take and/or the harder you work, the more of these vitamins you need. Obviously, your requirement will be higher on the days you work hard than when you are vacationing. Also the less sleep you get, the more of these vitamins you need.

The requirement of all vitamins appears to be greatly increased by stress. Your need, therefore, will depend upon the number and severity of stresses you are under. A person might be upset over a pending divorce (stress 1), working long hours under pressure (stress 2), getting too little sleep (stress 3), taking thyroid tablets and benzedrine to keep going (stresses 4 and 5) and sleeping tablets to relax (stress 6), worrying over a sick child (stress 7), and suffering from a sinus infection (stress 8); his requirements for these vitamins are tremendous indeed. I frequently find persons harassed by as many as 15 or 20 different stressor agents at one time. If you are such a person, it seems to me you have three possibilities: live on yeast, liver, yogurt, wheat germ, and even B-vitamin tablets; or remove the stresses; or look forward to ill health.

Your need for these vitamins also appears to be in proportion to the amount of liquid you drink. Years ago, Dr. George R. Cowgill of Yale University produced B-vitamin deficiencies in animals by force-feeding them water. Alcoholic drinks of all varieties increase the need for the B vitamins; these vitamins are needed in utilizing the alcohol in the body and are washed through the body by the liquid. Recently—I am sincerely sorry to write this—scientists at the University of Wisconsin have produced multiple B-vitamin deficiencies merely by feeding animals coffee. Animals thrived when given caffeine without water. It would appear that caffeine, by stimulating the heart beat, increases the flow of blood plasma through the kidneys and thus causes more of the B vitamins to be lost in the urine. So far no one seems to have investigated tea, but it is a fairly safe bet that the effect will be the same as that of coffee.

Heavy coffee drinkers almost invariably show symptoms of B-vitamin deficiencies even when their diets are excellent. I strongly suspect drinking large amounts of coffee is one factor contributing to the graying of hair and perhaps to baldness. Even drinking too much water may be unwise. This problem of liquid intake is probably more important than is appreciated.

Through the years I have been consulted by many persons who make a fetish of building health. For example, a woman recently told me that her breakfast was whole-grain cereal, hand ground immediately before it was cooked, on which she put powdered whey, bone meal, sunflower seeds, powdered milk, yeast, rice polish, cream, and "raw" sugar. Her husband commented that it was like compiling a compost heap; he was (understandably) intolerant of her ideas (an understatement). Even with such carefully selected foods, this woman and others not unlike her showed symptoms of severe B-vitamin deficiencies. Invariably I find these people not only believe that one should drink eight glasses of water daily but actually do it. Large amounts of water, coffee, beer, soft drinks, or any liquid wash these vitamins out of your body. On very hot days when B vitamins are lost in perspiration and you drink large amounts of liquids, your need for these vitamins is tremendously increased.

It seems to me there is only one way to determine the quantity of these vitamins which will make you feel your best: find your own dosage. Learn how to vary the amounts from day to day depending upon your own body structure, the quantity and type of food you eat, the strain of your work and exercise, the stresses you are under, and the amount of liquid you drink. For example, during the summer when I vacation in the mountains, I eat yogurt occasionally and take only a tablespoon of yeast daily, usually in juice. When working moderately hard, I drink 1 or 2 glasses of tiger's milk made with ½ cup of yeast and have some yogurt daily. If under stress, I eat 1 cup of yogurt and ¼ pound of fresh liver or take 2 tablespoons of desiccated liver in addition to the tiger's milk; on the days when the going is really tough, I have liver and yogurt and drink a quart of tiger's milk containing 1 cup of yeast.

The one day when I experienced the most exuberant feeling of well-being and felt that my mind was clearest was a time when I was under considerable strain. I was asked to give an intensive post-graduate course in nutrition to physicians and dentists. The procedure was to lecture from 9 A.M. until 5 P.M. with a five-minute break every hour. I was told that the last lecturer to give such a course had blacked out from exhaustion at the end of the day. I realized that if I were to sell nutrition, I had to stay rested and my mind alert. Frankly, I was frightened. I therefore had fruit with yogurt, liver and tiger's milk at breakfast; milk and a huge serving of lobster for lunch, chosen because lobster is rich in glycogen which would be changed slowly to sugar as the protein digested and would thus give a sustained pickup; and tiger's milk at 10 A.M. and 2 and 4 P.M. Although I stood except during lunch and spoke without a microphone, I did not experience one second of fatigue throughout the day or evening or even the next day when I kept expecting a letdown. This experience convinced me that, for the relatively healthy person, fatigue can be completely prevented.

The real test, I believe, is this: if you are never tired, the chances are that your intake of B vitamins is adequate or that your intestinal bacteria are pretty efficient. If you experience fatigue, your intake is probably too low. A man said to me recently, "You never realize how terribly tired you were until you've found out you don't need to be tired at all."

CHAPTER 16

A PLEA FOR CAUTION AND OPEN-MINDEDNESS

ALTHOUGH one could argue endlessly as to the differences between experimental animals and humans, the fact remains that almost everything learned about positive health has first been found in experimental animals and its counterpart later recognized in humans. I know of no exception. In our present state of ignorance concerning the B vitamins, it seems to me we must have caution in believing that the cheap B vitamins supply all the body requirements, that bacterial synthesis in the intestines takes care of the other B-vitamin needs of each individual, and that the B vitamins still little known or unknown are not important.

Let us consider, for example, heart disease. Heart failure is not produced in animals when they are deficient in vitamins A, C, D, and K, in any of the minerals, or in sugar, protein, or fat. Heart damage or collapse or failure is produced when animals are undersupplied with almost any one of the B vitamins. The thousands of persons who have died from the B-complex-deficiency disease, beriberi, have died of heart failure. In Denmark during World War I and in England during World War II, when wheat germ remained in all breadstuffs and decreased calories reduced the B-vitamin requirements, the incidence of deaths from heart disease dropped markedly. Dr. Morrison's spectacular results (ref. 5, p. 80) in treating coronary occlusion and coronary thrombosis with B vitamins cannot be ignored. Animals under stress not given the antistress B vitamins die of heart collapse, often while *still having all the appearances of health.* There is absolutely no proof that the human counterpart of these deaths is not widespread.

Six times more men than women die of heart attacks. It is recognized that men, as a rule, need much larger amounts of B vitamins than women do; men are usually larger, have more muscle tissue, do harder physical work, take more vigorous exercise, are submitted to greater and more numerous stresses, and often drink larger amounts of coffee and alcohol, each of which increases the need for the B vitamins. Perhaps men's greater need for these vitamins has caused more men than women to die of heart disease.

The scientist working with deficient animals for years learns to predict when death will occur. Similarly, those of us in clinical nutrition can sometimes predict death with depressing accuracy. One has only to watch an individual, learn of his dietary habits, and estimate his vitamin-B requirements to guess the severity of his deficiencies. He may appear to be healthy, but usually many telltale signs are obvious.

Not long ago a friend invited me to a lecture on psychology. She was much annoyed afterward because I commented that I could not listen to what the lecturer said for observing his numerous symptoms of multiple B-vitamin deficiencies and especially the way he breathed. I told her that unless he improved his diet, he would die soon of a bad heart.

"Oh, you!" she exclaimed in disgust. "All you can think of is nutrition!"

The following week, when this man actually dropped dead, her disgust changed to amazement.

I recently watched another seemingly healthy man who sneered at the idea of adequate nutrition but whose requirements for the B vitamins were extremely high; some 10 days after I had predicted that he could not live long, he died of heart disease. Anyone working in clinical nutrition could cite similar examples. Try it yourself. You will find it so easy as to be frightening. A man who has had warning in the form of a heart attack is lucky indeed because he usually takes more rest and thus decreases his vitamin requirements and/or improves his nutrition so that his body needs are met.

The statistics, "885,190 men died of heart failure last year," are cold and meaningless. But after you have known dozens of these men and seen the sadness of their children and the loneliness of their widows, these statistics become cruelly and tragically alive. You find you care not one iota that the findings proved by animal research are not yet accepted as proved with humans. If the work with animals indicates that lives can be saved, we should apply this knowledge and let the proof come later. A doctor friend, as intolerant as I with the purely scientific attitude, asks persons who defend it, "Have you yet time?"

What kind of men are they who are being taken off by heart failure? They are not the lumberjacks, the ditch diggers, or others who can eat large amounts of food and in so doing obtain at least a certain amount of nutrients. Rather, they are our leaders, our executives, our outstanding men, whose lives are largely sedentary. A friend of mine especially interested in this phase of nutrition has kept hundreds of clippings from newspapers: "Stettinius Collapses of Heart Failure," "General Arnold Dies from Heart Attack," and on and on.

At the height of Wendell Willkie's career he died of pneumonia, although physicians have prevented such deaths since the sulfonamides came into use; the real cause was the coronary attack which preceded the infection. Within recent years other important figures have died of heart disease: Maurice J. Tobin, former Secretary of Labor; John H.

Paxton, American Consul; Stephen Early and Joseph H. Short, White House press secretaries; Francis A. Truslow, appointed Minister to Brazil; and Beauford H. Jester, Governor of Texas. Outstanding men in all fields have recently died of heart attacks when still young: the Reverend Joseph P. Connor, priest and composer; Dr. Donald A. Stauffer, educator, poet, critic, and novelist; Horace Underwood, educator; Michel Licht, poet and translator; William J. Conners, Jr., publisher of the *Buffalo Courier;* Roger Riis, *Reader's Digest* roving editor; Fulton Oursler, author of best sellers; Dr. Louis Wirth, sociologist; Edwin Leland James, managing editor of the *New York Times;* Joseph K. Howard, editor, author, and historian; Albert L. Baker, wartime leader of the Manhattan Project; Arthur Szuk, miniature painter and caricaturist; Leo Pasvolsky, economics expert; David L. Behncke, president of Air Line Pilots' Association; Walter Geist, president of Allis-Chalmers Manufacturing Company; and Lewis Brown, president of the Johns-Manville Corporation. The Army and Navy have been saddened by untimely deaths from heart disease: Captain W. R. Edsall, skipper of the battleship *Missouri;* Admiral Forrest Sherman, U. S. Chief of Naval Operations; Major General Bryant Moore, Commander of the U. S. Ninth Corps; Major General Robert A. Soule, former division commander in Korea; Dr. Walter Van Dyke Bingham, the Army's chief psychologist; and Major Samuel Woodfill, Medal of Honor winner. Sports fans grieved on hearing that heart attacks had taken Joseph Jackson, baseball's great hitter; Norman Ross, former Olympic swimming champion; "Big Bill" Tilden, the tennis champion; Joe H. Palmer, sports writer; and Jacob J. Galomb, of the nation's largest sports equipment enterprise. Entertainers felt little like entertaining after the news that their colleagues were gone: Al Jolson, singer and comedian; John Garfield, actor of stage and screen; J. Edward Bromberg, character actor; Val Lewton, movie producer; Lamar Trotti, oscar-winning screen writer and producer; and young Hank Williams, singer and composer, who died when only twenty-nine. Not one man among these was old when a heart attack stopped his career. The average age of this group was only fifty-five years when death came. More than one-fourth of these outstanding people did not live to celebrate their fiftieth birthday. My friend adds another clipping from almost every newspaper he picks up.

Brilliant men are often taken at their very prime of life, perhaps in their early forties, after they have gained the education and experience which qualify them for splendid leadership. The years they should have lived would have been the years when their contribution would have been greatest. No country can afford the loss of such a tremendous asset.

Recently I had the opportunity to study such a person, a man of fifty-five years, 190 pounds, with a magnificent physique so rare in middle-aged men. This man is brilliant; moral strength, character, and integrity show in every line of his face. As an international leader, he is making no small contribution toward world peace, but the pressure he is under is unrelenting. Like so many leaders, his work keeps him traveling constantly. He must eat in restaurants where it is literally impossible to obtain adequate B vitamins; he is being entertained by hostesses from coast to coast, and guest meals, as a rule, are even nutritionally inferior to restaurant meals. Women who ordinarily serve whole-wheat breads, milk, perhaps fruit for dessert at family meals substitute white rolls, wine, coffee, and some oversweet pastry when entertaining. A psychologist friend says that when one offers food to one's guests, one is really offering love; if this be love, I say that it lacks depth. Since graciousness demands that such food be eaten, this man has gained 20 hated pounds during the last year. He tries to maintain his health and normal weight by vigorous exercise. In this case it is tennis, not ordinary tennis but hard games played with professionals.

Although one might consider this man to be in perfect health, close scrutiny and conversation revealed many signs of deficiencies: attacks of gout, showing rapid tissue destruction brought on by stress; concern over elimination; fatigue from exertion which should have caused no fatigue; nervous twitches when extremely exhausted; such exhaustion being fought off with coffee, and tension relaxed by whisky and soda. Although this man expressed the desire for 25 more years of useful, active life, my reaction was, thinking of his large frame, his added pounds, the tremendous pressure of his work, the intensity of his athletics, and the dire inadequacy of his food, that he would be lucky indeed to live another five years. Never in my life have I wanted so much to help another human being; yet this brilliant person knows so little about the needs of his body and I so little about psychology that I failed to do anything more than to antagonize him. One can only pray to God that this man and the thousands of wonderful men like him can learn the rudiments of nutrition before it is too late.

The circumstances in the lives of our leaders who have died at their prime in recent years are frighteningly similar to this man's. Yet few persons, if any, can study nutrition without obtaining the conviction that every one of these men could have enjoyed 20 or 30 more productive years.

It will be long before our state of ignorance can be changed to one of enlightenment. In the meantime, let us be open-minded, remembering that the experimental work with animals does eventually find its human counterpart and that the counterpart of the scientist's report, "The animals died apparently of heart congestion although they still had the appearance of good health," may be found in the widow's anguished cry, "He was never sick a day in his life."

Let us be cautious in feeling secure that a mere capsule of mixed B vitamins will supply the body's requirements. Let us realize that, in respect to the B vitamins at least, our needs must be met largely by wholesome foods chosen with utmost care. Let us keep on the alert for new findings, being aware that the nutrients which may have the greatest effect upon our health are still to be discovered. Let us stay open-minded to the fact that although nutrition is known to be important in maintaining health, the extent of that importance is still to be learned.

CHAPTER 17

THE TWO-HUNDRED-YEAR-OLD VITAMIN C

ALTHOUGH the word vitamin was not coined until this century, vitamin C has been known for over 200 years; its deficiency disease, scurvy, has played a major role in history. In 1754 James Lind wrote a treatise on scurvy recommending lemon juice for its prevention or cure. Despite the fact that we live in a land of plenty and our need for this vitamin can scarcely be called news, surveys show that three-fourths of our population receive less than the minimum daily allowance recommended by the National Research Council.

All fresh, growing foods contain vitamin C, or ascorbic acid. The richest sources are citrus fruits, guavas, ripe bell peppers and pimientos, and the seed pods of wild roses, known as rose hips. During World War II, the English extracted quantities of vitamin C from rose hips, simultaneously using hops from beer for the B vitamins; a wit remarked that England's magnificent strength was maintained by "her hips and her hops." Tomato juice, cabbage, and fresh strawberries are fair sources. Scurvy has resulted whenever people have been unable to get fresh foods.

One function of vitamin C is to help form and maintain a strong cement-like material, known as collagen, which holds together every cell in your body. The amount of collagen required uses about a third of all the body protein. The collagen serves much the same purpose as cement does in a brick building except that the "concrete" in a healthy body is in the form of a stiff jelly, like gristle or a tough gelatin, known as connective tissue; thus every cell in your body "reposes" in a protective bed of jelly. This connective tissue is concentrated in the cartilage, the ligaments, the walls of all the blood vessels, the base of the bones and of the developing teeth, and gives all of these structures both great strength and elasticity. Although vitamin C is necessary for the formation of this tough jelly, adequate calcium must be present before the "jel" can set.[1] Calcium is not part of the structure; it merely has a stiffening effect much as pectin does. In fact, pectin is to the plant world what connective tissue is to the animal body; neither can be formed without vitamin C or be strong in the absence of adequate calcium.

Strong connective tissue plays a role of far greater importance than has heretofore been appreciated. Cell walls are only a few molecules thick; almost any harmful substance can penetrate them, whether it be virus, poisons, toxins, dangerous drugs, allergins or other foreign materials which often gain access to the body. Strong connective tissue is not easily penetrated; thus the cells are protected. An undersupply of vitamin C, however, allows this tissue to break down; a lack of calcium allows it to weaken; protective doors are flung open, and pirates are invited in.

The walls of blood vessels must be able to expand or contract, depending on the amount of blood needed at a certain place and time; hence elasticity and strength are of paramount importance. Normal blood vessels are amazingly elastic, like rubber bands. Although a partial lack of vitamin C causes changes in all blood-vessel walls, those of the capillaries, made of single cells cemented with minute quantities of connective tissues, are affected most. When a deficiency exists, therefore, the capillary walls readily break

[1] Mary E. Reid, "Interrelation of Calcium and Ascorbic Acid," *Physiological Review,* XXIII (1943), 76.

down, and blood is freed into the tissues. These tiny hemorrhages occur first in the intestinal walls, the bone marrow and joints, sometimes causing pain spoken of as "rheumatism." When the walls break near the surface of the skin, the freed blood discolors to produce a bruise. Regardless of the severity of a blow, a bruise shows brittleness and loss of elasticity in the blood-vessel walls; it is usually the first visual evidence of a vitamin-C deficiency, especially in women and children. "Pink toothbrush" may be the first symptom in men, who bruise infrequently because their muscles are generally harder than women's. Bruises and bleeding gums are both important danger signals. When adequate vitamin C is added to the diet, however, the capillary walls become strong within 24 hours.

A subtle lack of this vitamin causes profound changes in growing teeth. A deficiency in childhood causes slow dental growth or temporary cessation of growth. The dentin formed during a deficiency is porous and soft; if decay later penetrates the enamel, it meets little resistance; the pulp quickly becomes infected; the tooth dies and is probably lost. Experiments with labeled minerals show that when vitamin C is added to the diet of a child lacking it, normal dentin formation is resumed within a few hours.

If vitamin C is inadequate, the foundation of the bones partially breaks down, minerals are lost, the bones become rarefied and brittle and lack elasticity and strength; such bones break easily. Even when generous amounts of calcium and phosphorus are available, they cannot be deposited in the bones because the collagen base is too weak to hold them.

If vitamin C is generously added to a diet otherwise adequate and the vitamin is well absorbed, dramatic changes take place in the bones whether during childhood or advanced age. New bone foundation forms within 24 hours, and minerals, if available, are quickly laid down. Bones thus continually change; a deficiency of vitamin C during the winter, followed by generous amounts from summer fruits and vegetables, produces alternate softening and strengthening of the bones, causing them to break easily at one time and to resist fractures at another.

Gum tissue fits tightly around the base of each tooth in a healthy mouth; it does not bleed even when brushed vigorously with a stiff-bristled brush. If vitamin C is undersupplied, the gums become puffy and spongy and bleed easily. Ever-present bacteria live on the dead cells of the gum tissue, and infections such as pyorrhea pockets often develop. When such patients have the pockets cleaned out and an adequate diet is eaten, soreness and inflammation often show marked improvement in a few days. A lack of vitamin A or niacin, however, also causes susceptibility to gum infections.

In pyorrhea the gums not only bleed easily and become infected, but much bone surrounding the teeth is destroyed, causing them to become loose. When guinea pigs (used experimentally because most animals produce their own vitamin C) are kept only mildly deficient in this nutrient, a condition strikingly similar to pyorrhea develops in nine months, which is equivalent to 40 years of human life, the age when pyorrhea most frequently appears. It seems probable that a subtle undersupply of vitamin C over a period of years plays a causative role in the onset of pyorrhea. Typical pyorrhea, however, is not uncommon among malnourished children and adolescents. If the infection is not too far advanced, an entirely adequate diet unusually high in vitamin C can restore oral health.

Scar tissue formed in healing wounds and injuries is a connective tissue made of collagen which depends on both vitamin C and calcium for strength. During the First World War it was noticed that wounds healed slowly or failed to heal unless fresh foods were eaten. Experiments prove that speed of healing and strength of the scar tissue are directly proportional to the vitamin-C intake. Operative patients deficient in this vitamin not only heal slowly, but their wounds frequently break open. When 4,000 milligrams or more of vitamin C has been given daily to such patients, the speed of healing is often dramatic. Medical journals have urged all physicians to recommend large amounts of this vitamin before and after surgery.

Vitamin C is especially important in the healing of broken bones. When it is lacking, a collagen bone base fails to form; hence the ends of the broken parts are unable to knit. Such abnormal healing occurs frequently in older persons whose diets are notoriously deficient in multiple nutrients. Bones heal readily at any age when an adequate diet is given and steps are taken to assure normal absorption. Protein, calcium, vitamin D and other nutrients, however, are equally as important as are large amounts of vitamin C.

Although not yet understood, vitamin C apparently plays a role in maintaining normal vision. In healthy eyes, the vitamin is concentrated in the lens; the vitamin is lacking or reduced in the lens of persons having certain types of cataract. Experimental cataracts have been produced by a restricted vitamin-C intake. Marked improvement in eye infections and inflammation of the eyes often follows when large amounts of vitamin C are taken.

This vitamin cannot be stored in the body. The tissues, however, can be saturated as a sponge might be saturated with water. The state of saturation, in which every cell has all of this vitamin it can use, is considered to be most compatible with health. After saturation occurs, any excess vitamin C obtained is promptly thrown off in the urine. The amount of vitamin C found in foods, blood, or urine can easily be measured. The tissues of seemingly healthy persons whose diets have been inadequate frequently soak up as much as 4,000 milligrams of this vitamin before any is excreted; this amount is equivalent to 40 glasses of fresh citrus juice. After saturation, the amount of vitamin obtained minus that lost in the urine gives the requirement for a particular day. By this method requirements of different people under various circumstances have been studied.

About 50 milligrams of vitamin C appears to be needed daily by the genuinely healthy adult to prevent scurvy, provided his tissues are already saturated; 75 to 100 milligrams is recommended by the National Research Council as the minimum intake. This amount can be supplied by a glass of fresh orange or grapefruit juice. The scurvy-preventing requirements of vitamin C appear to increase with advancing years, probably because absorption is often faulty and much of this vitamin is destroyed in the intestine when the stomach fails to produce normal amounts of hydrochloric acid. Studies show that the aged are appallingly deficient in this vitamin. Dr. Walter H. Eddy of Columbia University pointed out years ago that many signs considered typical of old age are actually symptoms of scurvy: wrinkles, or loss of elasticity of the skin; loss of teeth; brittleness of bones. Certainly the person who wishes to retain his youthfulness should see that his ascorbic-acid intake is ample.

The vitamin C in all plants is produced, by the aid of enzymes, under conditions of warmth and moisture at which the plant grows best. Unfortunately, the action of the enzymes is reversible; they can quickly destroy what they have made. After a food is harvested, the destruction of the vitamin occurs most rapidly under the same conditions as those at which the plant grew best, that is, in a heated market or a warm room. Furthermore, the enzymes destroy the vitamin by combining it with oxygen; hence, if a fruit or vegetable is peeled or chopped, the destruction is unusually rapid. The enzymes are kept inactive by refrigeration or are destroyed by heat at about 140° F. Since the vitamin dissolves in water, much or all of it is lost when foods are washed slowly, soaked, or boiled. The average housewife, untrained in nutrition, is a genius at destroying vitamin C before the food can be swallowed.

For practical purposes, the best source of this vitamin is citrus fruits and juices. Fresh orange juice averages 130 milligrams for an eight-ounce glass; grapefruit and lemon and canned orange juice, about 100 milligrams. Frozen orange juice may be as rich as fresh or may contain little, depending on the type of oranges from which the juice came, the method of extraction, and the length of time it has been stored. Often culls, containing little vitamin C, are used for juice. In general, the sweeter oranges, to which no sugar need be added, have the highest vitamin-C content. Other juices, such as apple, pineapple, or grape, are not good sources, whether canned, frozen, or fresh. Tomato juice may supply 30 milligrams of vitamin C per glass or may contain none. A ripe pimiento or bell pepper or one California persimmon often contain 300 milligrams of vitamin C, whereas ½ cup of guavas may supply 1,000 milligrams.

Tomatoes, both fresh and canned, all salad greens, fresh strawberries, and raw cabbage average 30 to 50 milligrams per serving. Green vegetables, such as spinach, Brussels sprouts, and broccoli, may be good sources, but 50 to 90 per cent is often lost in the water in which these foods are cooked. Apples, bananas, lettuce, potatoes, and peas may supply only 20 to 30 milligrams per serving but are important sources because of the quantities eaten. Foods such as butter, cheese, eggs, all breadstuffs, and dry beans lack ascorbic acid. Milk and cooked meat other than liver contain almost none.

Climate, soil, the degree of ripeness, storage, temperatures and methods of handling, cooking, canning or freezing all affect the vitamin-C content of foods. Little ascorbic acid is destroyed when foods are quickly frozen, but losses of 90 per cent may occur within an hour after the food has thawed. The variations are so great that tables of food analysis are of little value; hence they have been omitted.

Since citrus juices are the most dependable sources of vitamin C, a glass should be drunk daily by every child and adult. It is wise to serve a fresh salad at each lunch and dinner and to have appetizers of fresh fruit on the menu frequently. Studies have shown that people living on the Pacific Coast buy three times more vitamin C on the same budget than do those on the Atlantic Coast. Even today when frozen foods are widely used, fewer vitamin-C deficiencies occur in summer and fall when fresh foods are available than in winter and spring. This deficiency is especially common among the poor of all ages and the aged of all economic groups. If care is given to the purchase and preparation of food and the planning of menus, adequate vitamin C can be obtained even when little money is available.

The changes in collagen breakdown can be swift, harmful, and hidden. For this reason, a bruise should be interpreted as a danger signal, indicating that more vitamin C should be added immediately to your diet.

CHAPTER 18

A FINGER IN EVERY PIE

ALTHOUGH it has been known for centuries that a person dying of scurvy could make a startling and dramatic recovery if fresh foods were given him, vitamin C can bring about other startling and dramatic recoveries only recently discovered. Most of the research being done is still unpublished; only a few articles have yet reached the medical journals.

Aside from helping to build collagen, this vitamin appears to be a busybody with its fingers in every pie. When toxic or poison substances gain access to the body, adequate vitamin C, if available, detoxifies them, making them harmless. The toxic substance apparently combines with the vitamin, and the two are excreted together in the urine; this combination is now given the name of ascorbigen.

It has long been known that during infections and diseases, vitamin C disappears from the blood and urine; that the more vitamin C given, the less ill the person usually is, and the more quickly he recovers; and that 20 to 40 times more of the vitamin has to be given during illnesses to keep the tissues saturated than during periods of health. Furthermore, antibodies are unable to render bacteria harmless unless vitamin C is adequately supplied. Antibodies must be helped by a complement; if there is no vitamin C, there is no complement. Vitamin C seems equally helpful whether the disease is caused by virus or bacteria or is non-infectious, as is gout, arthritis, or a stomach or duodenal ulcer. Almost endless infections and diseases have been studied: colds, polio, rheumatic fever, tuberculosis, diphtheria, infections of the prostate, ears, eyes, sinuses and tonsils, the childhood diseases and many others. In every case, vitamin C appears to be the good little Christian ready to soothe the aching brow.

It has been found that vitamin C can prevent or cure chemical poisoning. This vitamin has been valuable in correcting the toxic effects of lead, bromide, arsenic, benzene, and many other substances which sometimes gain access to the body, especially of persons doing industrial work.

Studies have proved that vitamin C helps to prevent allergies; if enough is given, it can detoxify the harmful effects of allergins which have entered the blood, whether they be pollens, dusts, dandruff, or foods. This vitamin seems to be equally effective in treating all varieties of allergies, whether rhinitis (stuffy nose and/or postnasal drip), hay fever, asthma, eczema, or hives; spectacular relief often results from massive doses of vitamin C. Even the effects of poison oak and poison ivy often disappear when sufficient vitamin C is taken.

Any foreign substance reaching the blood appears to be more or less toxic; the harm is prevented by vitamin C, but the vitamin itself is destroyed in the process. For example, every drug apparently destroys vitamin C in the body. When a drug promises to save your life, the vitamin destruction is unimportant; if it is being taken promiscuously without a physician's prescription, both the drug and the vitamin loss may be unnecessary. It has been found that a single tablet of any one of several drugs widely used and considered harmless can continue to destroy vitamin C in the body for three weeks after the drug is taken. The *Journal of the American Medical Association* carried an editorial entitled

"Is Aspirin a Dangerous Drug?"[1] pointing out that aspirin had proved more dangerous in England and Europe than in America because our diets contained more vitamin C with which to detoxify it.

This vitamin appears to play no major role in producing energy; yet it helps to prevent fatigue. For example, a group of soldiers was given vitamin C until the tissues were saturated. Their performance was compared with that of a similar group not given the vitamin. After maneuvers involving carrying heavy equipment, walking miles, and climbing mountains, the soldiers given vitamin C experienced little fatigue, recovered quickly, and had no leg cramps, whereas the other soldiers suffered severely from cramps and fatigue and did not completely recover for days. The harmful "ashes" left from incompletely burned fats, known as acetone bodies, which accumulate in the tissues when the blood sugar falls below normal, is a major cause of fatigue; these acetone bodies are detoxified by vitamin C.

Vitamin C seems to help everything by being destroyed by everything. For a nutrition consultant, the situation as regards vitamin C becomes progressively more embarrassing. No one seems to be in danger of coming down with scurvy; yet almost every person has abnormalities which vitamin C has been proved to help. In order to do good work, a nutritionist seems to have to accept the fact that people think him a crackpot hipped on liver, yeast, orange juice, and vitamin-C tablets.

The quantity of vitamin C needed to detoxify a foreign substance depends upon the amount of that substance gaining access to the body. Relatively small quantities are required by the healthy person to prevent harm, particularly when adequate calcium is absorbed (p. 132). Many toxic

[1] Editorial: "Is Aspirin a Dangeorus Drug?" *Journal of the American Medical Association*, CXXIV (1944), 777.

substances, however, might enter the body simultaneously. For example, a person suffering from allergies and doing industrial work where toxic chemicals have reached his blood might suffer from a serious infection which prevents him from eating and for which he is given various drugs; his temporary need for vitamin C would be tremendous indeed. Fortunately, even massive doses of this vitamin are thought to be harmless; any excess not needed in the body is quickly lost in the urine.

Dr. Klenner, Chief of Staff at the Memorial Hospital in Reidsville, North Carolina, appears to have given the largest quantities of this vitamin to date, usually by injection.[2] It was my good fortune to visit with Dr. Klenner recently and hear him lecture. He showed slides of hospital records and fever charts and told of case after case of meningitis, encephalitis, polio, virus pneumonia, and serious complications following scarlet fever and other diseases treated with massive amounts of vitamin C. Many patients had not been expected to live; often penicillin, aureomycin, and other antibiotics had been given without success; in most instances, fevers ranged from 103 to 105° F. Within a few minutes after the vitamin was injected, fevers started to drop and temperatures often reached normal within a few hours. Usually the patient enjoyed the next meal and was ready to be discharged from the hospital in two or three days. The amount of vitamin given varied with the severity of the illness. The initial dose was usually 2,000 to 6,000 milligrams (2 to 6 grams), followed four and eight hours later by a second and a third injection of 2,000 to 4,000 milligrams if the

[2] Fred R. Klenner, "The Use of Vitamin C As an Antibiotic," *Journal of Applied Nutrition,* VI (1953), 274; "Massive Doses of Vitamin C and the Virus Diseases," *Southern Medicine and Surgery,* CXIII (1951), 101; "The Vitamin Treatment for Acute Poliomyelitis," *ibid.,* CXIV (1952), 194; "Virus Pneumonia and Its Treatment with Vitamin C," *ibid.,* CX (1948), 36.

temperature did not remain normal; injections were continued around the clock when needed.

Dr. Klenner told of an eighteen-month-old girl suffering from polio. The mother reported that the child had become paralyzed following a convulsion, after which she soon lost consciousness. When Dr. Klenner first saw the child, her little body was blue, stiff, and cold to the touch; he could neither hear heart sounds nor feel her pulse; her rectal temperature was 100° F. The only sign of life he could detect was a suggestion of moisture condensed on a mirror held to her mouth. The mother was convinced that the child was already dead. Dr. Klenner injected 6,000 milligrams of vitamin C into her blood; four hours later the child was cheerful and alert, holding a bottle with her right hand, though her left side was paralyzed. A second injection was given; soon the child was laughing and holding her bottle with both hands, all signs of paralysis gone. Dr. Klenner quite understandably speaks of vitamin C as "the antibiotic par excellence." A physician who has obtained striking results in treating polio with vitamin C at the Los Angeles County Hospital matched Dr. Klenner's enthusiasm with the remark, "If anything should be called a miracle drug, it is vitamin C."

With his extremely ill patients, Dr. Klenner found that no vitamin C whatsoever could be detected in the blood only a few minutes after massive doses were injected; nor was any vitamin C found in the urine. It is his belief that this vitamin combines immediately with toxins and/or virus, thus causing the fever to drop. In cases where the fever rises again later, he believes that too little vitamin C has been given in the initial dose; that virus not destroyed multiplies and again causes the temperature to increase. For this reason, he emphasizes that if the original dose is sufficiently large, no further massive amounts need be given.

Many other investigators have studied the effect of massive doses of vitamin C. In an attempt to saturate the tissues, physicians have recommended as much as 1,000 milligrams every hour during the day from 1 to 3 days to persons suffering from arthritis, gout and almost any infectious disease, infection, or allergy, the same amount being repeated during subsequent acute attacks. They have also recommended that this quantity be taken immediately at the onset of a cold or any infection and that the vitamin be stopped as soon as the symptoms have disappeared. On the other hand, satisfactory results have been reported when an allergy or lead poisoning has been treated with as little as 300 milligrams daily. These problems, however, are medical ones; our problem is prevention.

Physicians have pointed out that patients with polio, for example, have often been sick several days before a doctor is called in and a diagnosis made. By the time such cases are cleared by a social worker and a March-of-Dimes committee and are actually checked into a hospital, they are in what has been described as "a sorry state." Vitamin C has proved to be most effective when taken at the onset of an infection, at which time a patient rarely sees his physician. Relatively smaller amounts are needed than those required after an illness becomes serious. If sufficient quantities of the vitamin are obtained, often serious illness may be prevented. It appears desirable, therefore, for persons to learn when large amounts of vitamin C should be taken and how much should be taken. Such information has great comfort value.

I asked 15 physicians if they felt it wise to recommend that families keep high-potency, vitamin-C tablets in the medicine chest and use them at the onset of any illness. The most frequent reply was, "They are certainly safer than aspirin." Several physicians remarked, "Tell people to take them when they need to, but the rest of the time to stick to orange juice and natural sources." Others pointed out the importance of advising large initial doses rather than smaller frequent ones, the total of which might be larger than would be needed if the original dose were sufficient.

When persons are too ill to eat or retain food and/or to digest or absorb it easily, as were Dr. Klenner's patients, injections of vitamin C are obviously advantageous. If the vitamin is taken immediately at the onset of an illness, however, such difficulties rarely arise. Occasionally undissolved tablets can be seen in the stools, particularly if diarrhea occurs. For this reason I usually tell people to bring one cup of water to a boil, add to it 50 tablets of vitamin C of 500 milligrams each or 100 tablets of 250 milligrams each, stir until the tablets are dissolved, pour the solution into a glass jar, and keep it refrigerated. Since tablets do not contain the enzymes found in natural foods, the synthetic vitamin is quite stable to heat. Each teaspoon of this solution would contain 500 milligrams; one or two tablespoons added to any sweet juice are quite palatable. Less vitamin C is needed if the solution is taken in fresh, canned, or frozen orange juice to which are added the juice of a lemon, sugar to taste, and perhaps $\frac{1}{4}$ teaspoon of a calcium salt[3] (p. 181); the fresh citrus juices supply vitamin P, or rutin, which prevents vitamin C from being destroyed in the body by oxygen; the calcium helps to prevent the toxic substances from entering the cells. An adult can take tablets of both vitamin C and calcium. Since the vitamin is an acid, large amounts can cause severe burning of the throat and stomach. When more vitamin C is taken than is needed, the acid being thrown off in the urine usually causes a burning sensation when voided.

Although I have never been up a night with a sick child, I know of nothing which brings me greater comfort as a mother than the knowledge that vitamin C can help in emergencies. Other mothers feel the same. For example, a

[3] I use tablets or powder of calcium with mixed minerals, or Multi-Mins. See footnote, p. 119.

friend's little boy, then the only child, died of meningitis. Three children were born later. The mother's fear that something would happen to one of these children was ruining her life and theirs. During polio season they were not allowed to go to a pool or mingle in crowds. The mother gathered files of articles concerning diseases from newspapers and magazines; she became overcautious about sanitation and still lived in fear and dread. I saw her recently for the first time in years; the children were at a park, swimming. I commented on her change of attitude.

"I never worry about them any more," she answered. "At the first sniffle I give extra vitamin C. The kids haven't been sick a day in two years."

My first personal experience with massive doses of vitamin C came when my Geordie, then five years old, had the mumps. One morning when we awoke, the evidence was unmistakable. Starting at 7 A.M., I gave him 1,000 milligrams of "melted" vitamin C and a little calcium powder in ¼ glass of pineapple, apricot, or orange juice every hour except when he slept, making a total of 10 grams during the day. By that evening, all swelling was gone, and there was no further sign of illness. Within the next two months every member of our family including me—which proves I am younger than you think I am—had the one-day mumps. The children have now weathered most of the childhood "diseases" in the same delightful fashion. There has been no irritability, nausea, or vomiting; no meals have been missed; after vitamin C has been given, there has been no fever.

My only other personal experience occurred a year ago when I returned from an out-of-town trip to find that my daughter Barbara, then three years old, was ill. She had appeared to be well when put to bed, but when she was checked shortly before my return, her breathing was labored, her skin flushed and burning, and her rectal temperature 104° F. Fortunately, she was thirsty. I immediately gave her 2,000 milligrams of vitamin C in juice. Her temperature appeared to be normal within 15 minutes; she slept soundly the remainder of the night, awoke full of her usual vivacity, and went to play school that morning. She had no further evidence of illness. The amounts of vitamin C I have found effective with my children may be inadequate for youngsters who have received smaller amounts of this vitamin. I try to keep their tissues saturated at all times; at least I cannot recall having seen a bruise on either child.

The quantity of vitamin C to take depends on the type and severity of the illness and whether it is of short duration or chronic. Large amounts are usually needed at first to saturate the tissues; the quantities can later be reduced. Persons suffering from arthritis, asthma, or other chronic diseases have often taken drugs for months or even years; these drugs must apparently be detoxified before vitamin C is available to the tissues. For example, two years ago I was consulted by a man who had come to California for his health in 1927. He had suffered with severe asthma for several years before and continuously since that time; he told me that during this entire period he had taken drugs daily. Although I planned the most adequate diet for him that I could and recommended what I considered to be massive doses of vitamin C, he showed little improvement from September until December; his symptoms then disappeared and have not returned. It is my belief that results were slow in his case and similar cases because of the drugs remaining in his body.

The quantity of vitamin C most advantageous under all circumstances for all persons can probably never be known. Our requirements vary daily. Almost every person is exposed to chemicals from water purifiers, smog, smoke, or smoking; from arsenic, DDT, and other pesticides, traces of which are found in fruits, vegetables, meats, and milk; many people take drugs occasionally; and most of us are threatened by one or more infections per year. Each individual must find his own dosage, depending upon his own symptoms and the number of toxic substances he is exposed to. If you are going to use massive doses over a prolonged period, however, do it only when your diet is adequate in every respect and with your physician's permission and under his care. During normal times, use natural sources first: a glass of orange juice daily; salads; and fresh fruits for desserts and midmeals. Watch for bruises; if they occur, know that your intake of vitamin C is not meeting your needs; then supplement your natural sources if you need to.

Although massive doses of vitamin C appear not to be toxic, much research must be done before any long-term harm can be ruled out. If harm is caused by massive doses, however, it appears to be far less than that done by a disease. Large amounts of this vitamin often act as a diuretic, causing excessive urination, corresponding dehydration, and extreme thirst. These symptoms are largely prevented if calcium is taken with the vitamin. If calcium is not taken, extreme nervousness sometimes results; therefore let us be cautious.

The greatest value of massive doses of vitamin C will never be shown by research or found in a laboratory. It is in the hearts and prayers of the parents of the nation. They will render silent tribute to the wonderful scientists and physicians who have brought them peace of mind.

CHAPTER 19

THE NICEST PEOPLE I KNOW

IT IS undisputed that vitamin D aids the absorption of calcium, favors its retention, and improves its utilization. Certainly it is a fact that calcium is needed by adults; this mineral helps to relax nerves, induce sound sleep, and decrease sensitiveness to pain. The National Research Council concedes that small amounts of vitamin D are desirable for people working at night, for elderly persons, and for nuns and others whose clothing shields them from the sunlight. According to this Council, however, "vigorous persons leading normal lives" appear not to need vitamin D. What about the almost vigorous person leading an almost normal life? It seems to me the scientific scientists are indulging in unscientific double talk here.

Vitamin D is scantily distributed in foods. There is some in egg yolks provided the hens sat in the sunshine and preened their feathers well; 50 to 200 eggs daily might supply your needs quite adequately if modern hens were not forced to live in shaded cages. Caviar contains some vitamin D; there is a little in the milk from cows pastured on high mountain slopes. Artificially produced vitamin-D milk is excellent, but as a sole source it has little value in my opinion. Fish-liver oils are the only natural foods containing sufficient quantities of this vitamin to promote health; that is, if you call them natural foods as my children do.

Vitamin D can be produced in foods or oils by exposure to ultraviolet light; the commercial concentrate, viosterol, is made by such a method. This vitamin is formed by ultraviolet light from sunshine in the oils *on* the skin, provided you have oils on your skin and the shortest rays from the sun reach the earth. In winter, these rays do not penetrate our atmospheric blanket; during the summer they reach the top of the Empire State Building but usually not the street below it. Sunshine would be an excellent source of this vitamin if it were not for the facts that people are surrounded by smog, wear clothes, live in houses, have bathtubs and hot-water heaters, and listen to soap operas.

Most medical textbooks say that vitamin D is formed by sunlight on the oils *in* the skin although it was proved 16 years ago[1] that the oils must first be *on* the skin, then exposed to ultraviolet light, and later absorbed back into the body. If persons take a bath before going into the sunshine, the oils are washed off, and no vitamin D is formed; if they do not bathe before exposure to sunshine but bathe immediately afterward, the oils are removed before the vitamin can be absorbed into the body. Most of the oils appear to be washed off by cold water, and still larger quantities by warm water; warm soapy water does the job thoroughly. Time was when wood was hard to split, water hard to carry, and soap hard to make (and smelled too bad to use anyway); the Saturday-night bath was then a family institution. During the remainder of the week the oils stayed on the skin and absorbed any ultraviolet rays which reached them. The early settlers described the Indians as being great of stature with teeth "as even as piano keys," both the advantages of having no hot-water heaters and no soap. Now as a nation we are bath-happy and soap-happy; I, for one, call it progress.

There are to be found in any medical library many books and thousands of articles concerning the need of vitamin D by children. Except for a few articles and short paragraphs

[1] A. C. Helmer and C. H. Jansen, "The Absorption of Vitamin D Through the Skin," and "Vitamin D Precursors Removed from Human Skin by Washing," *Studies of the Institutum Divi Thomae,* I (1937), 83, 207.

on diseases known as osteomalacia, meaning literally bad bones, and osteoporosis, meaning porous bones, the need of adults for vitamin D is rarely mentioned. These diseases are identical except in degree; bad bones are worse than porous bones. In both, so few minerals are available that the bones become porous and honeycombed; the persons so afflicted may become shorter and may suffer from muscle cramps, twitches, and even convulsions, or tetany. Osteoporosis is usually painless, but in osteomalacia pain is experienced, especially in the hips; such pain is customarily spoken of as rheumatism; spontaneous fractures and breaks may occur. This disease is common in China and India, particularly when the need for minerals is increased by pregnancy and "becomes more piteous" (p. 684 of ref. 2, p. 36) with each child, especially when the mother "suckles her infant in the vain hope of thus warding off her tragic fertility." Skeletal remains indicate that the Norse colony founded by Eric the Red in Greenland gradually became extinct because the pelvic deformities of women suffering from osteomalacia hindered childbirth; it is thought that the colonists did not eat the local diet of fish and fish-liver oils; too little vitamin D could be obtained from the Arctic sun. Osteomalacia results from famines and food shortages during and after wars. It occurs in American and English cities "where solitary old people live in proud self-respecting poverty rather than apply for charity" (p. 684 of ref. 2, p. 36). This disease can be cured by vitamin D alone, but to speed recovery calcium and phosphorus are customarily given with the vitamin.

Sir Robert McCarrison, the great English physician, wrote of osteomalacia in India among the Mohammedan women observing the custom of purdah. These women veil their faces at adolescence and rarely go outside their homes. No milk or other food rich in calcium is eaten. Vitamin D, however, either from sunshine or cod-liver oil, so increases the absorption and utilization of the meager dietary calcium that health is restored. Here, at last, is proof that vitamin D alone, without any increase in calcium or phosphorus, can help adults as well as rapidly growing children.

Americans have no more cause to worry about osteomalacia than about scurvy; 60 per cent or more of our population, however, obtain too little calcium in their diets. Much of this supply fails to reach the blood. Calcium is tricky in that it does not dissolve easily; your teeth and bones, even though washed by saliva or tissue fluid, do not dissolve. Unless calcium from food is dissolved, it remains in the intestine and is lost in the feces. The calcium supply to the tissues can be increased by eating more foods containing calcium or by obtaining ample vitamin D; both should be adequate.

Long ago it was learned that excessive amounts of vitamin D can be toxic. A toxic dose for adults appears to be 300,000 to 800,000 units per day provided this quantity is taken daily for several months. Toxicity causes vomiting, diarrhea, and sluggishness; calcium is withdrawn from the bones, the amount in the blood becomes excessively high, and much is lost in the urine. These symptoms are prevented if generous amounts of vitamin C are supplied. Fear of toxicity has caused the National Research Council to recommend only 400 units daily for persons of all ages.

Almost nothing is known of the amount of vitamin D which can be taken advantageously by an adult. Dr. Johnston[2] of the Henry Ford Hospital in Detroit studied the needs of adolescent girls, some of whom had ceased growing. He found that even though a generous amount of calcium was supplied by the diet, if no vitamin D was taken, more calcium was excreted than was eaten. When the vitamin was supplied, the amount of calcium absorbed into the

[2] J. A. Johnston, "The Calcium and Vitamin D Requirements of the Older Child," *American Journal of Diseases of Children*, LXVII (1944), 265.

blood paralleled the vitamin-D intake. For example, when 650 units of vitamin D were given daily for a time, and later 3,900 units were given, the quantity of calcium absorbed was increased tenfold. In some cases 1,950 units of vitamin D were given with more calcium than could be obtained from an average quart of milk (1,343 milligrams); still no calcium whatsoever was retained in the body; this amount of calcium was well absorbed when vitamin D was increased to 3,900 units daily.

Unfortunately, Dr. Johnston did not study the calcium absorption when still larger quantities of vitamin D were given. His studies indicate, however, that the adult can profit by taking at least 4,000 units of this vitamin daily. It is entirely possible that the ideal intake may be nearer 7,000 units per day; since this amount is certainly not toxic, it appears wise to err on the side of obtaining slightly too much rather than too little. Aside from the need during pregnancy and lactation, I suspect the highest requirement is during the menopause; the calcium intake is usually lower then than during adolescence. Hot flashes, night sweats, leg cramps, irritability, nervousness, and mental depression, so frequently experienced at this time, can usually be overcome in a single day by giving calcium and vitamin D; when the calcium intake is already adequate, vitamin D alone can relieve these symptoms.

Vitamin D can be stored in the body provided an excess is obtained. For example, in England during World War II mothers were given cod-liver oil for their babies. Uncooperative babies sometimes burp up the oil, which stains clothing and smells bad; the oil is a nuisance for a busy, tired mother to give. Despite the fact that the oil was supplied free, severe bone abnormalities developed. English physicians, desperately trying to solve this problem, studied the effect of giving single massive doses of vitamin D by mouth to tiny infants in the doctors' offices. Many similar studies were made later on the Continent and in America. It was found that a single dose of 300,000 units of the vitamin promoted good bone growth for a year, indicating efficient storage of the excess; this amount was never found to be toxic.

Since vitamin D is stored, the cheapest source I know of for adults is a capsule of 25,000 units each which can be taken once a week, as after breakfast on Sunday. When the requirements are unusually high, as during adolescence, pregnancy, and menopause, such a capsule might be taken to advantage every Wednesday and Sunday. These capsules, although available,[8] are so little used that druggists often tell customers they cannot be sold without a prescription. The Food and Drug Administration has asked that the 50,000 unit capsules of vitamin D be sold only on prescription but not the 25,000 unit capsule. Since vitamin D, like vitamin A, cannot be absorbed unless in the presence of fat and bile, this vitamin should be taken *after* a meal containing some fat.

The positive results gained by taking adequate vitamin D throughout adult life are identical with the advantages of having ample calcium, to be discussed in chapter 21. Since adults can absorb calcium without vitamin D, the taking of this vitamin is similar to buying fire insurance: you hope you will never need it, but if you do, it is wonderful to have.

An advantage is that vitamin D helps to prevent tooth decay. All decay is apparently caused by sugar being broken down by bacteria-produced enzymes into lactic and pyruvic acids; any acid can combine with calcium. If the saliva can reach the area where the acids are being formed, and if it contains ample amounts of dissolved calcium, these acids are neutralized by the salivary calcium, and no decay results. Dental erosion appears to be prevented in the same manner. Although the subject is still controversial, an increasing

[8] See footnote, p. 119.

amount of evidence[4] indicates that both the enamel and dentin of mature teeth can be built up provided the nutrition is adequate; probably the two most important nutrients in such rebuilding are calcium and vitamin D.

Ample vitamin D undoubtedly plays an important role in the prevention of pyorrhea. If the diet is made adequate and all infection is removed, even severe pyorrhea can usually be arrested. Although pyorrhea is a disease involving infection and resulting from multiple nutritional deficiencies, the loss of teeth is caused by decalcification of the bones. When too little calcium is supplied the tissues, minerals are withdrawn from the jaw bones; the bones themselves become smaller and recede from around the teeth. As the bones recede, the gums likewise recede, exposing more of the tooth surface. The teeth appear longer than they should be, and the gums cannot fit tightly around the base of each tooth. Eventually, so little bone structure remains that it cannot hold the teeth firmly in place; the teeth, though they may be free from decay, become loose and must be removed.

Even when the teeth and all infection are removed, the destruction of jaw bones does not cease, nor does this destruction cease to be a problem. Dentures can fit well only when sufficient jaw bone remains on which to anchor them. If the nutrition is poor, so much bone tissue can be lost even six months or less after perfectly fitting dentures are made that the dentures shift, wobble, or refuse to stay in place. One of the delightful memories of my childhood is an occasion when a malnourished Methodist minister, apparently believing that the gospel was more effective when thundered, shouted his upper dentures into the congregation. An innocent dentist was probably blamed even by this good Christian; at least a dentist usually is. It is not a dentist's fault that a person's diet cannot maintain normal bone structure.

[4] "Isotope Studies in Dental Tissues," *Nutrition Reviews*, XI (1953), 89.

Often set after set of dentures have to be made as the destruction continues. Furthermore, persons whose bones are undergoing rapid destruction are so deficient in calcium that they are nervous wrecks; often they cannot stand to wear dentures no matter how well they fit. For a time a dentist referred to me many patients who complained that new dentures did not fit. As soon as the patients' diet was made adequate and their nerves relaxed, there were no more complaints.

A few years ago in a rural area, I visited four old friends, all of whom had dentures which they put in "for company." At mealtime the dentures were removed, and the food was gummed in comfort. If an adequate diet is adhered to and well absorbed, one set of dentures should fit during the remainder of one's life.

The calcification[5] of a person's bones, shown by dental X-rays, is probably a good index of the density of bones throughout the body. You might ask your dentist to compare your X-rays with those of some person whom he considers to have unusually well-calcified bones. Examine the bone structure both below and around your teeth; the denser bone casts a whiter X-ray shadow. If your own X-rays show poorly calcified bone, rigid adherence to an adequate diet may pay rich dividends.

Fragile bones break easily. Although most people expect to have pyorrhea sooner or later, few expect broken bones. Unfortunately, breaks do occur. When bones are so poorly calcified that teeth are lost from pyorrhea, the condition of the bones throughout the body can degenerate but little more before they may crumble or break at any minor twist or fall. Millions of Americans, including thousands of relatively young persons and almost every person sixty years old

[5] Because of its familiarity, the word calcification is used instead of the more accurate term mineralization.

and older, have porous bones. It makes no difference except perhaps to some physicians whether or not the porosity is of such a degree that the condition can be called osteoporosis. Formerly it was believed that bones naturally became porous with age. When experimental animals are kept on adequate diets, however, the longer they live, the stronger their bones become. Such evidence indicates that poorly calcified bones are the result of nutritional deficiencies; elderly persons have eaten faulty diets more years than has the younger person; hence the condition is more universal among them.

Since bones cannot be seen, few people think of whether theirs are well or poorly calcified. The difference in bones, however, is almost unbelievable. I used to lecture at a dental college where there is a large collection of skulls. The bones of some are so dense and heavy that they appear impossible to crack with a sledge hammer. Other skulls in this collection are so thin and porous that light shines through them; in fact they would make excellent lampshades. Any orthopedic physician or X-ray specialist can tell you that poorly calcified bones are extremely common.

If you think bones do well without care, you should go through an orthopedic hospital and talk with patients; you would soon be convinced that anything which helps to build strong bones and prevents such misery as you would find is worthwhile. Let me tell you about a few cases I have known personally.

A woman in her late thirties hobbled in to see me not long ago and, after putting her crutches aside, told me the following story. Several years ago she had somehow twisted her leg while walking across a lawn; the femur, or thigh bone, had broken near the pelvic joint. She lay in the hospital month after month before healing was sufficient for her to walk with crutches; in time they were discarded. Then one day, without warning, she simply fell in a heap. This time the bone had crumbled at the spot where it had been broken before. A plastic head was put on the femur which involved *deep, drastic, and expensive surgery;* the gold pin which held it in place showed clearly in the X-rays. Again months were passed in hospital beds before she graduated to crutches, but pain in that joint remained acute. She had been told that the pain was probably caused by calcium forming in rough deposits over the plastic head of the femur; she came to me requesting a *calcium-free diet.* She left with a nutrition program which included generous amounts of both calcium and vitamin D and was as adequate in all respects as I could make it. Only three days later she phoned to say the pain had completely disappeared. A month later she came to see me, carrying a cane; she walked, however, without using it and without a limp. Do you suppose she believes that any nutrient which helps to maintain normal bones is unimportant?

A plasterer, forty-two years of age, who had fallen from scaffolding, used to come on crutches to hear me lecture. He too had broken his femur; months had passed without healing. The jagged ends of the bone kept breaking apart. Apparently in desperation, his physicians put a steel plate around the bone to hold the ends together, but X-rays cannot be taken through such a plate to see whether healing has occurred. Eventually the plate had been removed, but the bone still had not knitted. Infection, called osteomyelitis, set in, and operation after operation followed. Great deep scars about two inches apart and each a foot long went round his entire thigh. The wound from the last operation was still draining; the bone was badly infected, and amputation had been recommended. During all these tragic years, he had never once been given vitamin D; certainly he had not been in the sunshine. No diet had been recommended rich in calcium, in protein necessary to form bone base, or in the B vitamins needed to insure that adequate hydrochloric acid could be produced to help the absorption of what little calcium he chanced to obtain. No extra vitamin C had been given to help prevent or fight the infection. When his nutrition was made adequate, improvement was rapid. He now walks to work but with a limp he will have throughout life. Do you suppose he thinks that vitamin D is a nutrient only for babies?

I have seen perhaps two dozen similar cases, most not so severe but many equally tragic. The elderly persons whose hip bones crumble after a minor fall, usually in a bathtub, seem to me most pathetic. The easy breaking of bones and/or their slow healing are, in my opinion, completely unnecessary. Yet such fire insurance, which in this case should cost no more than a dollar or two per year, is usually purchased, if at all, only after the house is burned. The adult who is ignorant of the advantages of vitamin D usually pays both figuratively through the nose and literally through the pocketbook.

Perhaps I am making a mountain out of a molehill, and "vigorous adults leading normal lives" do not need vitamin D. A friend jokingly implied as much once when I had mentioned something about saving teeth; he remarked, "Some of the nicest people I know wear dentures." He is undeniably right. In fact, there are some 32,000,000 nice people in these United States wearing dentures. I myself would gamble that all of these 32,000,000 nice people wish they had 32 nice teeth stuck firmly in their own jaw bones.

CHAPTER 20

LET'S APPLY IT, THEN PROVE IT

MORE vitamin E is found in the body than any other vitamin. Dr. Henry A. Mattill of the University of Iowa College of Medicine has made the statement: [1] "Perhaps no other of the vitamins mysteriously affects so many and so varied body processes." Apparently as part of an enzyme which helps to utilize fat, it appears necessary to the function of every cell. It is particularly concentrated in the pituitary, adrenals, and sex glands. Natural vitamin E also prevents vitamin A, linoleic acid, and perhaps other nutrients from being destroyed by oxygen in the body. If obtained in sufficient quantities, it is stored in body fat. Yet when humans are undersupplied with this vitamin, no recognized deficiency disease occurs.

No one doubts that humans need vitamin E. A hundred years ago, before our foods were refined, the daily intake was an estimated 100 to 150 milligrams. Authorities have variously suggested the requirements now to be 30, 60, and even 100 milligrams per day. Vitamin E, like vitamins A and D, can pass into the blood only when taken with fat and when bile is present in the intestine. The American diet supplies slightly less than 6.0 milligrams per 1,000 calories, or about 12 to 15 milligrams per day (p. 303 of ref. 1 *below*). The National Research Council [2] recommends seven basic

[1] "Vitamin E, a Symposium," *Annals of the New York Academy of Sciences*, LII (1949), 63.

[2] "Recommended Dietary Allowances," National Research Council, *Circular Series*, No. 122, Washington, D. C., 1945.

foods which, if consumed daily, supposedly supply adequate amounts of all nutrients; yet these foods furnish only 5.74 milligrams of vitamin E. The thousands of persons who eat no fat or whose bile flow is inadequate probably absorb little of even these small amounts. Most investigators claim that this vitamin is never toxic; 1,200 milligrams daily has been given to persons without signs of harm. Since vitamin E can be stored efficiently, massive doses would probably never be needed if diets were adequate enough to allow a small excess daily. As conditions are, however, deficiencies can be expected.

Relatively large amounts are required when new cells are forming; Dr. Kenneth C. D. Hickman of the University of Rochester has pointed out that the basic need for vitamin E is during the entire constructive period which reaches its height at adolescence. The need of the growing fetus causes the vitamin-E requirements to be tremendously increased during pregnancy. Even when all growth has stopped, a virile man produces as many as 200,000,000 sperm per ejaculation; the vitamin-E requirement of a man, therefore, may vary with his sexual vigor. It was brought out at the 1949 world conference on vitamin E that the requirement increases tenfold during menopause and that, to maintain health, the aging human may require 50 times the usual intake. I, as one aging human, am going to see that I get generous amounts of this vitamin.

The approximate milligrams of vitamin E (per 100 grams) in foods considered to be the richest sources are as follows (p. 293 of ref. 1, p. 160):

½ cup cooked potatoes, beans, beets, carrots, onions, leeks, or spinach; 7 Brussels sprouts; 1 cup raw shredded cabbage or ¼ head lettuce	0.5
½ cup cooked navy beans or green peas; 1 large bunch parsley or 1 cup cooked kale	6.0
4 slices white bread, if flour is not bleached	1.2

4 slices brown * bread	2.1
¾ cup cooked white rice	0.4
¾ cup cooked brown rice	2.9
¾ cup cooked oatmeal	2.0
½ cup wheat germ and middlings	8.9
¾ cup wheat germ	25.6
Cheddar-type cheese, 1 x 1 x 5 inches	0.4
8 ounces cows' milk	0.1
8 ounces human milk	4.0
2 large fresh eggs	3.0
¼ pound, or 1 serving, meat or fish	0.8
¼ pound butter	2.6
¼ cup olive oil	3.0
¼ cup peanut oil	36.0
¼ cup cottonseed oil	94.0
¼ cup wheat-germ oil	102.8
¼ cup soybean oil	120.0

* Not stated whether or not it is whole wheat.

Fruits contain almost no vitamin E. In most medical texts, lettuce is listed as the richest source; 30 heads might supply your minimum daily need. Less than a third of this vitamin found in vegetables is absorbed by humans. Most of the vitamin from grains is discarded when flours are refined, but if the wheat germ is retained, as in the "national loaf" in England during World War II, little vitamin E is lost. The amount in prepared cereals is practically nil. When oils are highly refined or hydrogenated, much of the vitamin E is sacrificed. Low cooking temperatures harm it little, but 90 per cent is lost in deep-fat frying, as when doughnuts or potato chips are prepared. Even slight rancidity (p. 42) destroys the vitamin both outside and inside the body. The only dependable sources appear to be fresh-ground, whole-grain flour and cereals, wheat germ, and vegetable oils.

The scientific name for vitamin E is alpha tocopherol; other tocopherols with some vitamin value occur in nature. Natural vitamin-E concentrates, prepared by distilling vegetable oils, and synthetic vitamin E, are available in capsule form. The synthetic vitamin cannot prevent the destruction of vitamin A and unsaturated fatty acids (p. 342, of ref. 1, p. 160) in the body, perhaps the most important function of vitamin E. For this reason mixed tocopherols from natural sources are superior to the synthetic product even though 149 milligrams of the synthetic vitamin equal 100 International units of the vitamin from natural sources.

More than three decades ago it was discovered that when animals were deficient in vitamin E, the males became sterile; females lost their young. If the vitamin was supplied, normal pregnancies occurred, but fertility in males could not be restored. Years passed before attention was directed to subtle deficiency symptoms.

As we examine the findings of animal experiments, let us think of similar abnormalities in humans. Since vitamin E is destroyed by rancidity, deficiencies are most readily produced by feeding rancid fat; other animals given vitamin E with the rancid fat remain in excellent health. Animals in which deficiencies are thus produced lack strength and energy; their hair becomes dull and later falls out; the thyroid and pituitary glands become underactive. The need for oxygen is tremendously increased. Nerves are so injured that some animals, particularly old ones, walk with a waddling gait, lacking co-ordination; sometimes they develop tremors and unusual sensitiveness to pain; since vitamin A in the body is destroyed without vitamin E, vitamin-A deficiencies, such as severe eye infections, often occur. The animals develop skin lesions, become emaciated, and may suffer from intestinal hemorrhages and diarrhea long before sexual disturbances are evident; they die early. One can easily find all of these abnormalities in humans. Who can say that an undersupply of vitamin E does not contribute to their cause?

Autopsy shows abnormal changes in the bone marrow, lymph nodes, spleen, nerves, and sometimes brain cells. The heart muscles, studied in detail, have been found to have undergone such degenerative changes that scientists have made the statement (p. 140 of ref. 1, p. 160): "These alterations justify the use of vitamin E in the treatment of certain cardiac conditions." The most characteristic finding is chocolate or cocoa-brown bits of pigment deposited throughout the voluntary muscles, heart, testicles, and walls of the uterus; the liver and adrenals are described as "loaded" with pigmentation. These pigments form when oxygen breaks down essential fatty acids, a chemical change similar to that of fats becoming rancid outside the body. The pigment itself is made of these breakdown products from essential fatty acids combined with lecithin, cholesterol, and certain amino acids. Pigmentation occurs long before sexual function becomes abnormal; it is greatly increased by a diet low in protein, by one high in fat but containing few essential fatty acids, by the giving of certain male or female hormones, and by age. The more severe the vitamin-E deficiency, the more severe the pigmentation becomes. Dr. Hickman (p. 201 of ref. 1, p. 160) refers to these pigments as "dirt" left when "organic housekeeping" becomes untidy.

Nutritionwise, I believe in playing my hunches; I have played hunches about vitamin E for 23 years. One of them is that "liver spots," which people get first on their hands and sometimes—usually later if at all—on their faces, necks, and backs, are cousins of the brown pigments produced in animals undersupplied with vitamin E. The only studies apparently made of brown pigmentation in humans is a post mortem examination of the testicles of twenty men and another of "brown atrophy" of the organs of elderly persons (ref. 1, p. 160); all the testicles showed pigmentation considered identical with that of experimental animals lacking this vitamin; the "brown atrophy" was also similar to that produced in old animals.

For several years I have looked for "liver spots" on every person who has consulted me; if such spots are present, I usually recommend that 100 units of natural vitamin E be taken after each meal. Months or years later many of these people have returned with all of the disfiguring spots gone. This spring I was consulted by a woman of fifty who had on her left cheek an irregular area of pigmentation ¾ inch across; six weeks later there remained only the faintest suggestion of a shadow. The arms and hands of one woman of fifty-nine were literally covered with "liver spots" a year ago; recently, when lecturing on vitamin E, I asked her to stand before the audience and let them see her hands; the skin is like that of a baby's; not a spot remains. Such spots seem to appear most quickly following menopause, when the requirement for vitamin E is known to skyrocket; as in animals, the spots sometimes become markedly worse when injections of sex hormones are taken without vitamin E being simultaneously increased. In both men and women they become more severe with age. Conversely, I have never seen these spots on any person of either sex who has followed a good nutrition program for several years preceding the "liver-spot age."

In female animals, the estrus cycle—menstrual cycle to us—becomes irregular when vitamin E is undersupplied. The onset of menopause is early, but if vitamin E is increased, normal estrus (menstruation) and fertility are restored. When large amounts of vitamin E are given, menopause is delayed to an advanced age, although eventually all females become sterile. If middle-aged or older males low in vitamin E are given testosterone, they develop enlargement of the prostate, and their testicles atrophy, or shrivel.

At the College of Physicians and Surgeons of Columbia University a four-year study was made of hundreds of animals past their menopause to see whether vitamin E was involved in the aging process. It was found that the less vitamin E given, the higher the percentage of sick animals. The testicles of males receiving less than optimum amounts of vitamin E atrophied, or became smaller, and both males and females lost sex interest and would not mate. Although animals showed no abnormalities when fed "normal" quantities of the vitamin, added vitamin E had a striking effect in prolonging youth and increasing the life span; the conclusion (p. 87 of ref. 1, p. 160) was that aging may be a consequence of multiple deficiency states rather than the result of "natural" processes.

Such research would indicate that vitamin E plays some role in the production of normal sex hormones. Although the relation of this vitamin, if any, to secondary sex characteristics has not been studied, my hunch is that it is important. A number of physicians have pointed out that young people these days seem to be losing their secondary sex characteristics. The hips of boys and men are often too large, whereas girls and women frequently have flat chests and slender hips. "Falsies" for women and corsets for men, semantically known as "surgical belts," have both become major industries. I am horrified at the frequency with which I find little boys, whose diets appear to be adequate except for vitamin E, with round-cheeked hips or girls with narrow masculine hips. It has been my experience that when the diet is made completely adequate and vitamin E is increased temporarily to perhaps 100 units after each meal, these children develop normal sex characteristics quite rapidly. In my opinion, a boy's chest should be at least two inches wider than his hips, and a girl's hips should be as wide or wider than her shoulders. I have seen a few cases where normal breasts have developed after flat-chested women from twenty to thirty-five years old have conscientiously followed an excellent nutrition program.

Another problem, possibly the result of multiple deficiencies of the nutrients including vitamin E, needed for normal hormone production, is that of children growing excessively large. The rooster becomes a huge capon when the testicles are removed; the slender-hipped bull becomes a steak-producing steer. Any animal supplied with too little sex hormones grows to a larger-than-normal size. Similarly many girls these days grow so large that their mothers, not realizing that poor nutrition may lead to glandular abnormalities which can result in overgrowth, are afraid, for example, to allow them to take vitamin supplements; the mothers fear that their daughters cannot find boys large enough to date with them or eager to marry them. Although there is no proof, I for one am going to follow my hunch. I want my children to achieve normal growth but neither of them to be excessively large; I want my son to have slender hips and my daughter to have something genuine to put inside her brassière; it is my belief that adequate nutrition in general and vitamin E in particular may help these wishes to come true.

Another hunch started years ago when a professor in biochemistry class stressed that when the ovaries were inactive, the body fat of women became redistributed; they developed middle-age spread and perhaps piano legs and ankles either long before or during middle age. Since I suspected vitamin E was related to ovarian hormone production, I have recommended 100 units of this vitamin after each meal to dozens of women whose weight was correct but whose faces were too thin and hips too large. Although vitamin E may not have done the trick, the weight of most of these women has been redistributed, which was all they or I care about.

I suspect that the middle-age spread of men is often not so much the result of age or too many calories as of an undersupply of hormones caused by cumulative multiple deficiencies of which vitamin E is one. This change from a former physique, I believe, is analogous to the transition from the narrow hips and flat abdomen of the bull to the broad hips and sagging abdomen of the steer. Although a hereditary tendency may exist, this theory can perhaps be supported by the fact that many men begin to thicken through the waist at ages of thirty-five or forty, whereas the general build of others does not change until the age of sixty-five, if at all.

Many physicians have reported successfully treating irregular menstruation and excessive or scanty flow with vitamin E. The vitamin has been particularly effective in resolving menstrual difficulties at adolescence or at menopause. When generous amounts of this vitamin are given one or two years after the menopause, normal menstruation may recur. I warn such women who consult me to expect the return of menstruation; otherwise they sometimes get panicky, thinking they have uterine cancer. A few women have conceived after dietary improvement, although menstruation had ceased a year or two earlier. Since the irate husband of one shouted at me, "You and your d—— vitamins," I also warn women that unplanned pregnancies may occur.

I have another hunch that when general nutrition is poor and vitamin E is undersupplied, the onset of menopause is early, whereas it may be markedly delayed if the intake is generous. Among my personal friends whose diets have been unusually adequate, I know of no woman whose menopause has set in before the age of fifty-three to fifty-five. Furthermore, I suspect aging occurs rapidly at menopause when vitamin E is undersupplied and, conversely, that women with delayed menopause stay physiologically young. One woman whose nutrition I have checked annually since 1936 is still menstruating at sixty-two years of age; she can pass for forty any day.

In animals, vitamin E is important in aiding the liver to detoxify a variety of harmful substances. The amino acid, methionine, has been considered one of the body's most important detoxifying agents. Vitamin E, however, has been found to be 400 times more effective than methionine. Far larger amounts of vitamin E are necessary to maintain normal liver function than normal sex function. Jaundice in humans, resulting from the toxic effects of such drugs as atabrine or bromides, has responded so favorably to large amounts of vitamin E as to indicate the wisdom of taking vitamin-E capsules along with any drug which must be used.

Vitamin-E deficiencies in animals take various forms in different species; enzyme systems also vary with different species. The brain is most affected in chickens and turkeys obtaining too little vitamin E; encephalomalacia is produced. This abnormality, known to experienced poultrymen as crazy chick disease, develops spontaneously in farm flocks. Cattle and monkeys, undersupplied with vitamin E, develop severe heart disease long before sexual function becomes abnormal.

If females of most species are given too little vitamin E during pregnancy and their young in turn are undersupplied with the vitamin, the voluntary muscles of the young become abnormal; when the deficiency is severe, these muscles stop growing, and a condition known as muscular dystrophy[8] develops. Dys means to stop; trophy means growth. *Normal muscle cells are often replaced by woody, fibrous* tissue which has no power to contract. Muscular dystrophy has been produced in such widely varied species as guinea pigs, rabbits, mice, rats, ducks, hamsters, calves, pheasants, pigs, dogs, and even kangaroos. The rabbits and kangaroos can no longer hop, the rats and mice cannot run, and the ducks and pigs stop waddling. Only in the guinea pig and rabbit can this disease be corrected by giving vitamin E; in all other species, permanent nerve damage occurs. The onset

[8] A. M. Pappenheimer, "Muscular Disorders Associated with Deficiency of Vitamin E," *Physiological Review*, XXIII (1943), 37.

of the disease is slow and insidious; it cripples rather than kills. Although this disease is purposefully produced in the laboratory, animals develop it under field conditions. These animals eat food from the same land we get our food from; the disease may develop in animals which we ourselves may eat as food.

Such research indicates that vitamin E plays a role in building normal muscles and perhaps in maintaining muscle tone. I have a hunch that the lack of vitamin E may be one cause of poor posture seen in perhaps 95 per cent of our population, from the wobbly-headed infant born of a malnourished mother to its stooped grandparents. Do you know of a baby clinic where 10 infants of normal weight can be found without potbellies? Do you know of a classroom of 20 youngsters, none with protruding stomachs and angel-wing shoulder blades? Have you seen a high-school room where all the students stand erect and walk with grace? I would gladly cross the continent to see any one such group. I find many children, especially adolescent boys, whose intake of protein and other nutrients appears to be adequate but whose posture is atrocious; improvement usually follows when this vitamin is given.

I have another hunch, and this one is strong. It is that each of the 252,000 known cases of muscular dystrophy and atrophy in the United States should have been prevented. The Muscular Dystrophy Association believes this figure to be only a fraction of the cases which actually exist. The incidence of this disease has apparently doubled in the last 10 years, running parallel to the numbers of fats which have been hydrogenated. The disease is little known because you rarely see these crippled people; most are too weak to leave their homes or to move wheelchairs. You do see a few but assume they are suffering from arthritis or the aftermath of polio.

The most depressing week end I have ever spent was last year when I was sent as a delegate to a muscular dystrophy conference in Atlantic City. Here were dozens of victims of this horrible living death; some were skeleton-thin; others appeared fat, bulky fibrous material having replaced normal muscle tissue. Many were pulled out of shape by muscles which had stopped growing long before the bones to which they were attached had ceased developing. It is almost unbelievable that weak muscles can pull the shoulder blades so close to the buttocks or can so disfigure the human form. One of their members, an eight-year-old boy, died that week end. Death occurred, as usual, from a slight cold; mucus cannot be coughed from the throat when muscles have given away. As this death was announced at the conference, one could see a look of dread and horror pass over the face of every parent in the room; you understood why each lived in deadly fear of colds.

All week end I talked with these people, admiring their spirit and marveling at their courage. I asked them about their food. Were any of them taking vitamin E in the hope of stopping the progression of the disease? Yes, a few. It has been known for years that muscular dystrophy runs in families. One Chicago family has six boys afflicted with it; a New York family, four boys. Were these people giving vitamin E to the other members of their families in the hope of preventing the onset of this disease? Not that I could find. Was one word said during the conference about preventing this disease? Not that I heard. These people want a cure, and may God answer their prayers!

It was not the contorted shapes, the emaciated forms or the useless limbs of these wonderful people facing the slow death they were all too keenly aware of which depressed me that week end. It was the mental picture of thousands upon thousands of similar children and adults who were yet to develop the disease and to suffer for seemingly endless years. As far as I know, not one step is being taken to prevent the onset of this horrible disease. Do you know of one obstetrician who routinely asks his patients to take vitamin E during pregnancy? I do not. Breast milk averages 40 times more vitamin E than does cow's milk, but few babies are lucky enough these days to get breast milk. Do you know of one pediatrician who routinely gives vitamin E to the babies who must live on formulas? I do not.

Nothing is being done because there is no proof. In the name of heaven, how much proof is wanted? There is proof that pregnant women get little vitamin E. There is proof that children are undersupplied with this vitamin. There is proof that oils are refined and bread is white. Muscular dystrophy is produced in a dozen species of animals when the diets of both mother and offspring are undersupplied in vitamin E. Is there any proof that the muscles of these animals differ much from those of people? Since that week end I have been far more afraid of muscular dystrophy than of cancer or of polio.

Physicians have used vitamin E in attempting to treat many diseases. The most encouraging reports on its therapeutic use have come from a group of physicians in Canada led by Dr. Evan Shute (pp. 354-408 of ref. 1, p. 160). He and his co-workers have studied the effect of vitamin E on women who have had repeated miscarriages and on hundreds of persons suffering from heart disease, high blood pressure, peripheral atherosclerosis, Buerger's disease, diabetes, diabetic gangrene, and gangrenous ulcers. Their results have been dramatic. It is proved that vitamin E fortunately decreases the body's need for oxygen; presumably death from heart disease is caused by lack of oxygen. Gangrene, gangrenous ulcers, Buerger's disease, and peripheral atherosclerosis are also conditions in which too little oxygen reaches the cells.

The work of these physicians has been confirmed in Canada, but in the United States it has met with bitter medical criticism. Several doctors have warned me that if I want physicians to respect my writing, I must not mention Dr. Shute's name. Dr. Shute answers his critics by pointing out that if, in the early days of insulin, every physician had had all the insulin he wished and had given each patient the same amount, no two batches standardized, experimental studies could not have produced identical results. My feeling is that Dr. Shute's work should be viewed with an open mind.

Although these Canadian physicians have found that they cannot obtain results with much less than 300 milligrams of natural vitamin E daily and that the need for at least adequate vitamin E is unquestioned, the diet used by physicians for high blood pressure (p. 303 of ref. 1, p. 160) contains only 7.22 milligrams per day. The reducing diet recommended by the American Medical Association (p. 303 of ref. 1, p. 160), frequently given to persons suffering from heart disease or women wanting a healthy baby, supplies 4.3 to 6.6 milligrams. The diabetic diet in a textbook (p. 619 of ref. 1, p. 160) used in medical schools and by practicing physicians supplies 8.6 milligrams. A tablespoon of soybean oil, taken as salad dressing at lunch and/or dinner, could at least supply 30 to 60 milligrams of vitamin E for these patients and prevent the destruction of vitamin A in their bodies.

I have a hunch that vitamin E played a major role, together with the B vitamins and other nutrients, in the vital statistics published in Denmark after World War I; when no grains were milled, there were fewer cases of high blood pressure, diabetes, and heart disease, the very diseases Dr. Shute has found to respond to vitamin E. Another of my hunches is that these same diseases could be less common in the United States. If we applied what is already known, proof might soon be forthcoming.

My final hunch is that if people stayed on adequate diets including a generous amount of vitamin E, they, like the hundreds of animals studied at Columbia University, might retain their appearances of youth and their normal sexual functions to a late age; their life span, too, might be tremendously increased.

CHAPTER 21

YOUR DISPOSITION TELLS THE STORY

NO PERSON aware of the rewards of adequate calcium would allow himself to be even slightly deficient in this nutrient. Calcium can be as soothing as a mother, as relaxing as a sedative, and as life saving as an oxygen tent.

Although 99 per cent of the calcium in the body is in the bones and teeth, symptoms resulting from an undersupply to the nerves and soft tissues can make life quite unbearable. For example, calcium aids in the transportation of nerve impulses. When this mineral is undersupplied, nerves become tense, and you become grouchy. The calcium-deficient person wastes energy, and his nervous tension and inability to relax induce fatigue out of all proportion to the work he actually does. He is usually so restless that it is tiring to be around him. His irritability and quick temper add nothing to his popularity. A mother whose seventeen-year-old son had an overdose of these symptoms, relieved by adequate calcium, said to me not long ago, "Thank you for making Johnny into a human being again." If the blood calcium becomes unusually high, as it does when toxic doses of vitamin D are given experimentally, relaxation reaches the point of lethargy or sometimes coma; even the excitability of nerves and muscles to electrical stimulus is greatly reduced.

Often the person undersupplied with calcium becomes an air swallower. Since such a person usually talks rapidly, the air may be forced from the throat into the stomach during conversation, a trick nervous women are particularly good at. Either sex may unconsciously form the habit of vigorously swallowing saliva and air simultaneously. Frequently a man gulps his food and, like a ravenous baby, swallows air as he eats; since no one burps him, he often suffers from "indigestion." The volatile oils from such foods as onions, green peppers, and garlic already in his stomach pass into the air bubbles, are tasted whenever he belches, and are blamed for the "indigestion." In time his can't-eat list usually becomes impressive. Often he is an enthusiastic user of soda or alkalinizing preparations. Besides forming enough carbon dioxide to force open the upper valve of the stomach and thus allowing gas and air alike to escape, these substances neutralize the valuable hydrochloric acid in his stomach; any calcium his food may have contained is made insoluble and cannot be absorbed into the blood. The swallowed air sometimes passes into the intestines, expands as it heats to body temperature, and may cause considerable distention and even pain. He becomes, in short, his own worst enemy. His symptoms, however, are quickly relieved provided adequate calcium reaches the nerves.

A calcium deficiency often shows itself by insomnia, another form of an inability to relax. The harm done by sleeping tablets, to say nothing of the thousands of dollars spent annually on them, could largely be avoided if the calcium intake were adequate. Since milk is our richest source of calcium, warm milk drinks taken before retiring have long been advertised for relief of insomnia; heat quickens digestion, calcium soothes the nerves, and restful sleep may follow. Such advertising has the blessing of both the American Medical Association and the Food and Drug Administration. For the person whose tissues are starved for calcium, however, the amount in a milk drink is a mere drop in a bucket. I usually tell persons whose insomnia is severe to take temporarily two or three calcium tablets with a milk drink before retiring and to keep both milk and the tablets on a bedside table and take more every hour if wakefulness persists. Twenty years ago I discussed this subject with a physician who himself suffered from insomnia; he still calls calcium tablets "lullaby pills" and tells me he continues to recommend them for patients annoyed by wakefulness.

An undersupply of calcium also causes irritability of the muscles which may take the form of cramps or spasms. If the blood calcium drops extremely low, convulsions known as tetany can occur; fortunately the usual muscle symptoms are less severe. Leg or foot cramps are the most common, although either cramps or spasms may occur in almost any muscle. For example, spasms in the intestine, spoken of as spastic colitis or spastic constipation, are usually relieved by adequate calcium. The amount of calcium in a woman's blood parallels the activity of the ovaries; the blood calcium falls to such an extent during the week prior to menstruation that nervous tension, irritability, and perhaps mental depression result. At the onset of menstruation, the blood calcium takes a further drop, often resulting in cramps of the muscular walls of the uterus. This condition is especially severe during adolescence, when the demands of growth exaggerate the need for calcium. Menstrual cramps usually disappear within ½ hour after calcium is taken. During the year before menstruation begins (ref. 2, p. 152) and again during the menopause, the lack of ovarian hormones causes severe calcium-deficiency symptoms to occur; at these times unusually large amounts of calcium should be obtained, and every step be taken to insure its absorption into the blood and to prevent its loss from the kidneys. When these steps are taken, the girl at puberty often becomes more pleasant and manageable, and the woman at menopause usually loses her irritability, hot flashes, night sweats, leg cramps, and mental depression. Even after the cessation of menstruation, a pseudo-menstrual cycle can usually be observed, and calcium-deficiency symptoms can be particularly noticed during one week of each month. The calcium intake should be increased at such times.

Another reason for an adequate calcium intake and for keeping calcium tablets in the medicine chest at all times is that this mineral is a pain killer par excellence. Old medical textbooks give as the treatment for the sharp stabbing pains of pleurisy—than which there are few worse—injections of calcium. Why calcium has not been used more widely in alleviating other pain remains a mystery. One physician tells me that he uses no opiates but injects one to four grams of calcium gluconate into the veins of patients suffering even excruciating pain and that relief occurs almost immediately. Although the severely ill person or one enduring a blinding headache usually cannot absorb enough calcium taken by mouth to relieve pain, a less ill person can. The migraine sufferer, for example, can be helped most by taking calcium between headaches. For years I have told people to take calcium tablets before visiting a dentist; the mineral not only helps them relax and feel less pain but makes life easier for the dentist. It has been my experience that adequate calcium usually relieves the itching of hives in a half-hour and the pain of arthritis within one to three days. Since the publication of my book on baby feeding, I have been amazed at the number of young mothers who have written or told me personally that they had experienced no pain during delivery. Invariably they have written or said, "I thought I was having gas pains when the baby was born." Now I tell women to grab a vitamin-D capsule as soon as labor starts and to take two or three calcium tablets every hour until they are wheeled into the delivery room. Regardless of the cause of pain, calcium can usually do something to relieve it; if no relief comes, blame it on poor absorption.

A further reason for obtaining adequate calcium is that it is necessary for the clotting of blood. This need for calcium in blood clotting can be a matter of life or death after an accident. A year ago I interviewed a woman in her forties, a milk-hater whose calcium intake was almost nil; she had suffered from nosebleed most of her life. At the time I saw her, the hemorrhages were so severe that she was paper-white and exhausted; she was being given blood transfusions every few days. Her hemoglobin had been 45 per cent the previous day prior to a transfusion and 58 per cent afterward. Vitamin K, another nutrient essential for clotting, had not decreased the clotting time. I planned a diet containing liver daily and a quart of tiger's milk to which were added powdered bone and dilute hydrochloric acid. I suggested that she take 25,000 units of vitamin D daily for three days and during this period three calcium tablets every two hours, sipping tiger's milk with them. A letter written 10 days later gives the following report: [1] "Had a hemo taken yesterday and it was 79. Pretty good, huh? A queer thing. I told you about the hot flashes and my nose would start practically every time I had a hard one. Well, haven't had one hot flash since I saw you. The second day was blistering hot. My nose bled a very little bit. None at all since. Gosh, sure is wonderful not to be afraid to breathe for fear of a nosebleed."

The 1 per cent of calcium in the soft tissues has still other functions. According to Dr. Cantarow a lack of calcium allows cataracts to form, "probably due to the effect of diminished calcium concentration upon colloid aggregation." [2] Cataracts are undeniably common during the advanced years when calcium deficiencies are legion. Calcium appears to be necessary before vitamin C can function effectively (p. 132). Physicians have often been afraid to give adequate calcium to persons suffering from arthritis, thinking that still more minerals might be deposited in the joints;

[1] Published with permission of the writer.

[2] A. Cantarow, *Calcium Metabolism and Calcium Therapy* (Philadelphia: Lea and Febeger, 1931).

the lack of calcium necessary to help vitamin C in forming normal cartilage around the joints appears to be a major cause of the disease. Calcium decreases cell-wall permeability (ref. 1, p. 132) and thus prevents harmful substances from entering the cells. This mineral is also essential in maintaining normal muscle tone, or excellent posture, and strong muscular contraction; it is for this reason so valuable during labor at childbirth. Calcium has been found also to delay fatigue and to hasten recovery (p. 152 of ref. 1, p. 35).

A lack of calcium causes susceptibility to decay of teeth and demineralization of bones which cannot be overcome with any amount of vitamin D alone. Both calcium and vitamin D must be abundantly supplied, absorbed, and retained if dental and skeletal health is to be maintained. Although phosphorus is combined with calcium in bones and teeth and is possibly more important than any other mineral in the body, it is so rarely lacking in the American diet that a discussion of its value has been omitted from this book.

Many authorities believe that the deficiency of calcium is more widespread than that of any other nutrient; milk is the only dependable source in the American diet. There is, of course, calcium in sour milk, cultured buttermilk, yogurt, and any food prepared with milk. The calcium is lost in the making of cheese. Churned buttermilk contains little calcium because cream is a poor source.

A certain amount of calcium can be obtained from mustard and turnip greens, soybeans and blackstrap molasses, but these foods are rarely eaten daily. The quantity needed to meet an adult's calcium requirements per day from the following foods, listed in medical textbooks as good sources of calcium, would be 72 apples, 80 bananas, 42 oranges, 11 cups of carrots, 33 eggs, 77 potatoes, or 214 dates; the quantities of other foods listed are even more ridiculous. Certainly there are healthy peoples who do not drink milk, but each has a source of calcium; the Hawaiians' source is poi;

the Orientals', soybean curds. The Eskimos, the African natives and formerly the American Indians obtained calcium from bones of fish, small game, and birds. Dr. Michael Walsh found that Mexican Indians, "starving" by our standards, had a calcium intake equivalent to eight quarts of milk daily; this calcium was obtained from the soft limestone used in grinding corn for tortillas. In America the calcium needs of a person who does not drink milk are not met unless he takes a calcium salt, a poor substitute indeed for milk.

Many calcium salts are available. Calcium gluconate and calcium lactate, or calcium combined with the sugars glucose and lactose, usually absorb more readily than does dicalcium phosphate or calcium chloride (ref. 2, p. 179). Bone meal, or ground bone, is often poorly absorbed. Fine bone powder (see footnote, p. 119), however, is quickly dissolved by the hydrochloric acid in the stomach and hence is absorbed readily. Cereals, homemade breads, and many other foods can be advantageously fortified with powdered bone.

Although calcium salts are not harmful, only a limited quantity can be absorbed even under ideal conditions. Taking larger quantities is somewhat like dropping beads through the hole in a spool of thread; the spool is not harmed, but the procedure borders on stupidity if expensive beads are lost. Physicians sometimes fear that taking calcium salts may cause kidney stones. The formation of such stones, however, appears to result from a combination of innumerable physiological abnormalities including too alkaline urine, possibly the lack of vitamin A, and a number of combined factors such as an undersupply of unsaturated fatty acids and/or protein or excessive phosphorus which allow minerals to be lost in the urine.

It is not enough to see that calcium is adequately supplied; it must pass through the intestinal wall into the blood before it can be of value. Calcium must first be dissolved by hydrochloric acid in the stomach. If this acid is absent, as it usually is when persons have the tongue symptoms described on page 63, calcium cannot be absorbed, though the supply be generous. Even when the stomach acid is normal, the added citric acid supplied by a glass of orange juice or lemonade has been found to increase calcium absorption markedly. Lactose, the sugar obtained by drinking milk, causes a pronounced increase in calcium absorption (ref. 2, p. 179) because it is broken down by intestinal bacteria into lactic acid. If the diet is excessively high in phosphorus, calcium and phosphorus combine in the intestine to make insoluble salts which do not dissolve even in acid. The taking of soda or any alkaline substance, which neutralizes the food and stomach acids, or the eating of candy or other concentrated carbohydrate, which stimulates the flow of alkaline digestive juices, decreases or prevents calcium absorption.

After calcium is once soluble, it must next combine with fat, making a soap which dissolves as readily in water as ordinary soap dissolves in a bathtub; in this form, the calcium passes across the intestinal wall into the blood. If so much fat is eaten that it cannot be absorbed, soap is formed, and both the fat and calcium are lost in the feces; this soap becomes hard, often causing constipation as well as robbing the body of valuable calcium. The stools of persons attempting to gain weight by drinking rich milk and eating quantities of fat often look like shiny soap; instead of gaining, such people usually become thinner because the loss of calcium results in greater nervousness and overactivity.

Conversely, almost any person who stays on a fat-free diet absorbs little or no calcium from his food. For example, leg cramps and other calcium-deficiency symptoms suffered by women during pregnancy or menopause can sometimes be relieved more quickly by fat than by extra calcium. More calcium is absorbed from yogurt and buttermilk, which supply both fat and lactic acid, than from sweet whole milk. If you wish to use skim milk, drink it at a meal when you have a salad tossed with oil. Using fresh or powdered skim milk without fat being obtained simultaneously may be actually dangerous; besides calcium being lost, the need for vitamin B_2 is increased (p. 99).

After calcium has reached the blood, the next task is to prevent it from being lost from the body. If cholin and/or linoleic acid are undersupplied, if the protein intake is inadequate, or if thyroid, benzedrene, or certain other drugs are used, large quantities of calcium may be lost in the urine. Even a slight increase in protein intake can markedly increase calcium retention. The most important factor, however, is the quantity of phosphorus in the diet in relation to the amount of calcium. Ideally, no more than twice as much phosphorus as calcium should be obtained; yet persons often ingest 10 times more phosphorus than calcium. Aside from such urinary losses, calcium and phosphorus which might be thought of as worn out are lost daily in the feces.

Phosphorus is necessary to the life processes of every cell not only in all animals but in all plants. The American diet, poor in calcium, is therefore rich in phosphorus. In the maintenance of bones and teeth, calcium is used in chemical combination with phosphorus. If calcium is undersupplied in proportion to phosphorus, there is nothing for phosphorus to combine with. In this case, phosphorus is excreted in the urine. There is, however, always calcium in the blood. Unfortunately, urinary phosphorus is excreted in the form of calcium-phosphorus salts, and the body is robbed not only of its limited calcium supply but of phosphorus which may *also be greatly needed. For these reasons, calcium gluconate* and calcium lactate are preferable to calcium salts containing phosphorus.

Liver, yeast, and wheat germ are unusually rich in phosphorus and yet poor in calcium; if large quantities of these foods are consumed, calcium lactate or calcium gluconate should be obtained simultaneously. When such a precaution is not taken, the proportion of phosphorus to calcium may become so high that the excretion of the excess phosphorus in the urine can induce a severe calcium deficiency. Sometimes a person who uses little or no milk becomes enthusiastic about obtaining large amounts of the B vitamins; his high intake of phosphorus and lack of calcium can cause him to become a nervous wreck. Phosphorus, calcium, and vitamin D are interdependent. When liberal quantities of milk, cultured buttermilk, yogurt, and foods prepared with fresh and powdered milk are used, calcium is supplied, and no problem arises unless large amounts of liver, yeast, and/or wheat germ are eaten temporarily; in this case, a calcium salt can both prevent harm and be of great value.

Excess calcium which is absorbed and retained is stored in the shafts at the ends of the long bones as a lacy network of bony structure known as trabeculae, absent when no excess minerals have been available. You probably have noticed this lacy structure when a soup bone has been cut lengthwise. Calcium thus stored can be used at times of dietary insult; thus health can be protected. When no minerals are stored, calcium and phosphorus, aided by a hormone from the parathyroid glands, are removed from the bones to supply the needs of the soft tissues. The amount of calcium in the blood therefore remains at a normal level even when bones become progressively more porous and fragile, teeth become susceptible to decay or erosion, and multiple symptoms of calcium deficiency become evident. When deficiency symptoms are persistent, the bones are probably in a precarious condition.

Instead of bones being lifeless structures, unchanging after the cessation of growth, a continuous tidal flow of minerals passes in and out of them every hour of life. If sufficient calcium is obtained and absorbed, the tide flows into the bones, building and repairing until all porosity is gone and dense mineralization is formed; any excess is then stored in the trabeculae. When too little calcium is obtained, the tide flows first from any calcified trabeculae; if no minerals have been stored, calcium and phosphorus are removed from the bones to supply the calcium needs of the soft tissues.

The calcium content of milk varies with the feed of the cow and season of the year; a quart of milk may contain 800 to 1500 milligrams. Powdered milk, made from summer milk when the supply is generous and green food is usually available, contains more calcium than does average winter milk. Powdered milk should be used liberally in cooking, always in recipes containing fat. If optimum health is to be obtained, adults should have daily at least one gram of calcium, the amount obtained from four glasses of average milk, yogurt, or cultured buttermilk. Still larger amounts may be advantageous. In times of prosperity, the daily calcium intake of the Finns and Swiss averaged six grams; many primitive races obtain even larger amounts of calcium. If a small excess is allowed for daily storage, large amounts of calcium would never be needed nor would calcium deficiencies ever exist.

Your own disposition can probably tell you the adequacy or inadequacy of your calcium intake, absorption, and retention. If it is good, no one can enjoy it more than yourself.

CHAPTER 22

AS I SEE IT, THERE'S NO EXCUSE

I CANNOT see how any intelligent person could let himself be deficient in either of the two nutrients, iron and iodine. The need for both has been known for decades. Iron is found in almost every natural food, whereas iodized salt has been sold at no extra cost for years. The fact that deficiencies of both iron and iodine are still widespread gives me a depressing you're-butting-your-head-against-a-brick-wall feeling. But then I remind myself, more logically, that people will never apply sound nutrition until convinced it has personal value for them.

Not long ago a physician referred to me a man suffering from a fatal disease in which iron is held in the body in the form of a pigment. This man's identical twin had already died of the disease. My problem, supposedly, was to plan a diet which could maintain maximum health but which supplied no iron, meaning no meat, eggs, fruit, vegetables, yeast, wheat germ, or whole-grain breads or cereals. If you can plan such a diet, let me know. I could not.

Anemia can result from inadequate protein, iodine, cobalt, copper, ascorbic acid, or almost any one of the B vitamins, particularly folic acid, vitamin B_{12}, niacin, or pyridoxin. Approximately half of all persons suffering from anemia have abnormal or sore tongues, indicating a lack of B vitamins. Probably every nutrient plays some role in building healthy blood. Much anemia does exist, however, which can be corrected by nothing more than iron.

Red blood cells, or corpuscles, are made in the bone marrow. It is estimated that approximately one billion per minute are produced by a healthy adult. In a cubic millimeter of blood, an imaginary cube about 0.04 inch on every side, there are normally about 5,000,000 red corpuscles. This number is spoken of as the blood count.

Each corpuscle must contain a certain amount of red coloring material, or hemoglobin, which carries oxygen by combining chemically with it. An easy method of estimating the amount of hemoglobin in the corpuscles is by comparing the color of blood with that of a standard series of colors. Blood which matches the brightest red of the standard is considered to have 100 per cent hemoglobin. If your blood matched the color marked 80 per cent, it would indicate that you have 80 per cent of the total amount of hemoglobin you should have.

Iron-deficiency anemia is a childish or feminine disease rare in men; the chief reason is that children grow and women menstruate. Men, however, may produce anemia in themselves through hemorrhage from stomach ulcers. Severe anemia often occurs in blood donors whose admirable generosity is not matched by an intelligent replacement of iron. Anemia in general means that the body does not produce enough red corpuscles or enough hemoglobin or enough of both. If the only deficiency is one of iron, the number of red blood cells is only slightly below normal; the hemoglobin, however, lacks color. The body of an anemic person cannot be supplied with sufficient oxygen; energy production is interfered with. The chief complaints are weakness, perhaps dizziness, shortness of breath on exertion and consciousness of a pounding heartbeat, or palpitation; fatigue amounts to a continuous dead-tiredness. The fingernails are often brittle and show longitudinal ridging. Such persons are literally and figuratively colorless, listlessly lacking in vitality. Since too little oxygen reaches the brain, they cannot think as clearly or quickly as is normal, and they forget easily. Yet when an adequate diet is adhered to and well absorbed, the amount of hemoglobin and the number of red corpuscles quickly become normal.

Aside from the iron needed for hemoglobin, iron is in the *nuclei*, or business center, of all body cells. It is part of substances known as cytochrome, important in energy production, and myohemoglobin, or hemoglobin of the muscles. During iron deficiency, iron for the production of cytochrome and myohemoglobin has priority over that of hemoglobin.

The greatest single cause of iron-deficiency anemia is the refining of breads, cereals, and molasses. Although much has been said about the iron in "enriched" flour, only 6 milligrams per pound is added; whole-wheat flour contains approximately 18 milligrams. Brewers' yeast and wheat germ are both excellent sources supplying per ½ cup 18 and 8 milligrams, respectively. Blackstrap molasses is not only one of the richest sources of iron but also of many other minerals and of inositol. It supplies about 9 milligrams of iron per tablespoon; dark unrefined molasses, 1.5 milligrams; sugar, none. As a by-product of sugar refining, thousands upon thousands of gallons of blackstrap molasses are available. The dumping of blackstrap in Cuba became a public health hazard because it attracted so many gnats and bugs. It seems an affront to the human ego that insects, with their minute brains, can appreciate nutrition so much better than people can.

I used to recommend blackstrap stirred into milk or tiger's milk. Then I saw a formerly anemic child of three whose parents, superinterested in nutrition, had given him directly from the tablespoon almost a half cup of blackstrap daily. The child had never been allowed to taste candy even at Christmas, but his teeth were decayed to the gum margin. Since then I have been afraid to recommend blackstrap.

This reason, of course, may be only rationalized, the real one being that I can no longer take the ribbing. The blackstrap gags have become shopworn. The following, however, written before a geologist, Dr. Natland by name, left for Arabia, is no isolated example:

> Camel's milk, boiled goat, dates and cheese,
> Poor Nat will starve if he can't eat these;
> Sun-warmed, fly-specked and sprinkled with sand,
> Sounds like a diet Adelle Davis had planned.

In a mixed diet—not mixed with sand—only about 50 per cent of the iron is absorbed even by a healthy person; the remainder is lost in the feces. In experiments in which anemia was treated with single foods, liver was found to produce most hemoglobin, kidneys second, apricots third, and eggs forth. Many foods which contained as much or more iron failed to be good blood builders. Part of the iron in leafy vegetables is held in insoluble compounds which cannot be absorbed. The iron from most fruits reaches the blood stream. In general, the softer the texture of any food containing iron, the more complete the absorption. Much iron in meats is in the form of hemoglobin which is incompletely digested.

When iron-containing foods are digested, the freed iron must dissolve in hydrochloric acid from the stomach before it can pass through the intestinal wall into the blood. Since approximately two-thirds of all anemic persons lack this acid, much nutritional anemia cannot be overcome unless acid is supplied with adequate iron. Foods which contain acids, such as buttermilk, yogurt, sour fruits, and citrus juices, aid the absorption of iron. Even the drinking of sweet milk increases iron absorption because milk sugar is converted into lactic acid by intestinal bacteria. Conversely, refined carbohydrates decrease iron absorption both because they stimulate the flow of alkaline digestive juices and because they do not support the growth of valuable intestinal bacteria. Persons with stomach ulcers, anemic from loss of blood, cannot absorb iron while taking alkalinizing preparations.

Most inorganic iron is well absorbed, even iron rust. An old medical treatise entitled *Self-help for People in Remote Places* suggests for "the disease of pale ears" soaking rusty iron shavings in vinegar-water overnight and drinking the water. An ancient treatment of anemia was to stick rusty nails into a sour apple, allow it to stand overnight, remove the nails, and eat the apple. A rusty horseshoe would be an excellent toy for an anemic toddler who puts everything in his mouth. Ferrous chloride and ferrous sulfate are used medically in treating nutritional anemia. The body, however, needs only a limited amount; if more is absorbed than is needed, these drugs may be mildly toxic. I frequently find persons who are taking both an iron preparation and more than adequate amounts of vitamin C but who show multiple signs of vitamin-C deficiency; I suspect the vitamin is destroyed by the excess iron. I find liver, yeast, wheat germ, and eggs far more effective in correcting anemia than are iron salts.

A small excess of iron is stored in the liver, the bone marrow, and the spleen and is used at times when the diet is inadequate. The person suffering from an iron deficiency is anemic only because he lacks such a store.

The life span of red corpuscles is three to four months. They are then withdrawn from circulation by the spleen and liver and are broken down by enzymes. The iron is used again and again in building other corpuscles. Most authorities believe that healthy women after menopause and adult men need no dietary iron. The non-iron parts of broken-down hemoglobin are excreted by the liver as waste products. They are carried away in the bile and are known as bile pigments. These pigments give the color to the stools and urine.

Iron requirements are especially high during adolescence, when the blood volume increases rapidly, and during pregnancy. The needs of non-pregnant women vary with the losses during menstruation. Many women have excessive menstrual flow for years without realizing that it is excessive. Usually an adequate diet particularly high in protein, the B vitamins and especially vitamin E will correct excessive flow in a few weeks. Cumulative menstrual losses, pregnancies, and the long use of deficient diets cause anemia to be prevalent in women at and after the menopause. Besides causing needless fatigue, mental confusion, and depression, anemia can bring about such forgetfulness that these women often become convinced they are losing their minds.

So-called normal blood, arrived at by studying averages, has 4,500,000 red cells and 80 to 100 per cent hemoglobin for children and women and 5,500,000 cells and 100 per cent hemoglobin for men. When an adequate diet is given growing children, adolescent girls, and women of the reproductive age, hemoglobin of 100 per cent can be maintained, and the average blood count of 4,500,000 increases to 5,500,000. Such improvement shows that the standards for women are below normal. There are no age or sex differences in blood color or number of corpuscles in well-fed animals.

The National Research Council recommends 12 milligrams of iron daily for adults and 15 milligrams for adolescents and pregnant women. Probably slightly larger amounts are more nearly ideal for women with heavy menstrual flow. Any diet adequate in protein and the B vitamins, supplied by natural sources, will be more than adequate in iron. If anemia does persist after a sound nutrition program is adhered to, a physician should certainly be consulted.

A blood analysis tells a physician many things; it usually tells you nothing you could not learn by examining yourself carefully before the mirror. If your ears are red and if your forehead, neck, and skin not hidden by rouge have a glow of health, you can assume that your bloodstream is satisfactory. You have one of the fundamental attributes of genuine beauty and probably the vivacity which helps to make up the intangible qualities known as charm and personality.

Too little iodine can be even worse than a lack of iron. When iodine is undersupplied in the mother's diet during pregnancy, the baby fails to develop normally; if the deficiency is quite severe, he may become an idiot, or cretin. I am told that institutions for subnormal children in goiter belts are filled with such cases. When a severe lack of iodine occurs later in life, myxedema results. I have seen only one case each of these abnormalities and, please believe me, one of each is too many. The child, the first of wonderful parents, is eighteen months old, sluggish, disgustingly fat, still toothless, and covered with eczema; so many behavior problems are developing that the conscientious young mother is already nearly insane. Her physician told me, "Her troubles haven't even started yet."

I hesitate to tell of the other case, it is so unbelievable; a woman of perhaps forty-eight, unable to leave her home. I saw her on a sweltering day in August. A daughter opened the door and took me to the living room where the mother sat on a davenport, wearing a heavy winter coat, her knees covered with a blanket, a small gas heater burning at her feet, and every door and window in the room tightly closed. One could scarcely breathe in the room. The woman was stuporous, her eyes were glassy, and her movements and thinking were unconceivably sluggish. The condition had come on gradually. Her physician had given her thyroid, but she had failed to consult him again when the cumulative effect of repeated doses had made her extremely nervous and had caused frightening heart palpitations. She had stopped the thyroid weeks before. A small amount of iodine daily could have prevented both conditions and all others like them.

Iodine is needed by the thyroid glands, situated on either side of the windpipe. These glands produce an iodine-containing hormone known as thyroxin, which can be produced in normal amounts only when adequate iodine is supplied. Thyroxin has a profound effect upon growth, mental and physical development, and the maintenance of health throughout life. Although minute amounts of iodine are found in all parts of the human body, it is concentrated in the adrenal cortex, the ovaries, and particularly the thyroid gland which soaks it up like a sponge.

Thyroid activity is now measured by analyzing the blood for protein-bound iodine. A normal basal metabolic rate, or BMR, means that energy is produced as it should be. The normal range is from minus 10 to plus 10; persons with such a BMR have iodine values of 4 to 8 micrograms for each ½ cup (100 cc.) of blood. Persons with less than 4 micrograms of iodine have a BMR of minus 10 to minus 50. It must be remembered, however, that low blood sugar or an undersupply of protein, vitamin B_1, or any one of several other nutrients decreases energy production. If a person's diet is inadequate in any of these nutrients, his basal metabolic rate can be far below normal even though the iodine intake is adequate.

A partial or severe lack of iodine causes goiter, or enlargement of the thyroid glands. The enlarged glands often use the limited iodine supply more efficiently than can normal glands; hence the amount of thyroxin produced may remain the same, and the BMR may not drop below normal. Aside from a slight fullness and perhaps a mild pressure in the neck, there may be no other symptoms. The swelling in the neck may be so slight as to go unnoticed; yet every person, in my opinion, should learn to detect even a small goiter. Stand before a mirror and turn your head as far as you can from side to side; if you can scarcely see the ligaments in your neck as you turn your head, your thyroid glands are probably somewhat enlarged, and your iodine intake should be increased. Even large goiters disappear when sufficient iodine is taken together with an adequate diet; the process is slow, but eventually new, healthy cells do replace the abnormal ones. The seriousness of goiter often lies in its very mildness, which can easily lead to neglect. Goiter is a danger signal, pointing to possible troubles ahead, years and years of possible troubles.

I grew up in a goiter belt and know these troubles only too well. Mine were typical difficulties associated with iodine deficiency. When I was about fourteen, came blinding, pressure headaches associated with the menstrual period; each time I felt as though my neck would burst and my head would blow apart. A physician pointed out my goiter at that time and recommended iodine, which I considered a sort of aspirin substitute and failed to continue; he was the only physician who ever recommended iodine for me. The headaches continued for years. In a nutrition class at the University of Wisconsin the famous Dr. Amy Daniels mentioned that it was difficult to find an adolescent girl in the Middle West whose thyroid glands were not enlarged; she pointed out several girls with goiter in the class, then glanced at me and said, "You have a bad one." I still did not take iodine; correction was not stressed.

Later, as the need for iodine decreases, the goiter disappears, but a low metabolic rate persists. There is no spontaneity or joy in work or exercise; energy is not produced normally. You are cold when other people are comfortable; your hands are clammy; your feet are so cold at night that you cannot get to sleep. Your cooling system, however, does not work right either; in hot weather you are still more miserable. You are mentally and physically sluggish. College is difficult, and you learn by the plodder method, envying friends who complete an assignment at first reading. You gain weight easily, forever trying to reduce and forever staying too fat. The heavy-hipped, thick-legged, goiter-belt figure, resulting from iodine deficiency during growth and particularly at puberty, can be recognized the world over. Probably every one of the millions of women who have it hates hers as much as I hate mine. Taking iodine after growth had ceased cannot change it.

During my next 15 years, perhaps a dozen physicians told me to take thyroid tablets, but it is no easy trick to find the correct dosage. If you take too much, you become high-strung, nervous, wakeful; your heart nearly jumps out of your chest. Soon you become discouraged and give up until you either realize how important iodine is or are driven by sluggishness to try thyroid tablets again.

Later, for me, came the years of wanting children, with the accompanying heartaches and frustrations only a childless woman can understand. You spend hundreds of dollars trying to correct the unknown difficulty and take shots until you feel like a pin cushion. Hope rises at each intermenstrual period; crushing disappointment comes with the onset of each menstruation. Eventually you learn that the ovaries are usually damaged when the iodine deficiency has been too severe during the developmental period; taking iodine later cannot restore normal ovarian function. Then followed years of empty-armed despair, spent searching for children to adopt. Yet every one of these abnormalities could have been prevented in my case and thousands of similar ones by five cents' worth of iodine or at no cost if iodized salt had been available years ago as it is now.

In 1917, Drs. David Marine and O. P. Kimball showed that goiter could be easily prevented. These doctors gave iodine twice a year to 2,190 girls in Akron, Ohio; only five developed goiter. Among an untreated group of 2,300 girls, almost 500 relatively severe goiters developed. After this classic study iodized salt was made available; not one case of goiter should have ever again occurred. Yet recent surveys, made more than 30 years later, revealed that 55 per cent of the girls and 30 per cent of the boys in the Cincinnati schools had goiter; in Minnesota, 70 per cent of the girls and 40 per cent of the boys; in Portland, Oregon, 40 per cent of the girls and 22 per cent of the boys. In Cleveland, the incidence of goiter was found to be exactly the same as it was before iodized salt was put on the market. This valuable salt was not and is not being used. Figures like these are disgraceful. The ignorance and apathy which allow such abnormal conditions to be so widespread are likewise disgraceful. The amount of goiter among adults is not known, but the incidence is appalling when one considers that both prevention and cure have long been known.

The chief source of iodine is the ocean. The only parts of our country where adequate iodine may perhaps be obtained without using iodized salt is a narrow strip along the Atlantic seaboard, around the Gulf of Mexico, and in regions which in recent geologic ages formed the floor of the ocean, such as parts of Kansas, South Dakota, Utah, western Texas, and New Mexico. Foods grown on these soils usually contain some iodine. Other soils, although near the coast, contain little or no iodine. No food is a reliable source except ocean fish and seafoods. Even fresh-water fish in Minnesota are said to develop severe goiters. Many cities on the Pacific Coast use melted-snow water which is iodine free; despite nearness to the ocean, iodine deficiencies are common.

Iodized salt, approved by the American Medical Association, contains the amount of iodine that occurs naturally in unrefined ocean salt. When iodized salt is used throughout life, the iodine needs are supplied. No harmful effects can result from using this salt because iodine is lost continuously in urine, perspiration, and even exhaled air. Harm caused by not using it runs into millions of dollars spent for the surgical removal of goiter alone. The monetary value of the loss of efficiency resulting from an undersupply of iodine cannot be estimated. Surveys reveal that only 15 per cent of the salt purchased even in the goiter belts is iodized. So great is the contribution of this nutrient to health that the compulsory iodinization of all salt seems to be the only answer. Wherever this step has been taken, as in Switzerland and Austria, goiter has disappeared, and basal metabolic rates stay more nearly normal.

The iodine requirements are increased in early childhood, puberty, and adolescence, during pregnancy and lactation, and particularly at menopause. It is during menopause that goiters most often grow to be huge. No additional amounts of iodine need be taken at these times if iodized salt has been used continuously for years; the thyroid gland traps and stores iodine for future safety. If this valuable salt has not been used constantly, some form of iodine should be taken to meet current needs and make up the deficiency. Dr. William T. Salter, professor of Pharmacology at Yale University School of Medicine, writes (p. 132 of ref. 1, p. 35): "There are still clinicians and surgeons alive who favor one type of iodine preparation over another, but this is a problem in psychology rather than in clinical science." This physician states that to correct goiter, one minim—a few drops—of Lugol's solution every Sunday is sufficient. Any druggist can prepare Lugol's solution in a couple of minutes; it costs little and is almost tasteless if added to 1/4 cup of water or milk. Often physicians who recommend Lugol's receive poor co-operation because patients become discouraged by the slow improvement; goiters which could have disappeared are removed surgically at great cost. Despite the ease of prevention, every year millions of people who fail to obtain a normal supply of iodine pay for their neglect through a lack of mental and physical efficiency and alertness; thousands more, through pain and misery.

When one has suffered personally from a deficiency of a nutrient, it is perhaps difficult not to overemphasize its value. I have been guilty of that. Years ago I found an unopened box of salt on the kitchen sink; since its label assured me it was free running but not iodized, I tossed it into the trash can. Later, my husband asked if I had seen the salt; I told him what I had done and why. He was understandably a bit irritable as he explained that he had wanted to put it into the toilet of our mountain cabin to keep the water from freezing and that he did not consider its iodine content of great importance.

CHAPTER 23

HOW FIRM A FOUNDATION?

ALL UNREFINED foods grown on good soil contain minerals necessary to the normal life processes of animals and humans and to the plants themselves. Besides the minerals already discussed, there are sodium, chlorine, potassium, and a group spoken of as trace minerals.

There is no trick, of course, in getting sodium and chlorine, which are supplied by ordinary table salt, or sodium chloride. It is usually assumed that the other minerals are generously supplied in a "well-balanced diet"—whatever that means—mostly because many of them are needed in such small amounts. The small-amount argument, in my opinion, is what we used to call on our Indiana farm "so much hog-wash."

Cobalt is a trace mineral needed only in small amounts. It forms part of vitamin B_{12}; as little as three micrograms of vitamin B_{12} daily can cure pernicious anemia. The fact that the amount needed was small did not keep thousands of people from suffering from fatigue which tortured every cell in their bodies; it did not prevent a crippling paralysis from dooming them to a stumbling and falling existence and finally a bedridden living death during the years before Drs. George R. Minot and William P. Murphy found that raw liver could control the disease. Thousands of cattle, sheep, and other animals, grazed on land deficient in cobalt, especially in Florida and Australia, sickened and died from a crippling anemia. Such deaths could be prevented if a few pounds of cobalt were added to each acre of land. Pernicious anemia, however, was never confined to Florida or Australia. Studies conducted at the University of Florida Agricultural Experiment Station showed that 81 per cent of the children living in the area suffered from anemia, just as did the animals; 50 per cent showed definite anemia, whereas 31 per cent were borderline cases. When the land is deficient, the plants grown on that land are deficient; the animals which eat the plants are deficient; the people who eat the animals and the plants are deficient. It cannot be otherwise.

I believe that the various minerals are far more important to health than anyone realizes; I believe that our diets are far more deficient in them than anyone realizes. One reason for my belief is that in any agricultural library you can obtain books [1] with beautiful colored pictures of deficiency symptoms of vegetables, fruits, and other plants which we and animals use as food. You can see those same deficiency symptoms in the food in every market: the split stalks of celery; the cracked cores of cabbage and cauliflower; the uneven ripening of the apricots and tomatoes; the yellow margins on the spinach; the rusty streaks of the lettuce; those signs and dozens more. Such symptoms occur only when the plant is deficient in one mineral or another.

Potassium is said to be widely found in foods, particularly in small green leaves. The three nutrients, potassium, sodium, and chlorine, are important in keeping the body fluids near neutrality; they determine the amount of water held in the tissues, and they attract nutrients from the intestines into the blood and from the blood into the cells by means of maintaining what is known as osmotic pressure. These minerals are essential parts of the glandular secretions. Potassium helps in sending messages through the nervous

[1] *Hunger Signs in Crops, a Symposium* (Washington, D. C., National Fertilizer Association, 1952). Frank A. Gilbert, *Mineral Nutrition of Plants and Animals* (Norman, Oklahoma: University of Oklahoma Press, 1948).

system. Chlorine is used in forming hydrochloric acid in the stomach. These three minerals are excreted daily in the urine, the amount being equal to that ingested by a healthy person.

A partial deficiency of potassium in animals causes slow growth, constipation, gas formation, and a nervousness typified by extreme alertness and insomnia. The hearts of potassium-deficient animals beat slowly and irregularly, the heart muscles are damaged, the kidneys become enlarged, and the bones fragile. The symptoms produced in animals are so similar to the nervousness, constipation, and digestive disturbances endured by millions of Americans that a study was made of human subjects maintained on a diet low in potassium. All developed constipation, indigestion, insomnia, and nervousness. Potassium is largely lost when foods are refined or when vegetable-cooking water is discarded. Our high consumption of refined foods and our sloppy cooking methods, to say nothing of the condition of our soil, could easily allow unrecognized potassium deficiency to be widespread.

Under normal conditions, a healthy person runs little risk of deficiencies of sodium and chlorine. In extremely hot weather, however, so much salt can be lost through perspiration that death may result. Death from salt deficiency occurred during the first years of work on Boulder Dam and similar projects. During the blistering summer of 1933 I corresponded with an engineer who was working on Parker Dam. Each letter contained some such cheerful note as, "We had a wonderful cook but he died yesterday of heatstroke." The symptoms of sunstroke also are now recognized as caused largely by loss of salt through perspiration.

A lack of salt causes symptoms varying in severity from mild lassitude, weariness or hot-weather fatigue, common during heat waves, to heat cramps, heat exhaustion, or heatstroke, familiar to people who work in iron foundries, furnace or boiler rooms, and industrial plants such as steel or paper mills. Even persons who foolishly play tennis or take similar exercise in hot weather may suffer from heatstroke. The symptoms of heatstroke are nausea, dizziness, exhaustion, vomiting, and cramps in the legs, back, and abdominal muscles or any muscles being used at the time. Without salt, the more water drunk, the worse the condition becomes. Persons working in extreme heat are now advised to take a salt tablet with each drink of water. During hot weather, salty foods, such as salted nuts or soybeans, cheeses or potato chips, should be kept near the drinking water, and at least one well-salted food should be served with each meal. Too much salt rarely harms a healthy person; if more is eaten than is needed, diarrhea occurs. Since normal people may lose as much as a tablespoon of salt daily in the urine, it is unwise to restrict the salt intake unless advised to do so by a physician. Except during hot weather, the healthy person can allow his taste to be his guide as to the amount of salt to eat.

Another essential element, magnesium, is a component of chlorophyll. This mineral is necessary to the action of some 30 enzymes in the body. The best source is green leaves; like potassium, however, it can be lost if cooking water is discarded. Whole-grain breads and cereals contain some five times more of this mineral than do the refined products. When animals are deficient in magnesium, their hearts usually become abnormal and beat too rapidly; they are extremely nervous and irritable and often have tremors and/or convulsions; slight noises such as turning on a water faucet or an electric fan near by can cause the animals to go into convulsions which may be fatal. The animals' behavior resembles certain types of insanity more nearly than that produced by any other means.

The blood of persons suffering from extreme irritability has been found to be low in magnesium. Recent work indicates that the soothing effect of vitamin B_6 (p. 84) is due to better utilization of this mineral. For years Mrs. Gladys Lindberg, who works as a nutrition consultant, and I have obtained remarkable results in giving vitamin B_6 to many persons suffering from nervousness, insomnia, mild or severe tremors, convulsions (epilepsy), or even paralysis agitans (palsy). Reports in medical journals often state that these same conditions have not been helped by vitamin B_6. I believe that the difference lies in the fact that we also recommend for every malnourished person a supplement of trace minerals containing magnesium.[2] It is my guess that magnesium deficiencies are partly responsible for the widespread nervousness, insomnia, and irritability supposedly caused by the "fast pace of modern living."

The relation of this mineral, if any, to insanity has not been investigated. In many of our institutions for the insane the diets provided are far from adequate. No well person could eat the food served in some of these places, let alone an ill one. There has been no effort to find out what a well-absorbed diet adequate in vitamin B_6 and magnesium could do for mentally ill persons. Whenever I think of the tortured human beings writhing in straitjackets or perhaps held down in hot water by canvas fitted around their necks and the sides of the tubs, as I have seen them in too many institutions and psychopathic wards, I long to give these people injections of vitamin B_6 and magnesium. Yet I know of no physician who is even interested; and how could one be? In a new 900-page book on clinical nutrition, written as a reference book for the practicing physician and as a textbook for medical students, the word magnesium is not even mentioned or listed in the index. The assumption is that it is unimportant because it is "generously supplied in our foods."

[2] See footnote, p. 228.

Copper helps the bone marrow to produce red blood cells. Anemia results if it is undersupplied. It aids in forming certain enzymes necessary to the function of the nerves. This mineral plays some role in pigment formation, thus possibly being a factor in the prevention of gray hair. Black animals, lacking copper, become gray. Graying in humans has long been known to be often associated with anemia. Copper also appears to aid the body in using vitamin C economically; signs of scurvy in guinea pigs without vitamin C can be prevented by giving this mineral (p. 400 of ref. 2, p. 63).

Copper-deficiency symptoms can be recognized in plants. "Swayback" disease occurs in lambs grazed on copper-deficient soil, and anemia in the ewes; both conditions may be prevented by putting copper in the soil. In infants and small children, anemia which is not corrected by iron alone is corrected when copper is added. Yet one finds in medical textbooks such statements as, "Since the human requirement is so small and the element is so widely distributed in foods, it is difficult to imagine circumstances under which copper deficiency might develop." I find it as easy to imagine as it is to imagine a person with gray hair.

Zinc deficiency is not recognized in humans, but it is in plants, where it results in little-leaf disease (p. 119 of ref. 1, p. 35). The healthy human body contains more zinc than any other trace mineral. Zinc is present in all human tissues, especially in the pancreas where it is associated with insulin. The zinc content of the pancreas of diabetic patients is only half that of normal persons. Zinc is known to be part of several enzymes in the body and acts as a cell catalyst, or "speeder-upper," of energy production. Zinc deficiency in experimental animals results in slowed growth, loss of hair, faulty food absorption, skin abnormalities, and emaciation. Zinc is lost when foods are refined; diabetes increases when foods are refined; perhaps a mere coincidence.

Manganese is also necessary to human growth and health, although its exact action in the body is little understood. It is found in all healthy human tissues and can be stored in the liver and thyroid glands. This element is important in maintaining normal reproductive functions; it is related to the use of calcium and phosphorus and is found in the bones; and it activates at least four known enzymes. An undersupply of manganese causes a loss in mating interest and later sterility in male animals. It interferes with the maternal instinct in females; mother rats on manganese-deficient diets will not suckle their young nor will normal mother rats adopt manganese-starved baby rats. Manganese is found in green leaves if the food is grown on good soil; it is often discarded in cooking water. Whole-grain breads and cereals contain about six times the quantity found in the refined products.

Fluorine is another element essential to health. I have received many letters asking my opinion on fluoridation of water. People become so emotional about this subject that I am tempted to say that my opinion is like my religion, no one's business but my own. I recently heard a forum on fluoridation; dentists, physicians, and biochemists argued it out, each with violent convictions for or against. Some speakers were unscientifically emotional; others, emotionally scientific. Everyone seems to agree that the right amount of fluorine will reduce tooth decay. The opponents argued that if youngsters' teeth no longer decay, mothers will make no more effort to keep the child's nutrition adequate; that fluoridation has not been studied sufficiently; and that even small amounts may be toxic. Too much fluorine obtained when the teeth are developing causes them to be mottled with an unattractive brown pigment.

The first argument seems unsound to me. Mothers of children whose teeth decay most severely are usually ignorant of or not interested in nutrition and/or cannot afford excellent food. Furthermore, many intelligent, conscientious parents, doing everything they can, still cannot prevent their children's teeth from decaying; sweets are given the children by well-meaning neighbors, store owners, and even strangers and are served at parties, cub scout meetings, and endless other places. The argument that fluoridation has not been studied sufficiently is probably true. Long-term "experiments," however, have occurred naturally in dozens of places, some of which have been studied in great detail. In certain communities where the water contains as much as three or four parts of fluorine per million, there have been little or no mottling and no tooth decay. No other toxic effects have been found. In communities perhaps only a few miles away, almost no fluorine occurs in the water; tooth decay is rampant. The reason there seems little danger of toxicity from adding one part of fluorine per million (as is already being done in many communities) is that fluorine, like iodine, is excreted daily in the urine. Even when relatively large amounts are obtained for a time, fluorine is held temporarily in the body and laid down in the teeth and bones; when little or no fluorine is supplied, it is gradually withdrawn from the body and excreted.

My conviction on fluoridation is also emotional. My father used to make maple syrup almost every spring; I loved it and still do. Furthermore, I was an unhappy motherless child. Our general diet was atrocious enough, but in addition I ate far too much maple syrup to compensate for the love I craved and never got. Dozens of nights as a child I sobbed with seemingly unbearable pain from abscessed teeth or from decay which exposed the nerves. Thousands of youngsters, through no fault of their own, have screamed with similar pain, and thousands more will unless enough kind people try to prevent it. Furthermore, fluorine makes bones as well as teeth stronger. In every hospital in this country are old people—sad people—with not many years to live perhaps and not much to make them happy, lying motionless and uncomfortable hour after hour because of broken bones which should never have broken. You and I will be old some day, and we may fill those hospital beds; fluoridation of water might help us to enjoy our last years instead. My emotional conviction, therefore, which no one need accept unless he wishes to, is that every water supply in this United States should be fluoridated, even at the risk that some toxicity may occur.

There are a number of trace minerals which can be either valuable or harmful to health depending on the amount obtained. In fact, all trace minerals can be toxic if taken in excess. Arsenic, well known as a drug and a poison, may be important in human nutrition. Relatively large amounts are found in the liver and blood, particularly before birth. Aluminum occurs in the human body and in the bodies of animals which have never eaten food prepared in aluminum utensils; minute amounts of it, too, may be essential. Bromine is found in human blood; in a type of insanity known as manic depressive, the amount of bromine in the blood falls to half the normal quantity and increases only upon recovery from the disease. Tin, silver, nickel, and mercury are also found in human tissues; their functions, if any, are unknown.

The trace minerals, like calcium and iron, cannot be absorbed until they are first dissolved in the hydrochloric acid of the stomach. As we have seen, this acid is frequently undersupplied or absent. Poor absorption, therefore, can lead to deficiencies. This reason, however, is only a minor one.

A friend of mine, who has made a hobby of vegetable raising, has composted his soil. In flavor and beauty his vegetables so far surpass those purchased at the market that you can scarcely recognize them as the same. This year his soil was analyzed at the Foundation for Agricultural Research;[3] their report states: "With one or two exceptions, this soil is in very good condition. It shows evidence of repeated composting." My friend tells me that his soil ranked high in comparison with 3,000 other analyses this foundation has run. It was only slightly too alkaline, contained somewhat near the optimum amounts of nitrogen and manganese, was adequate in potassium, or potash, and was somewhat high in calcium but within a favorable range. This far-above-average soil, however, contained one-half as much sodium, one-fourth as much phosphorus, one-eighth as much sulfur, one-tenth as much copper, less than one-twentieth as much cobalt, one-fortieth as much boron, less than one-fortieth as much zinc, one-sixtieth as much iron, and one-eightieth as much manganese as are considered to approach the ideal. Although this soil is less than two miles from the Pacific Ocean, it contained no detectable iodine. If this is far-above-average soil, what are our market vegetables, fruits, and grains being grown on?

The point of view I shall next express is bitterly contested by some commercial fertilizer interests. It is viewed with contempt by many agriculturists, but not all, in the United States Department of Agriculture and the State Agricultural Colleges and Experimental Stations. Granted the subject is controversial. My point of view, however, is that of some outstanding agriculturists, physicians, and other scientists whose interests lie in the promotion of health from the ground up. In fact the following discussion has been read

[3] 216 Market Street, San Francisco, California. This foundation considers that soil deficiencies exist if there are found less than the following amounts of elements or compounds available in pounds per acre on a basis of 6-inch depth: 4,000 calcium, 700 magnesium, 100 phosphorus (P_2O_5), 200 potash, or potassium (K_2O), 20 copper, 40 manganese, 40 zinc, 20 cobalt, 30 iron, 30 boron, 5 iodine, 400 sulfur, and 200 sodium; and that less than 0.350 per cent total nitrogen indicates deficiency.

and blessed by persons holding doctorates in agriculture, medicine, dentistry, and biochemistry.

According to my understanding, it is not merely the mineral content of the soil which determines the nutritive value of foods grown on that soil. Many other factors enter in. There must be minerals, of course, although plants seemingly flourish when many deficiencies exist; if minerals are not in the soil, they cannot possibly be in the plants. To build genuine health in plants, however, there must also be humus which serves as food for bacteria, fungi, and molds. Furthermore, these minerals must first be changed to ionized form by soil bacteria and so held in the soil moisture. The soil fungi, which grow into the roots of plants, pick up the dissolved minerals and thus feed them to the plants. This co-operative situation between fungi and plant roots is known as the mycorrhiza relationship. If all minerals are generously supplied, the plants, so fed, remain healthy and resist disease. Their protein, mineral, and vitamin contents are high. They can support the health of animals and of people. Thus was all the food grown on the well-mineralized virgin soil of young America; such food helped make great men of our forefathers. The nutritive value of their food was limited only by the natural supply of minerals in the soil.

Then mass production came and with it the use of chemical fertilizers: natural rock treated with concentrated sulfuric acid, now sold as superphosphate; the pure chemicals ammonium sulfate and potassium sulfate, which is spoken of as potash. These chemicals dissolved in water as easily as sugar in a cup of coffee. They saturated the soil moisture, making it difficult or impossible for the less easily dissolved iron, copper, magnesium, zinc, and other elements to stay in the soil solution. The excessive amount of sulfur, accumulating from repeated applications of chemical fertilizers, became toxic to the mineral-transferring fungi. The importance of humus was often overlooked; the already existing humus was used up, and little or none was returned to the soil. The valuable bacteria and fungi cannot grow without humus to feed them. Minerals may be in the soil, but without massive numbers of bacteria and fungi they cannot be dissolved; without life-sustaining humus, fungi no longer grow into the plant roots. The soil was gradually depleted of natural minerals which were taken into the plants, shipped to markets, passed through human bodies, and thrown into the sea or rivers as sewage. Lands became mineral-poor.

Still the plants grow; they look green and bulky but can no longer support optimum health. Bugs and worms and aphids multiply; Sir Albert Howard pointed out that bugs and worms destroyed only the unhealthy, the sooner to return soil-rebuilding humus to the land. It now appears that the soil molds produce aureomycin, streptomycin, and penicillin or similar antibiotics, which bugs, worms, and aphids do not enjoy; hence they will not eat healthy plants. Without sufficient humus, molds cannot grow to produce enough antibiotics; the insects come. Their destruction is costly to the producer. Every year more kinds and more pounds of sprays and poisons are poured onto our foods, now 800,000,000 pounds annually of arsenic alone. Arsenic is one of the many chemicals used to produce experimental cancer. Bees, needed to pollinate blossoms, are destroyed by poison sprays. Valuable bugs, needed to eat harmful bugs, are likewise killed. The poison sprays drop to the ground, dissolve in the soil solution, and are carried into the very core of all our foods. The housewife tries to wash them off, but no amount of washing can remove them.

The protein content of our food and the food of animals has decreased and continues to decrease still more. The mineral content of foods is apparently only a fraction of what it used to be or of what it could or should be. The vitamin content varies with the health of the plant. Fresh foods no longer have keeping qualities. Flavor is gone; there is little joy left in eating. I talked to a Frenchman from the provinces, an architect from a village in Mexico, an Englishman lecturing in American universities, an engineer who had lived in the north of China. All asked the same question, "What's wrong with American food? You eat and eat, and it doesn't fill you up. It has no flavor." These people had been used to better foods. Our grandparents were used to better foods. From now on *I* am going to be used to better foods, but how the entire population of America can get better foods, I do not know.

For four years I raised all of our own vegetables and much of our fruits in soil composted and mineralized without chemical fertilizers. The worms in the compost piles looked like plates of spaghetti. Bugs and aphids were no problem; no disease which I could recognize invaded the garden. The flavors of these foods were superb. People say that flavor is due to freshness, but it is not freshness alone. Many times I have brought in too much and kept the excess in the refrigerator, using it later when I was busy or the garden was muddy; the marvelous flavors were retained. The quantities we ate were unbelievable; often the children had to be told to stop eating vegetables. This year I thought I was too busy to put in a garden; I bought the best vegetables I could find and cooked them the best I could; we tasted them and threw them out. The fruits were not much better. Now I have shipped to me vegetables and fruits grown on rebuilt soils without commercial fertilizers or poison sprays. They are not fresh when they reach me, but they seem fresh and are still delicious. Until I found a supply, we had stopped eating vegetables except as carriers of salad dressings. As I figure it, the cows ate "vegetables," and their digestion is more complete than ours. We get some minerals in meat and milk. Chickens are better fed than humans. Ocean fish suffer no dearth of minerals. Perhaps the animal body detoxifies the poison sprays to a certain extent at least. A diet of these foods, however, is expensive.

In a city where I go to lecture live a doctor and his wife, both wonderful people; I stay with them so often that they file my bedsheets under D. The last time I was there, at about three o'clock in the morning, the three of us were dreaming though we were not asleep. The doctor's specialty is agriculture, the health-starts-in-the-soil variety. He was saying:

"No virgin soil has ever been found to contain all the essential minerals in amounts now known to be somewhere near optimum in producing the health of plants, animals or humans. Experiments are carried on in which land is rebuilt with minerals and humus; the protein content of alfalfa grown on such land has already been increased from the average of 9 per cent to 32 per cent. The protein content of other foods is increased correspondingly. No one yet knows the upper limit. The quantities of the cobalt, copper, and other trace minerals can be multiplied in our foods, yet they never reach the point of toxicity. Plants grown on such soil stay healthy, free from the dozens of diseases which have changed agricultural journals into medical magazines and treatises on poison sprays.

"There are a number of experimental farms where soils have been improved to known standards for minerals and humus for several years. Animals grazed on such land were injected with the most virulent types of bacteria; a week or two later, the blood of these animals showed not one sign that bacteria had been injected. Illness could not be produced in them, not even Bang's disease or the dreaded hoof-and-mouth disease or any of dozens of diseases which plague stockmen. The milk, meat, eggs produced by animals ranging on such soil, and the vegetables, fruits, and grains grown on such soil may produce in man a degree of health, the potential of which is not known.

"Land built up with minerals and humus can surpass any virgin soil ever found. On a single acre a man can create his own Shangri-La. The land is available; the know-how is here; the application of that know-how is coming; the rewards for humans no one can guess."

Thus we dreamed into the dawn, but the dream was not original. Years ago Sir Albert Howard had dreamed that dream in India. Now Lady Eve Balfour is dreaming it in England. America has many such dreamers: Bromfield, an author in Ohio; Rodale, a publisher in Pennsylvania; Pfeiffer, a scientist in upper New York; Albrecht, a university professor in Missouri. Each of these dreamers has his followers. There are large groups of dreamers in South Africa and New Zealand and Australia.

That dream has to do with agriculture, but it is not of agriculture. It is a dream of world peace. This dream starts with a family which perhaps creates its Shangri-La on an acre of land, a family in which a high degree of health has laid the foundation for character, courage, integrity, serenity, graciousness, and love in the home. Enough such families can make up a community, a state, a nation, a world at peace.

CHAPTER 24

THE PERFECTION THAT IS YOU

LET US now see how all nutrients help the body by imagining that we can watch one of your cells. Let us say that you are in perfect health; therefore all the processes of this cell are perfect.

The cell is the shape of an egg. Foods can pass through its walls just as spilled juice might pass through a tablecloth. Every moment from birth until death there is poured in and sucked out a continuous surf of blood plasma, or tissue fluid. The incoming surf is pushed in by the force of the blood pressure from capillaries branching from arteries; the outgoing surf is withdrawn by the attraction of the tiny particles of a protein, albumin, in the capillaries joining the veins. The incoming wave carries fresh supplies; the outgoing wave removes wastes.

We can see through this ever-moving fluid as a diver can observe sea life about him when he walks the floor of the ocean. As we gaze into the cell itself, we see endless particles in fantastic and ceaseless motion. First we notice the business center of the cell, the nucleus. It is made of amino acids from the proteins you have eaten and of nucleic acid, obtained perhaps from yeast or liver; with the help of at least three B vitamins (biotin, pantothenic acid, and vitamin B_6) these substances are formed into what are known as nucleotides; they in turn are combined into genes and chromosomes carrying your hereditary pattern, the life program of this cell. Surrounding the nucleus are ever-changing clusters of *protein particles, or molecules, formed into what are known* as colloids; these protein clusters make up the tissue of the cell, the cytoplasm. The whole, or the nucleus and cytoplasm together, is called protoplasm.

There is so much to observe that we scarcely know what to look at first. Before us are molecules of fat and glucose, both combined with phosphorus; bits of the body starch, called glycogen, made up of dozens of glucose molecules; tiny globules of the fat-like materials, cholesterol and lecithin. We see every known vitamin and mineral.

Our eyes fall on the worker ants in this amazing anthill, the carpenters who build, the demolition crews who tear down; these workers are the enzymes. Your genes carry the blueprint of the enzymes in your body; it is by enzymes that heredity is made possible. If you have blue eyes and brown hair, some of your enzymes are different from those of the person having hazel eyes and black hair. All enzymes are made of protein, but many also contain a vitamin and/or a mineral, such as magnesium or cobalt. They have been named according to the work they do, just as a family might originally have been named Smith because the father worked as a blacksmith.

We watch an enzyme family called phosphatase breaking phosphorus free from molecules of glucose and fat, thus beginning to change them into energy. By the help of other enzymes containing vitamin B_1 or pantothenic acid, the particles of carbon, hydrogen, and oxygen which form the sugar and fat are torn apart. Hod-carrier enzymes containing vitamin B_2 take oxygen from the blood cells and carry it to the fat or sugar. Still other enzymes, this time containing vitamin C, pick up the hydrogen freed as the food is broken into its component parts. With the help of these and other enzyme families, oxygen from the air is combined with the carbon, hydrogen, and oxygen which once formed sugar and fat and which are changed into carbon dioxide and water. By this process energy is liberated; all energy, in turn, is changed into heat.

We observe many other enzyme families; ones which tear down the genes of old cells and rebuild genes for new cells, the nucleotidases. The enzymes containing vitamin B_6 are demolishing and rebuilding bits of the protein cytoplasm. Still others containing pantothenic acid are building or demolishing the unsaturated fatty acids combined with proteins, which together form the lumber for this amazing house. Other enzymes are breaking worn-out protein into sugar, fat, and nitrogen-containing substances. There is the enzyme family of glycogenases, quickly changing glycogen into sugar to replenish that used in energy production, and there are other enzyme families, hundreds of them.

We next notice little telegraph messengers, the hormones, racing in and out of the cell. A messenger from the thyroid glands, thyroxin, helps to determine how much energy is needed and to keep the temperature at the point at which the cell can function best and the worker enzymes can be most efficient. We see another messenger from the pancreas, insulin, aiding the cell to change the sugar not needed for immediate energy into glycogen or fat. Still another messenger from the adrenal glands, cortisone, stands by to break body protein into sugar and fat if sufficient glucose is not supplied. A messenger called adrenaline (epinephrine) is here from the adrenals to speed up the change of glycogen into sugar in case large amounts are needed quickly, as during anger or fear, to produce energy required for fight or flight. Even messengers have come from the sex glands to affect the life of this cell and all cells of the body.

Our eye now catches our old friends, the minerals. Here is phosphorus, both free and combined with protein and fat as part of the cell structure. Calcium is here ready to help relax the cell when rest is required, and potassium is waiting to stimulate it into greater activity when the need arises.

Here is chlorine which originally came from table salt; like the shuttle from Times Square to Grand Central, it shifts continuously in and out of the cell, thereby aiding the body in removing carbon dioxide. Here are all the trace minerals, the catalysts, or speeder-uppers; they are the traffic cops which keep all traffic moving at a fantastic speed. Movement can take place without them, but it is slow and the traffic jams. Here is cobalt in the vitamin B_{12} portion of certain enzymes; iodine is part of thyroxin; zinc is helping the messenger, insulin; here are magnesium, fluorine, and all the other minerals, each helping the cell to function.

Just outside the cell wall is sodium, which may have originally come from meat or table salt. In some way not understood, sodium carries on a lifelong duel with potassium, largely inside the cell. This mysterious duel is apparently fought over the water supply. When the sodium appears to be winning, the cell contains more water, but potassium is withdrawn and excreted in the urine; when potassium wins, much sodium and water are lost. The referee for this duel appears to be a messenger from the outside of the adrenal glands.

Perhaps with the help of these duelers and of calcium and vitamin C, this cell has an amazing power of selectivity. If poisons, harmful chemicals, allergins, and/or bacterial toxins are carried in the tissue fluid, this healthy cell refuses to let them enter. On the other hand, if the nutrition is good, the tissue fluid carries every nutrient to this cell; the cell invites whatever nutrients it needs to enter, withdraws what it wants, and leaves the remainder to be carried on to other cells. When too little of a nutrient is supplied, the cell adjusts itself as best it can; when too much is given, the cell fights back but is sometimes defeated.

Every nutrient has its own duties; yet each works cooperatively with the others. Vitamin E helps linoleic acid, linoleic acid helps vitamin D, vitamin D helps phosphorus,

phosphorus helps calcium, calcium helps vitamin C, ad infinitum. No nutrient plays a hermit role.

Many activities which take place in this cell are brought about by other substances; although neither the activities nor the substances are described, both are known and understood by scientists. There are still, however, myriads of unknown activities and unknown substances which scientists have yet to understand.

This cell with all its processes and activities, multiplied by billions and billions, is you. The degree to which this cell can maintain its ideal structure and can carry on its normal functions is the degree of your health. A seemingly minor lack of a single nutrient or of many nutrients can damage the structure and/or interfere with its functions; a severe deficiency of one or more nutrients can bring about disaster. It is the amount of nutrients supplied to the cell itself which determines the state of your health. Malnutrition does not necessarily mean a faulty diet or even faulty absorption; it means only that less than enough of one or more nutrients reaches the cell.

The sum total of all the never-ceasing activities of all the cells is spoken of as metabolism. When these hundreds of activities, although still carried on at fantastic speed, are at their slowest, as when you lie motionless not even digesting food, the total is called basal metabolism. A lack of any nutrient or nutrients can slow down the activities of the cells; less food is needed, and unwanted weight may be gained. Only when all nutrients are generously supplied can the activities of the body be maintained at ideal speed, and the metabolism remain normal.

All other parts of your body are but servants of the cell. The heart, for example, which people think of as important, only makes it possible for supplies to reach the cell and wastes to be removed. The arteries, veins, and thousands of miles of capillaries are mere pipes through which supplies and wastes are carried. The lungs are slaves which supply oxygen and throw off carbon dioxide; the kidneys are slaves which purify water and remove the wastes freed by the tearing down of worn tissue; the urinary bladder is merely a reservoir. The digestive tract is nothing more than a mechanism for changing food into the form which the cell can utilize. The bone marrow is a slave which produces blood corpuscles to carry oxygen, and the spleen is the graveyard for these corpuscles when their usefulness is spent. All of the glands are slaves which produce hormones to help regulate each cell's activity; the master gland, the pituitary, is in turn a slave which supervises the functions of the other glands and of each body cell.

The most important slave of all is undoubtedly the liver. This organ is the storage house which holds fats, sugars, and proteins coming from the digestive tract, ready to supply them to the cell the split second they are needed. It is largely in the liver that toxic substances which might damage the cell are rendered harmless; here the nitrogen-containing waste products from worn-out cell proteins are broken down; the protein, albumin, needed to collect urine, is made here, and still other proteins, the antibodies, which destroy bacteria, are produced. The liver makes the fat-like substances, lecithin and cholesterol; it likewise produces the bile necessary to aid the digestion of fats and the absorption of vitamins A, D, E, and K; it stores not only these vitamins but also minerals such as iron, copper, and the trace elements; it forms and stores the body starch, glycogen. By the help of insulin, it largely controls the amount of sugar in the blood, withdrawing sugar when the supply is generous and changing it into body starch or fat or, when the supply runs low, changing the starch back into sugar and spilling it into the blood. When no food is eaten and all the stored glycogen is used up, cell proteins are torn down into sugar and fat; the liver again withdraws sugar from the blood and feeds it back once more as needed. This servant produces enzymes capable of inactivating the hormones which would otherwise accumulate to the extent that the cell might be injured. In spite of all these duties and many others, this master servant has only one purpose: to help maintain, regulate, and protect the life of the cell. Like the nutrients, all of these slaves co-operate with each other.

Although the structure and activity of every cell in the body are similar in that each must have oxygen and food and from each waste must be removed, the cells themselves are differentiated; their hundreds of duties vary endlessly. The cells of the muscles are the body's pulleys; their cytoplasm is so made that it can contract, and by each cell contracting in harmony, muscles are shortened and movement is made possible. The cells which make up the bones attract minerals and solidify them to give form to the body. The cells of the glands are manufacturers, turning out hormones. Thus is the function of groups of billions of cells each differentiated to make up the separate structures of the body.

Foods can be selected which will supply all the nutrients known to be needed by each cell. If these foods are grown *on good soil* and eaten in as nearly their natural state as possible, the nutrients still unknown can probably be furnished. Digestion and absorption, if faulty, can be improved; the destruction of nutrients in the digestive tract and the blood and losses of those nutrients from the body can be prevented. The well-nourished body can protect itself from bacterial invasion and can detoxify foreign materials which gain access to it. My belief, therefore, is that every person, if intelligent enough and financially able to obtain a completely adequate diet, can achieve perfect health provided irreparable harm has not already been done.

Dr. Szent-Györgyi, who was given the Nobel Prize for his early work on vitamin C, pointed out that when he was a medical student, everything appeared to be always wrong with the body. There were so many diseases that it seemed impossible to learn them all; he tells how he flunked examinations covering this subject. Later, when getting his doctorate in biochemistry, or the chemistry of the body, which is the study of health, he was amazed to find that this time everything was so right, so very right. Probably there never has been a person who has studied the detailed mechanisms which make up health who has not felt as did Dr. Szent-Györgyi.

In fact when one considers the healthy body as a functional structure of billions of cells having hundreds of separate purposes, yet each working co-operatively in perfect unison with absolute harmony and almost inconceivable synchronization, so far surpassing the most delicate machinery made by man, one cannot help being reminded of the philosophers who argue that there is only one perfection, and that perfection is God. Regardless of the religious skepticism of any person when he starts to study the workings of the healthy body, he usually soon agrees with the philosophers and realizes simultaneously that only disease is man-made. The God-made perfection is health, and potentially this perfection is you.

CHAPTER 25

LET'S NOT BE PART-SMART

ONE FREQUENTLY hears the statement that all nutrients should come from good wholesome food. Of course they should. It is extremely difficult, however, to get good wholesome food. Certainly our overprocessed, overrefined American diet diluted with soft drinks, candy bars, and "quick-energy" cereals has little or no relationship to wholesomeness.

Selecting the best food available and preparing it by the best methods known are both extremely important. Selection and preparation determine the degree of health you enjoy. Food supplements may help, but food itself is far more important. Let us suppose you do obtain wholesome food and bring it into your kitchen. Losses of 60 to 100 per cent of certain vitamins and many minerals can occur during food preparation. One can predict with fair accuracy both the sickness expectancy and the life expectancy of a family by observing the wife's cooking methods. Any man can be sure of decreasing his life span by marrying a fluffy-cake-and-biscuit artist or one who does good-ole-Southe'n cookin'. The green vegetables prepared by some of these women look like the business end of a mop and taste, to me, like something a mop has picked up.

I personally know one such woman, a veritable feminine Bluebeard, who has buried three husbands from heart disease. I call it murder by the lemon-meringue-pie method. If you do wish to murder your husband, this method is excellent; no messy *investigations* by the police, no prisons, no loss of social prestige except among your acquaintances who are interested in nutrition. In fairness to women, however, it must be stated that many husbands commit suicide; men will continue to do so as long as the way to their hearts—often meaning their billfolds—remains the French-fries-apple-pie path.

Neither careful food selection nor preparation should be minimized. In my opinion, however, the best of both can still not assure health although the absence of either can and usually does assure illness. As I see it, we are caught in a double-squeeze play. We must have nutrients to maintain health. Most of us, however, live sedentary lives; we can use few calories. The desired nutrients come in packages with undesired calories. We cannot obtain the nutrients because we cannot use the calories; this is the first squeeze play. Because of the stresses of modern-day living, our nutritional requirements are extremely high, higher for our entire population than ever before in our history. Because our foods are overprocessed and overrefined, our chances of obtaining these nutrients from foods are extremely low, lower for our entire population than ever before in our history; this is the second squeeze play. We are caught like trapped animals, and like trapped animals, we are suffering.

People are different from the experimental animals in a nutrition laboratory. Such animals are put on diets adequate in every respect except for one requirement, which may be only partially undersupplied. All other nutrients are generously supplied, their sources checked and double-checked. Even then the animals' health gradually changes to disease, and their life span is shortened. People's diets are often partly inadequate in from 20 to 60 nutrients simultaneously. A few nutrients may be severely lacking; others only slightly so. Just as the scientist produces ill health in experimental animals, so do people produce ill health in themselves. The principal difference is that, with these animals, illness is planned and expected; with people, illness is dreaded but expected.

Instead of the clean-cut, single-deficiency symptoms discussed in the previous chapters, persons usually suffer from multiple deficiencies, the symptoms superimposed upon each other. For example, an individual uninterested in nutrition may suffer from symptoms of a severe lack of 20 amino acids and 12 B vitamins intermingled with the symptoms of milder deficiencies of vitamins C, D, and E and of calcium, iron, iodine, and the trace minerals; during certain hours of the day the symptoms of low blood sugar may become more severe than any others. Such deficiencies, however, are not too difficult to correct.

As I see it, every day you do one of two things: build health or produce disease in yourself. There is, of course, a sliding scale ranging from the most perfect health which you as an individual can attain, through all degrees of semi-health and semi-illness to serious disease. Your choice of foods can largely determine where on this scale you will fall. Neither sickness nor health is a matter of chance.

The problem, however, is less simple than merely selecting and preparing food. The reason nutrition is not applied and may never be applied is largely psychological. We enjoy foods; our pleasures are few enough; if the only foods we feel we can enjoy are the refined and/or processed ones, we will fight to keep them, thus fighting to hold our few pleasures. We as a nation have become so malnourished that we crave sweets as an alcoholic craves drink. This craving is being bred into our children from the very day of birth when, instead of being given life-saving colostrum, the child is offered sugar water in a hospital nursery, which is soon changed to a formula often prepared from solids containing 50 per cent or more refined sugar. Later, limited budgets, radio-and-television blarings, tired mothers, kids' parties, Girl-Scout-cookie sales, and a hundred other forces combine to perpetuate this craving for sweets. People will fight to satisfy these cravings. The cravings themselves must be prevented if health is to be built.

Unpleasantness at meals often makes us dislike the food served at those times; many of these unpleasantnesses come early in life and are forgotten, but the food dislikes remain. I shudder to think of the future eating habits of a nation of individuals who, as babies, grope eagerly for warm nipples and instead have cold, hard spoons forced into their tiny mouths; of babies who long for the security of their mothers' arms but endure the vacuums imposed by bottle holders. These babies are served unappetizing meals of canned foods which their own mothers could not stand to eat. Later, flavors may improve, but beside the children sit giantesses, urging, scolding, prodding, nagging. The children are too young to understand that the well-meaning mothers are concerned only about their health. They become too tense to eat at meals and satisfy their hunger by eating between meals, when only junk is available, their low blood sugar urging them to eat the sweets they have already been trained to love so much. These are only a few of the psychological reasons why good nutrition may never be applied.

Let us now suppose that sound dietetics is put into practice. The best food available is obtained and prepared by the best methods known. If this food happens to be disliked, if fatigue is too great, if unpleasantness occurs during the meal, if worries are carried to the table, if the food is said to be health-building and you better eat it or else, or if fears of indigestion are harbored, the flow of digestive juices is decreased or inhibited. Few enzymes are produced. This excellent food, deliciously prepared, stays partly or wholly undigested; most of the nutrients supplied never reach the blood. For example, fecal analysis of a group of successful businessmen revealed quantities of undigested meat fibers.

Such factors as worry, fatigue, and perhaps the stress of competition combined to prevent their five-dollar steaks from digesting. Relaxation and graciousness should reach their height before any meal. The mother who arranges her table as best she can, whether with pottery on clean enamel or with lovely linen, silver, crystal, flowers, and candles, is building health as surely as the one who selects and prepares food carefully. Any person who wishes to apply nutrition must keep these many psychological and physiological factors in mind before becoming too optimistic about the results expected.

There are two major rules to follow in planning a nutrition program for any person, young or old, well or ill. First, every known requirement must be adequately supplied. Second, except for correct cooking, foods should be eaten in their natural state as nearly as possible; thus nutrients still unknown can probably be furnished. Certain foods are the best sources of each body requirement. A summary of such foods, supplying nutrients in most concentrated forms, can give a basis for a day's dietary:

1. A quart of milk which can be in the form of whole milk, preferably certified and not homogenized, buttermilk, yogurt, tiger's milk, or skim milk drunk at the same meal when fat is obtained; or any combination of these milks, making a total of one quart. If health is seriously desired, eight ounces of yogurt should be eaten daily.

2. Whole-grain breads and cereals used as weight and activity permit; wheat germ used in cooking or added to cereals. Yeast and/or liver daily if requirements for the B vitamins are high.

3. Some dependable source or sources of vitamin A: green and yellow fruits and vegetables, liver, cream, butter, or margarine; capsules of vitamin A if requirements are high and/or cannot be met by food.

4. Eight ounces of fresh orange or grapefruit juice or the equivalent in whole fruit or 12 ounces of canned or frozen; if frozen, select brands without added sugar.

5. A dependable source of vitamin D, as fish-liver oil or capsule of viosterol.

6. Iodized salt used to the exclusion of any other.

7. One or two tablespoons of vegetable oil as salad dressing, made preferably of soybean or corn oil untreated by heat, or two to four tablespoons of nuts (50 per cent oil) or ¼ to ½ avocado (33 per cent oil).

8. Enough green leafy vegetables to carry a tablespoon of salad oil at lunch and/or dinner. Cooked vegetables, preferably green or yellow, as desired. Starchy vegetables only when calorie requirements are high.

9. Fruits in addition to juice if desired. Colored fruits are preferable to colorless ones, raw to homecooked, homecooked to frozen, frozen to canned, and unsweetened to sweetened.

10. Two servings or more of meat, fowl, fish, eggs, cheese, or a high-protein meat substitute. Glandular meats, such as liver, brains, heart, and kidneys, served twice each week or more often. Some type of seafood once a week or daily if desired.

Now let us turn the tables and see that we have a dependable source of every body requirement:

1. Vitamin A: colored fruits and vegetables, cream, butter or margarine, eggs and liver; vitamin-A capsule if used.

2. The B vitamins: yeast, liver or wheat germ, whole-grain breads and cereals; separate B vitamins obtained from milk (B_2), green leaves (B_2 and folic acid), meats (niacin), blackstrap molasses (inositol), brains (cholin).

3. Vitamin C: orange or grapefruit juice; smaller amounts from any fresh raw fruit or vegetable; supplemented by ascorbic acid tablets if needed.

4. Vitamin D: fish-liver oil or vitamin-D capsule; vitamin-D milk if used.

5. Vitamin E: wheat germ, soybean oil, other vegetable oils; natural mixed tocopherols in capsule form if requirements are high.

6. Vitamin K: produced by intestinal bacteria; need be no concern to a healthy person if diet is adequate in milk and unsaturated fatty acids and low in refined carbohydrates; intestinal bacteria are increased by eating yogurt.

7. Vitamin P (rutin): citrus fruits, especially lemon rind; helps to prevent destruction of vitamin C in the body; helpful but not essential when massive doses of vitamin C are used.

8. Unsaturated fatty acids: vegetable oils, such as corn, soybean, peanut and cottonseed, and lard; avocados, nuts and unhydrogenated nut butters.

9. Calcium: milk, whole or skim, buttermilk, yogurt and/or tiger's milk; bone powder and/or calcium tablets if used.

10. Phosphorus: milk, eggs, cheese, meats; all unrefined and unprocessed foods.

11. Iron: liver, yeast, wheat germ, meats, whole-grain breads and cereals.

12. Iodine: iodized salt.

13. Trace minerals: seafoods; liver, blackstrap molasses, and egg yolk usually dependable sources; unrefined foods grown under biological soil conditions; tablets of trace minerals or preparations of sea kelp if used.[1]

14. Proteins: tiger's milk, yeast, fresh, canned and pow-

[1] Many excellent varieties of trace-mineral tablets or powder and kelp preparations are marketed. If none is available in your locality, Multi-Mins, containing calcium and trace minerals, can be obtained in tablets from Plus Products, 2302 East 38 Street, Los Angeles 58, California, or in tablets or powder from Lindberg Nutrition Service, 4807 South Western Avenue, Los Angeles 62, California. Nutramin, a preparation of natural trace minerals and B vitamins from seaweeds (kelp), can be obtained from Thurston Laboratories, 2457 Fletcher Drive, Los Angeles 39, California.

dered milks, yogurt, buttermilk, cheese, meats, game, fowl, fish, eggs, soybeans and soybean flour.

15. Bulk: fruits, vegetables, whole-grain breads and cereals.

16. Liquids: milk, fruit juices, soups, all beverages; any amount of water you may wish to drink.

Such a simplified method of checking is only superficial. Each requirement must be adjusted to the needs of the individual, the amounts of nutrients depending upon such factors as weight, activity, and degree of health.

Since breakfast determines the amount of energy you have for the day and establishes your metabolic rate, it should be high in protein and supply some fat and carbohydrates, although it need not be a large meal. Lunches should likewise be high in protein and moderate in carbohydrate and should contain some fat. Dinners or suppers can be perhaps more graciously served but, calorically speaking, they should be no larger than breakfast or lunch. All meals should be delicious. The daily menus may be somewhat as follows:

BREAKFAST

Orange or grapefruit juice or a vitamin-C tablet with other juice or fruit

¼ to ½ pound liver, chops, steak, hamburger, brains, kidneys, mixed grill, fish, or other meat; or eggs with another protein as ham or sausage, or cheese omelet, or eggs scrambled with powdered skim milk and/or cheese or brains, or an egg served with melted cheese on toast (bacon I consider an appetizer rather than food); or wheat germ and middlings or any whole-grain cereal cooked in milk and/or with powdered milk added; or waffles, hotcakes, or muffins made of high-protein ingredients

whole-grain toast or bread if desired; cheese or peanut butter used instead of butter or margarine if enjoyed

milk or milk drink, preferably tiger's milk

coffee if you must; preferably Sanka, postum, or other coffee substitute, perhaps made by adding milk instead of water to instant varieties daily, immediately after eating, if used: capsules or tablets of vitamins A, C, E, calcium and/or trace minerals, enzymes and/or hydrochloric acid; vitamin-D capsule every Sunday if desired

LUNCH

Eggs, cheese, meat, fish, fowl, or cream soup; or peanut butter or other protein sandwich, if desired
green salad with oil dressing or vegetables in soup to which is added one tablespoon of vegetable oil
milk, skim or whole, yogurt, buttermilk, or tiger's milk
whole-grain bread and butter or margarine, if desired
fruit, if desired
capsules or tablets if used

4 P.M.

Fruit or fruit juice, milk, tiger's milk, yogurt, or buttermilk

DINNER OR SUPPER

Soup or fruit or fish cocktail if desired
meat, fish, fowl, or meat substitute such as eggs, cheese, or waffles with creamed ham or tuna
tossed green vegetable salad with one tablespoon oil for each person being served
one cooked vegetable if desired, preferably non-starchy
whole-grain bread and butter or margarine if calorie requirements are high
milk, buttermilk, yogurt, or tiger's milk
fruit, cheese, and nuts if desired
capsules or tablets if used

AT BEDTIME

For hungry persons or those whose health is below par: milk or milk drink

Such a dietary is only a suggested outline. In order to allow considerable freedom of choice, much more food is listed than most people would care to eat. This outline, however, can be used as a basis in planning menus for almost any person regardless of age or degree of health. I usually have fruit or fruit juice, meat, tiger's milk, and coffee or Sanka for breakfast. The youngsters' favorite breakfast is fruit or juice and buttered muffins containing soy flour, wheat germ, fresh and powdered milk, eggs, raisins, and soybean oil; they eat quantities of the muffins with milk or tiger's milk. Unless I am invited out, I have only salad and tiger's milk or yogurt for lunch; if there is no time to eat, I have nothing except a glass of yogurt or tiger's milk. Afternoon snacks I particularly enjoy; I usually have fruit or a glass of yogurt or milk, then Sanka. Our suppers are skimpy, perhaps only scrambled eggs or cottage cheese with salad, milk, and fruit; or yogurt with fruit and homemade bread. Even when I entertain, I serve only meat or meat substitute, tossed salad, dark bread if anyone wants it, milk, and fruit. Sometimes I cook a vegetable and occasionally make custard, cheese cake, or some other dessert. The woman who helps me feels so sorry for my guests because they get no potatoes or gravy except on Thanksgivings. My friends are at "that age"; they seem to run to chubbiness.

The objection is sometimes made that such a dietary is expensive. I consider it the reverse. No money is wasted on junk; little or none is needed for medical or dental bills. Thousands of people who could afford adequate diets live on markedly inadequate ones. Persons who have little money also spend tragic amounts on "foods" which can never produce health. Perhaps two-thirds of the items in our food markets are not worth carrying home, let alone paying for, unless the goal be to produce disease.

The trouble with any general instructions is that they cannot meet individual requirements. For example, my first book contained a reducing diet; I recall how proud I was when a woman told me she had followed this diet and had lost 20 pounds. My glow quickly disappeared when I discovered she had also lost 12 teeth partly because the diet had not met her needs. The pounds quickly returned; her teeth did not. Every person's nutritional requirements vary from those of other individuals and from day to day. No one can possibly know those variations as well as you yourself; for this reason everyone desiring health should have a thorough knowledge of nutrition.

People frequently ask me what vitamin supplements I take. My requirements may vary widely from yours. I use fresh orange juice and yeast and/or liver daily as my sources of vitamins C and the B vitamins and eat yogurt almost daily to supply bacteria which I hope are producing vitamin K and still more B vitamins. For years I have taken after breakfast 25,000 units of vitamin A, 100 units of vitamin E in the form of natural mixed tocopherols, and 100 to 250 milligrams of vitamin C, the amount varying with the number of people who are currently sneezing in my direction. I used to take 25,000 units of vitamin D every Saturday because I was afraid I would forget it on Sunday; now I take it on Saturday because a woman told me she understood that vitamin-D-on-Sunday held a religious significance for me. For one week of every month I take daily three to six tablets of calcium combined with trace minerals; I have hoped that enough trace minerals would be stored for the three following weeks. Occasionally, when working under unusual pressure, I take additional B vitamins in capsule form. If something causes me to blow my top, I run for calcium and vitamin B_6 tablets, or if I miss so much sleep that a cold threatens, I take more vitamin C.

While I was visiting a friend recently I was startled to overhear her teen-age daughter remark, "I'm going to bed and leave the menopause gals to themselves." This jolted me into increasing my vitamin E to 200 units daily, the mixed minerals to an after-breakfast routine, and the vitamin D to 25,000 units every Wednesday and Saturday, still without religious significance.

If you can find an everything-in-one capsule which meets your needs, that is excellent but I have never been able to. Such capsules are usually expensive; many B vitamins are omitted, some are supplied only in microscopic amounts, and the cheap ones are too plentiful. In most cases, to obtain enough vitamin D or E, you need to take several which, besides increasing the expense, may supply far more of other nutrients than you need. The supplements I take meet my needs at about nine cents per day; to obtain my requirements from all-in-one capsules would usually be many times that.

In my opinion, the vitamin business has become a racket. I am continuously shocked at the amount of money people spend on vitamin supplements. Before buying any supplement, read labels and compare potencies and prices of various brands. Products shipped across a state line are inspected by the Food and Drug Administration. No company wishes *its reputation marred by government citations;* therefore the potencies stated on the labels of products marketed for some time are usually reliable. The prices vary widely, however, even for products often prepared by the same manufacturers. The cheaper product is often excellent.

There is little value in improving your nutrition if your digestive system is so below par that the food is not efficiently digested or absorbed. If your tongue shows the symptoms discussed on page 63 or if you get gas from taking yeast, milk, or other nutritious food, you can be sure, unless you are eating too fast and swallowing air (p. 175), that your digestion is on the rocks. In such case lemon juice or dilute hydrochloric acid (10 per cent solution purchased from a drugstore) should be added to yeast, milk and/or tiger's milk if used. To aid in digesting other foods, hydrochloric acid tablets, usually labeled as "glutamic acid hydrochloride,"[2] are excellent. Tablets of digestive enzymes with bile are often advisable.[2] One physician I know tells his patients to take five of each kind of these tablets after each meal; if

[2] See footnote, p. 119.

no gas occurs, to decrease to four, three, two, and finally one of each, increasing the amounts again if gas recurs. Such a procedure is excellent, but I have never had nerve enough to recommend it; I usually advise one tablet of each after each meal, to be increased later if trouble with gas persists. Both should be stopped as soon as digestion appears normal, or in about a month after a good nutrition program is initiated.

Removing numerous bottle tops daily would make a hypochondriac out of anyone. If you become a tablet taker, buy an attractive box designed for keeping several packages of cigarettes, dump your tablets into it, and keep it on the breakfast table. Avoid, if possible, the display of taking tablets in public.

There are two approaches to improving the diet when nutrition has been neglected. The cautious approach is to increase the amounts of supplements and such foods as yeast, yogurt, or tiger's milk gradually; thereby you can prevent digestive upsets and give yourself a chance to cultivate a taste for these foods. Improvement may be slow, but this method is safest for persons without supervision. The other approach, which can end in disaster or spectacular improvement, is to take enough supplements to saturate the tissues and large amounts of foods supplying proteins, B vitamins and other nutrients for a few days, then decrease the amount drastically when body needs have been met. I use the latter method but have sometimes regretted it. Persons who consume more nutrients than their bodies need lose a fortune annually through their excreta.

I take vitamin pills and recommend them, but I still disapprove of them. If wholesome foods were available, supplements would rarely be needed except for vitamin D. Few people can obtain wholesome food. By *wholesomeness*, I mean the kind of food our grandparents and all our ancestors before them ate at every meal. Just plain food. Fruits, vegetables, and grains grown on naturally mineralized, naturally composted soil untouched by smog, chemical fertilizers, and poison sprays. Milk from healthy animals grazed on green pastures (most such milk need not be pasteurized, and its hormones, enzymes, and steroids are not destroyed; if "pasteurization" is necessary, it can be done by the natural methods of souring or changing into yogurt). Eggs laid by hens allowed to run on the ground, gathering worms and scratching in manure piles rich in bacteria-produced vitamin B_{12}, vitamin K, and many other nutrients. Fertile eggs produced by hens kept with roosters (such eggs are rich in steroids which commercial eggs lack). Meats from animals which have not been castrated. Foods which have not been refined or processed.

Although such foods have been eaten by billions of people who have lived and died, this degree of wholesomeness is now too dreamy to be practical. As I see it, thousands of adults and millions of children in our country have never once had one mouthful of wholesome food. Everything we eat is tinkered with in one way or another. With every tinkering come losses, some small and unavoidable, some large and avoidable; the cumulative amount of these losses is staggering and crippling. It is we who are staggering, we who are being crippled. We must do the best we can, but our best can be none too good. Supplements, therefore, appear to be necessary.

One should constantly be aware that a certain balance seems to exist between the various nutrients in the body, as in the case of the B vitamins. Furthermore, the absorption, utilization, and/or retention of one nutrient often depend upon the presence of another. For example, it is silly to take calcium if you fail to obtain enough fat and/or vitamin D to absorb and use that calcium; or it is useless to spend money on vitamin A unless fat and vitamin E are available simultaneously. These problems are largely taken care of automatically when natural foods are eaten. The overall picture, however, should be kept constantly in mind.

It seems to me that the situation is much like boxes inside of boxes. Each box should be seen as a whole and in relation to each other. The smallest box, let us say, represents the whole of nutrition from the proper preparation of the soil, through the harvesting, handling, processing, and marketing of food; the careful selection which makes it possible for each of the 60 or more body requirements to be met; the scientific preparation and gracious serving of that food; the pleasantness and relaxation necessary to assure digestion and absorption; and the factors which must be controlled to prevent destruction of nutrients in the body and losses through the excreta.

The next larger box might symbolize the body as a whole, all its parts and organs functioning co-operatively. Health is not of a part of the body but of all the cells together. Whether recognized or not, disease is not of a part but also of every body cell. The third box could be symbolic of the body needs as a whole, such as love, peace of mind, psychological adjustment, relaxation and personal recognition as well as the needs for exercise, sleep, fresh air, sunshine, and warmth. The next larger box might represent the individual in relation to his environment, family, friends, work, hobbies, and recreation. The largest box could symbolize this individual's personal philosophy, religion, convictions, ethics, prejudices, and morals, which in turn determine the part he plays in the world about him. Nutrition, seen in such light, becomes a small part; yet it remains a vital part.

A doctor friend of mine calls persons only part-smart who fail to see nutrition as a whole and its relation to the world about us. When an individual takes vitamin B_1 or a physician gives injections of vitamin B_{12}, either is granting that nutrition has a little value; since some 60 nutrients are considered essential, he is approximately one-sixtieth part-smart. Wonderful physicians have made such outstanding contributions by their clinical research with vitamins B_1, B_2, and niacin that they now have become famous; these brilliant men are still, nutritionwise, only part-smart. The person who fails to see the value of soil bacteria, the losses caused by refining, the psychological factors involved in food choice and/or absorption or any other fragment of the picture is, in my opinion, only part-smart. The individual who perhaps harms nutrition most is one who exaggerates its importance; he is often neurotically part-smart. The man who has not yet realized that nutrition plays a role in his ability to be a good husband and father, to make a good income or to enjoy recreation or that it can influence his thinking and feeling is, nutritionwise, not even part-smart.

Personally applied nutrition is a means to an end, a means which need be remembered only a few minutes daily during the remainder of your life. The end goal is health in all its aspects, a type of physical health which can help to form a basis for mental, emotional, moral and spiritual health. Such a goal is valueless unless you do something worthwhile with the health you attain. If a high degree of health, however, increases your mental alertness and emotional stability and can thus give you the moral courage to live up to your spiritual convictions, then you will find your work fulfilling, your fun rewarding, your goals tantalizing and the world about you both a good place to live and a better place because of your presence. Then only will nutrition have reached its personal goal.

Dr. Rountree has pointed out that the goal of nutrition is growth of body, mind and conscience. She states that the possibilities of improvement of family, community, and world conditions through better food and the use of nutritional knowledge for man's welfare make up a vision all must catch; that nutritional knowledge alone is of little value but that what you do with this knowledge is all-important. She reminds us that undernourished bodies are tied up with self-centered, pessimistic minds and that malnourished people are not interested in abstract ideas like democracy. She writes: [3] "Nutritional knowledge can give us a sense of mastery over life, help balance the budget, reduce medical costs, maintain the right architectural propositions for social success and long life, improve the sense of humor, promote efficiency in home, school and business and make us better able to take it. Nutrition well taught will make people glory in the American way of life."

It seems to me that the person who can be ever mindful of such a concept of health is, nutritionwise, no longer only part-smart.

[3] Jennie I. Rountree, "Nutrition in Health Education," *Modern Nutrition*, V (1952), 7.

CHAPTER 26

PERSONAL REWARDS OF GOOD NUTRITION

WHEN a good nutrition program is conscientiously followed, other problems often disappear. They are rather like happiness which comes as a by-product of unselfishness but is elusive if sought directly. No one can say what nutrients or combinations of nutrients have brought about the change. Probably the improved psychological outlook which comes with feeling better helps as much as anything.

It has been known for years, for example, that persons who drink excessively suffer from multiple nutritional deficiencies. Only recently has the work of Dr. Roger J. Williams at the University of Texas and of other scientists shown that the desire to drink, in itself, can be caused by nutritional deficiencies.

Many experiments have been conducted, the general gist of which is as follows: Large numbers of rats are given the choice of four beverages: water; 3 per cent alcohol, representing beer; 10 per cent alcohol, comparable to light wines; and 50 per cent alcohol, suggestive of hard liquors. Each rat is kept in a separate cage, its liquid consumption measured daily. All the animals are given the same "normal" diet. Under such treatment, some rats become teetotalers; others land on skid road. Then the abstainers are put on an inadequate diet, perhaps partially lacking one or more B vitamins. The excessive drinkers are given a superior diet containing far above normal amounts of certain nutrients, especially the B vitamins. Before long, the teetotaler rats start drinking, and many land on skid road. All the skid road rats drink less, and many become teetotalers. When offspring of the teetotaler rats and the skid road rats are offered their choice of drinks as were their parents, like-father-like-son, they become abstainers or drunkards.

A number of conclusions have been drawn from such experiments. First, there is no such thing as a "normal" diet. What is normal for one person may not be normal at all for another. Second, the need for greater than so-called "normal" amounts of certain nutrients is a hereditary need. When these excessively high nutritional requirements are not met, the person with such needs becomes susceptible to certain abnormalities to which Dr. Williams has given the name "genetotrophic diseases," of which alcoholism is one. If the nutrition is adequate for each individual, however, such diseases need not appear in any generation. Another conclusion is that alcoholism might be partly prevented if our national diet were improved. The third conclusion to be drawn from the experiments is that if persons who have the compulsive urge to drink excessively are given far-above-average amounts of certain nutrients and are treated with understanding, their desire for liquor may decrease; a few may even stop drinking.

Although an undersupply of B vitamins appears to be a major cause of alcoholism, the blood sugar level is also of extreme importance (ref. 3, p. 14) as is the amount of fat and protein in the diet. A factor N_1 believed to be in yeast, liver, meat, and wheat germ [1] has been emphasized as being another nutrient perhaps necessary in preventing the craving for alcohol. Although Alcoholics Anonymous deserves no word of criticism, its members suffer unnecessarily by being unaware of the value of good nutrition. They wash B vita-

[1] "Nutrition and Alcoholism," *Nutrition Reviews*, XI (1953), 212.

mins from their bodies by drinking tremendous quantities of coffee. They lower their blood sugar levels by overstimulating their insulin flow with quantities of sweets. They merely change crutches from alcohol to tremendous quantities of coffee, sugar, and tobacco. Ignoring as they do the simple rudiments of good nutrition, without either dietary or psychological help, it is surprising indeed that as many give up alcohol as do. Certainly nutrition is only one part of this problem. Who knows how important a part?

Mrs. Gladys Lindberg, who in my opinion is making an outstanding contribution to nutrition, has worked for some years with men whom Alcoholics Anonymous has failed to help. As usual, it started with one man, who, down and out, an alcoholic for 32 years, came to see her. Let us call him Mr. X. Mrs. Lindberg asked him if he would help her with an experiment to see if good nutrition could decrease his craving for alcohol. He agreed, and she supplied the nutrients. At the end of the first week he reported incredulously that his craving had decreased and that he felt unbelievably better. Each week improvement was greater. Soon he found employment.

In our city a man and his wife, themselves ex-alcoholics, own a large car-washing establishment. They employ about 20 men, all alcoholics whom they usually find in flophouses; they give these men food and a dormitory to sleep in and guarantee employment as long as they do not drink. Mr. X. became one of their employees. In the evenings, the men came to the dormitory, threw themselves on the beds with exhaustion which went to the marrow of their bones; they were too exhausted to seek entertainment, too afraid they would be tempted to take the drinks which could bring relief. Mr. X. worked as hard as they but felt no exhaustion and craved no drinks. He told them of Mrs. Lindberg, and they went to her and told their friends who then went to her. They found that as long as they followed her nutritional program, their exhaustion and their craving disappeared.

Mrs. Lindberg gives these men an adequate diet supplemented with yeast mix containing liver concentrate (see footnote, p. 119), massive doses of synthetic B vitamins, large amounts of soybean oil, vitamins A, C, D, and E in capsules or tablets, and enough enzyme tablets and hydrochloric acid tablets to insure efficient digestion. Although her results will never reach the pages of a medical journal, I suspect that she will have a special feather in a wing some day. If you ever want to talk to men who have gone overboard on good nutrition, you should talk to some of her teetotalers.

A problem which is in my opinion easily corrected by sound nutrition is a low basal metabolic rate (BMR), or subnormal energy production. Probably no physician would agree with me. The reason, I believe, is that although any doctor sees hundreds of patients with low BMRs, few if any have seen patients who have improved their nutrition sufficiently to raise their BMRs to normal. "Internal laziness" could describe this condition except that it would ignore the external laziness which is far more of a problem. Physicians usually recommend thyroid tablets for subnormal energy production. Such tablets are perhaps necessary at times and do increase the BMR, often, I am afraid, at the expense of general health. To me taking thyroid is like whipping a tired horse instead of letting it rest awhile, then giving it enough oats so that it no longer wants or needs to rest.

Aside from having a metabolism test taken, there are a number of little tricks by which you can determine a person's rate of energy production. One is to notice how quickly he moves or thinks or how warm he keeps his house. A neighbor once gave me quite a serious lecture on the possibility of my children dying of pneumonia because our house was so cold and they often went outside without coats or sweaters. I silently turned up the furnace, later sold her on nutrition, and now she is comfortable in our house. All energy is turned into heat; if you have no energy, you can have no heat. The energy production of a healthy child is usually much more efficient than that of an adult. In fact, the BMR of a mother can be guessed quite accurately by how much she bundles up her children; such a mother then feels happy, but the children usually feel miserable. Anyone who pays fuel bills will agree that low energy production is quite expensive.

If you are comfortable at a room temperature of 70° F., love a cold shower, need only moderate covering on your bed, and enjoy a pleasant breeze which some people call a "draft," your metabolism is quite normal. One woman told me she slept with an electric pad at her feet under an electric blanket covered by two more blankets and still was cold. A man said the only time he felt warm was when he got into his car which had stood all day in the hot sunshine with the windows closed. After following an adequate nutrition program, these people, and dozens with milder symptoms of inadequate energy production, soon became comfortable at moderate temperatures. A physician tells me his temperature increases a degree within an hour after drinking a glass of tiger's milk, showing the rapid and marked increase in energy production. In Dr. Thorne's experiments at Harvard (p. 13), the BMR increased within a few minutes after a high-protein breakfast was eaten.

Probably every nutrient plays some role in helping the body to produce energy. The lack may be predominantly one of the B vitamins, iodine, or protein but not necessarily so. Since the trace minerals act as catalysts, or speeder-uppers, of energy production, an undersupply of these minerals may be the major cause. Whatever the cause, if an adequate diet is eaten and well absorbed, energy can be produced in excess of human needs.

A problem which is intimately related to a normal metabolic rate and which often disappears when the nutrition is adequate is that of reducing. I myself was as slow as molasses in discovering this easy solution. A number of obese persons who wanted to reduce when they came to me have been too ill to be put on reducing diets.

"Let's forget about reducing for at least three months and concentrate on building health," I would tell them. "Get your basal metabolism built up, and then you can reduce while you sleep. You'll feel like working and exercising by that time, and reducing will be easier."

Many of these persons were so malnourished that I recommended 200 to 300 grams of protein daily for them temporarily: large servings of meat, fish, or fowl including liver daily if they enjoyed it; a quart of tiger's milk made with whole milk; as much yogurt, cheeses, and eggs as they could eat or wanted; a green salad at each lunch and dinner tossed with a tablespoon of cold-pressed soybean oil or approximately two tablespoons of French dressing; two or three tablets of mixed minerals and usually 250 milligrams of vitamin C after each meal; vitamins A and E in capsules daily after breakfast; a capsule of vitamin D every Sunday. I told them to get tablets of digestive enzymes with bile and more tablets of glutamic acid hydrochloride in case gas became a problem. I asked them to forego foods which would fill them up too much or overstimulate their insulin production, such as potatoes and other starchy vegetables; cereals of all kinds; honey, molasses, any concentrated sweet; desserts except fruits. Certainly refined foods had no place in their health-building regimes: they were to pass up soft drinks, refined-sugar concoctions, foods prepared with white flour. Their menu plans followed those on page 229. They used Sanka instead of coffee unless too exhausted to live without a stimulus.

Some of these people gained weight for a week or two; then they complained they could not eat so much. Their blood sugar was high; they had no craving for sweets. When the diet is adequate, few calories are needed or desired. By the end of three months they had lost weight; some phoned or came in to ask, "How can I stop losing?" One was a seventy-six-year-old woman who had been in a wheelchair for years with arthritis; she had weighed 186 pounds; now she is 40 pounds lighter and walks well with a cane. Another was a man with heart disease, his legs swollen to twice their normal size; now his weight is exactly as he wants it, and all heart symptoms are gone. I shall never forget a middle-aged woman, whose brilliant mind worked sluggishly, and who had huge varicose veins covered with elastic stockings; she had a history of repeated attacks of gout. Three months later I did not recognize this woman: she had been transformed into an alert, slender person with a new vivacious personality and without a visible varicose vein or a tinge of gout. There are many others.

Finally it dawned on me that this method was the way every person should reduce. My advice now is: Throw away your bathroom scales and calorie charts; forget about reducing and forget about exercising, but never forget about building health. When health comes, you cannot keep yourself from exercising; you will work twice as hard without fatigue; you will find yourself wanting to go skiing or dancing or walking or swimming, your own vitality urging you into activity. Weight loss will come slowly perhaps, but if you adhere to the program, it will come. And it will be a permanent loss.

There are many people who want to reduce, but their principal hunger is subconscious. Eating is a substitute for love. The child first experiences love as his mother feeds him, at the same time cooing, singing, and caressing him. The happy old-fashioned mother loved and nursed her baby perhaps 1500 times. Under these circumstances any child soon associates love with food; later, if love is withdrawn, overeating becomes a compensation. People who suffer in this way can usually be helped only by a competent psychiatrist.

To say that obesity is caused merely by consuming too many calories is like saying that the only cause of the American Revolution was the Boston Tea Party. There are many causes. One, I suspect, is that our foods are so depleted of the nutrients which starved bodies crave that overeating is due to a physiological compulsion to obtain them; even that usually fails to supply the nutrients longed for by the tissues. Another cause is that people often eat too little rather than too much; the basal metabolism drops far below normal; there is no energy for work or play, none to be turned into heat. When few calories are used, few are needed. Such people sit, sluggish as lizards sunning themselves, gaining weight on tiny meals and becoming more miserable with each added pound.

If an improved nutrition program does not cause you to lose weight, I would say that the program is not adequate for you or that you should go to a psychiatrist for help.

Another reward of nutrition is gaining weight, if that is desired. In the spring of 1932 I planned a diet for a man who weighed 121 pounds and who wanted so much to gain weight; that fall he asked for a reducing diet. Not long afterward, an extremely tall, ill man came to see me; he then weighed 155 pounds and he, too, wished to gain. A year or so later he weighed 210 pounds and wanted to reduce. I still know both of these men. Although gaining was no problem and a "reducing diet" was planned for each of them, neither has reduced.

For years I have refused to make out a gaining diet for anyone. When faulty digestion and absorption are corrected, when nerves and muscles are relaxed to the extent that energy is no longer needlessly wasted and sound sleep is induced, the underweight person gains easily without increasing his calorie intake. A gaining diet usually causes him to put on too much weight.

There is another problem which almost invariably disappears if nutrition is taken seriously over a considerable length of time. For me, the most striking example of this problem is a woman I saw first when she was twenty-nine. She was underweight, pale, and listless; her hair was stringy; tension lines cut her forehead; and fatigue was stamped on her face. Her blood count and blood pressure were both low. She had trouble with constipation and hemorrhoids and was "miserable from gas." The radio and youngsters made her "fly off the handle." She had severe headaches about twice a week. My notes say, "Can't sleep; stays up all night at least once each week to be sure she can sleep the next night." She told of several miscarriages. Because of tumors her uterus had been removed shortly before I saw her.

Three years later, when this same woman came to a series of lectures I was giving, she had become my idea of genuine beauty. She reminded me of a race horse being held back at the starting line. Her eyes were bright and flashing, her skin had both color and glow, her figure was the kind any woman might envy. Her hair was resilient and amazingly alive. Her face was animated; it glowed with health even in repose. After these lectures, a group of us often went to her home for "coffee," meaning a near-smörgasbord of cold meats, cheeses, and dark breads. I usually sat watching her, fascinated. Every time I saw her, I asked myself how any person could have met her and not been immediately struck by her beauty. I knew the answer perfectly well. When I first saw this woman, she was *not* beautiful: she was pale and listless; her hair was stringy; tension lines cut her forehead; and fatigue was stamped on her face.

Too much "beauty" is only cosmetic-deep, though that is better than no beauty at all. The person who is satisfied with cosmetic-deep beauty, in my opinion, has low standards.

Beauty should be at least vivacity-deep. It is better still if it can be both vivacity-deep and character-deep. Before I die, I hope mine can be soul-deep. Sound nutrition is absolutely essential for vivacity-deep beauty, a form of beauty which, I believe, any semi-healthy individual at any age can have provided it is wanted badly enough. When persons are seriously malnourished, as far too many of them are, those who could have character-deep beauty are often so ill and mentally confused and self-centered because of their illnesses that they fail to achieve this higher form of beauty. When malnutrition is severe, it prevents the serenity and calmness which in my opinion are essential ingredients of that rare and intangible quality I think of as soul beauty.

Another problem which often disappears after dietary improvement has to do with sexuality. Let us grant that perhaps 95 per cent of such problems are psychological, and consider only those which may be nutritional. Probably every nutrient plays some role in stimulating normal hormone production or in maintaining the health of the prostate, the uterus, and the penial and vaginal passages, all essential before mate relationships can be fulfilling.

Many people have told me that, after dietary improvement, their sexual difficulties have disappeared; a few say a contemplated divorce was forestalled. These reports have covered many varieties of sexual problems. Several were cases of impotence; others, of restoration of libido, or sexual desire. A young husband complained one month that his wife had no sex interest and the next that she had too much. A sixty-year-old widower told me that he felt much better when eating an adequate diet but that he could no longer do so; he would gladly follow the diet again as soon as he remarried. Many reports had to do with prostate infections which had interfered with sexual expression; others concerned eczemas on the genitalia or Manila albicans infections in the vagina or penis resulting from the use of aureomycin, streptomycin, or other antibiotics. Whatever the improvement was, it came as a by-product of dietary help sought for other reasons.

Worry over possible inability to express sexual love seems to be a masculine trait. These fears might disappear if men understood more fully the relation of nutrition to sexual function. For example, the pituitary gland, situated at the base of the brain, produces gonadotrophic hormones which in turn stimulate the gonads—testicles or ovaries—to produce other hormones necessary for normal sexual activity. The gonadotrophic hormones are made of protein; the sex hormones, of protein or fat-like substances known as steroids. If the diet is seriously inadequate in protein, fat, the B vitamins, or almost any nutrient, the pituitary and/or the gonads are unable to produce these hormones in adequate quantities. For example, I was amused to find that scientists had studied the vitamin-C content of the pituitary gland before and after male rabbits were bred. When the diet lacks vitamin C, the animals do not care to breed. If the diet is adequate, the pituitary is saturated with vitamin C before breeding but depleted of the vitamin afterward. Anyone who has bred a rabbit will admit that this is rapid utilization of a nutrient.

Studies of men in prison camps, of the conscientious objectors in the starvation experiments at the University of Minnesota, and of numerous clinical investigations show that libido decreases or disappears when the nutrition is inadequate. On the other hand, as long as even an average degree of health is maintained, glands rarely become abnormal. I know of no man who worries about the function of his thyroid, pancreas, or adrenal glands; if they become abnormal, he knows he can obtain thyroxin, insulin, or adrenalin from his physician. Testosterone is also available, but it is probably never needed when the nutrition is adequate.

If neither psychological nor nutritional problems exist, sexual function is probably maintained as long as is health itself. A doctor told me of his Danish grandparents. At the age of eighty-seven, his grandfather, after working in the garden all morning and eating a hearty lunch, had quietly passed away while sitting in his chair. Grandmother, considerably younger, outlived him many years. Once when the women of the family were gathered with their sewing, someone asked the grandmother at what age, in her opinion, men became functionally unable to express love through sexual union. Grandmother answered softly in Danish, "*Aldrig*"—which means never. This same doctor, speaking of the importance of maintaining adequate nutrition in order that the sexual relationships may be fulfilling, then remarked, "It's putting money in the bank which will be a pleasure to spend."

Now I come to the you-won't-believe-it problem which sometimes disappears, the problem of growing older. Actually I am convinced it need not be a problem at all. There are people—not many, but a few—who seem to grow younger instead of older.

One day on a television program I may show you some of these people. For all of you doubting Thomases I could supply names and addresses, except in one case. This is a woman of eighty-two who enjoys tremendously the fact that most people think she is sixty; she works half-time as a secretary, flitting about like a humming bird. There is Mr. G., now eighty-six, who talks about having fun on borrowed time; he loves to garden, and once when I was entertaining, he turned our house into a florist shop and in addition brought a camellia corsage for each guest. Mrs. S. must be nearly eighty by now. It is unbelievable that one person can do as much good as she does; I know how much she helps people because she sends many to me for nutritional advice. She was ill and old when I first saw her 15 years ago; now she is active and young and vibrantly alive.

Mrs. L. is one of the most amazing of this group. I would bet that in 12 years she has swallowed no morsel of food which does not build health. Her figure is that of a thirty-year-old. I tell her I should pay her to visit me instead of vice versa. She is particularly amazing because she is a crack skier and is on the ski patrol, skiing down the slopes with stretchers, helping to carry youngsters who have broken bones. She does not worry about breaking bones nor does she need to.

Mrs. H. has been one of my favorites since 1936. She came to me because of pernicious anemia, exhausted, depressed, her mouth and tongue so sore she could hardly eat. Her life has been hard; money always scarce. Before child-labor laws were passed, she was taken out of school and forced to work in the New England woolen mills, leaving home when it was still dark in the morning and returning after dark at night. There was little love and few bright spots in her life until she was sixty-eight; then a childhood sweetheart found her, a wonderful physician whose record is in *Who's Who.* A friend and I poured coffee at their wedding, a big occasion with the brightest bunch of oldsters I have ever seen assembled; we laughingly said we were the only persons present who could hold a coffee cup without shaking out its contents. This woman sent me a report of her physical examination from Johns Hopkins Hospital: "Although this patient claims to be seventy-four years old, she has the body of a fifty-year-old woman." She and Dr. H. are now spending happily-ever-after summers in Vermont and winters in Florida. Dr. H. asked me to visit them in Vermont. I said I could not decide when to come; I wanted to be there for maple-syrup making but also for autumn colors. His answer was graciousness at its height: "If you can come only once, come in the spring and stay till the fall."

I wish you could all meet Mr. and Mrs. R., people whom it seems God must have made especially for each other. He is seventy-six; she, seventy-two. She had been crippled with arthritis for years, and he had the usual old-age symptoms: a tremor, fatigue, some shortness of breath, trouble with his eyes; years of hay fever and sinus infection, both still troublesome. The arthritis scarcely bothers her any more; his symptoms, too, have gradually cleared. Both are now amazingly active. She is busy with a grandchild who lives with them, with Spanish classes and social gatherings. Mr. R. holds down what could be considered three full-time jobs. He is president of a building and loan association which takes a great deal of his time; he operates three oil wells which require as much attention as spoiled children; and he has gardened their acre of land since their Mexican gardener, an old man of forty, became ill. Besides these activities he plays 18 holes of golf twice each week. I remarked that he probably played with men 20 years his junior, and he said they were sometimes 30 years younger than he. If you want to taste really good homemade bread, you should drop in to see them, as I frequently do.

And lastly, there is Dr. P., who earned his Ph.D. at Columbia half a century ago. He and his family lived in Shanghai for years, then in Manila where he was caught at the outbreak of World War II. He spent the war years in the terrible Santo Tomas Prison. His health was broken then, and recovery was never complete; heart attacks followed and then polyneuritis, the American term for beriberi. His pain was too excruciating to be deadened by opiates. Although he was given B vitamins by many physicians, he became worse and was not expected to live. As a last resort, his wife and daughter came to see me. Tiger's milk, liver, wheat germ, all three in small amounts at first, large quantities of pantothenic acid which had not been given before, calcium tablets to help deaden pain, vitamin pills of every letter, tablets of enzymes and hydrochloric acid to digest the food combined to turn the tables; his recovery was spectacular. Since childhood, Dr. P. has had a wonderful voice, and singing had been his joy. He sang solos at churches, clubs, and weddings, including Chiang Kai-shek's wedding, his wonderful wife playing his accompaniment. His voice failed with his illness, but now he believes it is stronger than ever; again he is singing for churches and clubs and weddings. Just before he left for Manila to be an executive of an insurance company, he sang to me a song he said he had especially selected. It was, "I'll be loving you always." And if I had a voice and could have held back the tears, I would have sung the same song to him.

These are young people, every one of them. The good health they enjoy, however, is no mere happenstance. Every person in this group takes his nutrition seriously, not just occasionally but every meal of every day and year after year. The rewards are pretty wonderful. With these people there is no gap between the generations. Each one of them is an inspiration, almost a vision of what could be for possibly every human being. They remind you again that aging may not be a "natural" process but the result of years and years of cumulative nutritional deficiencies. I tell them that they make me look forward to my nineties.

Are you looking forward to yours?

CHAPTER 27

IS OUR NATIONAL HEALTH ON THE DOWN-GRADE?

THOUSANDS upon thousands of persons have studied disease. Almost no one has studied health.

Thirty years ago a dreamer-researcher named Dr. Weston A. Price traveled the world over, examining people untouched by so-called civilization. He investigated groups in a then isolated part of the Swiss Alps, in northern Italy, on the Isle of Man, in the New Hebrides, Australia, New Zealand, central Africa, the South American jungles, the north of Canada and Alaska and on various islands in the South Pacific. The foods of many of these peoples were limited indeed. In some cases their diets were largely meat or fish without vegetables or grains; in others, vegetables and grains without meat or fish; they appeared to have nothing in common. These peoples, however, had two things in common: their diets met every body requirement; and the know-how for refining foods was lacking. The latter allowed the former to be so.

Dr. Price told of his findings in a book, *Nutrition and Physical Degeneration.*[1] He tells of people with erect posture, unbelievable endurance, and cheerful, even dispositions. These people had excellent bone structure; their faces and jaws were so wide and well developed that their teeth were not crowded together, and stayed free from decay just as their bodies stayed free from disease. The statistics con-

[1] Weston A. Price, *Nutrition and Physical Degeneration* (Los Angeles 48, California: American Academy of Nutrition, 1950).

cerning the incidence of cancer, ulcers, high blood pressure, tuberculosis, heart and kidney diseases, polio, muscular dystrophy, multiple sclerosis, and cerebral palsy were zero, zero, zero in every case. Names for these diseases were unknown and unneeded. Dr. Price found no physicians, surgeons, psychiatrists; no prisons, institutions for the insane or feebleminded; no child delinquency, no homosexuality. Every mother nursed her babies; a non-functional breast was unheard of. Mental, moral, and emotional health accompanied physical health.

Sir Robert McCarrison, an English physician, investigated the health of the Hunzas, living high in the Himalayas. Their foods were limited, but their lands were composted and watered by glacial streams rich in minerals from rocks grinding on rocks. Dr. McCarrison's statistics were the same as those gathered by Dr. Price: all zeros. He could find no ulcers, cancers, heart or kidney diseases, polio, or the rest; no prisons, mental institutions, child-delinquency problems. As a physician, he would have starved; as a researcher and dreamer, he made a great contribution. Other Hunza visitors have written of the cheerfulness and lack of fatigue of these people after great feats of endurance; a runner carried a message to a nearby village only 35 miles away and returned the same day with no sign of fatigue. As mountain guides, the Hunzas scrambled sure-footed over precipitous cliffs, carrying tremendous loads, laughing and singing the while.

Years ago a group of medical missionaries, Mormons by faith, collectively examined more than a million natives in central Africa; they found no disease, no cancer. A similar group found none among primitive peoples in South America.

Recently Dr. Michael Walsh studied Indians in an isolated district in Mexico, people without even a water supply. Their only beverage was fermented cactus juice, so rich in vitamin C that the amount allotted per person per day was equivalent to a dozen glasses of fresh orange juice. These people had never taken a bath; yet they were as free from body odor as they were from cancer, high blood pressure, coronary thrombosis, and other diseases.

These same dreamer-investigators also studied diseases; they did not have to go far to find them. In villages only a few miles away, white men had brought white sugar, white flour, and less-white "civilization." In such villages, Dr. Price found faulty bone structure, crowded, crooked teeth, rampant tooth decay, diseases of all kinds, prisons, perversions, and sexual immorality. Dr. McCarrison found ulcers, heart and kidney diseases, cancer, high blood pressure, colitis, and tuberculosis. In Africa and South America the medical missionaries found cancer rampant among members of the very tribes who, on their native diets, had stayed cancer-free. Now, only a generation later, these African natives are dying like flies from a form of malnutrition called kwashiorkor; 60 per cent coming to the autopsy tables have died of cancer. In populated areas in Mexico, Dr. Walsh found every disease he had the heart to look for.

I hunted for statistics of health in America to compare with the zeros found by Drs. Price and McCarrison. All I found were records showing people suffering from diseases in huge, heartbreaking numbers. The one group of statistics of the numbers and causes of rejections during the Korean War compared with those of World War II threw me into a depression which lasted days—the time interval is so short, the increases in abnormalities so appalling. These are not sickness figures; merely statistics of our finest young men at the height of their physical development.

Statistics can tell so little. The number of new cancer cases discovered each year tells nothing of the fear and dread in the hearts of millions of Americans who already know that some day they themselves will suffer from the disease. Statistics about the "chronics" in every county and state home, people whose illnesses go on year after year, do not mention the tired underpaid nurses ready to drop in their tracks; the stinking bedpans, the raw, running bedsores, or the looks of despair on the faces from which hope was lost so long ago. Statistics of the number of elderly people sitting or lying out monotonous and/or agonizing days in the thousands of rest homes in our country do not mention the bitterness, the fear, the hopelessness in the hearts of these still fine old people; if you see enough of these homes, you wonder whether our increased life span is always to be viewed with unmitigated pride.

The morbidity statistics all seem the same even though the diseases and numbers of people suffering from each are different. The new cases of polio per year, for example, tell nothing of the man- and woman-hours of the wonderful physicians, nurses, physiotherapists, and mothers who with endless patience help persons to some slight use of nearly useless arms and legs; of the heartbreak of youngsters who want to play football or dance, of ill mothers who ache to care for their children or of fathers who long to support their families. Each year the Red Cross pleads for blood plasma with which to fight polio. "More cases are expected this year than ever before," goes the appeal, and the Red Cross predictions have not yet been wrong; they will probably not be wrong in the future.

It is easy to find statistics on the billions of man-hours lost from work per year when 7,000,000 people per day are sufficiently sick to require medical care. These statistics tell nothing of those who suffered from minor but painful ailments, or of the millions whose illnesses were severe but who called no physician because they feared the expense or because none could come during the night when the pain was most excruciating.

There are no statistics available for dozens of things which really matter or really hurt; of exhausted mothers who, missing nights of sleep because of a sick child, must still go to an office the next day or drag themselves through mountains of housework, simultaneously caring for other children. No statistics tell of the billions of father- and mother-hours of worry or anguish endured per year; of the billions of spankings given annually to good children whose parents were irritable or frustrated; of the billions of meals ruined per year by nagging and scolding; of the billions of student-hours wasted because so many of the 30,700,000 in school attendance receive too few nutrients to keep their minds alert; of the number of parents paying dentists with savings they had hoped to spend on college educations.

I could find no health statistics. What is health? It seems to be something we talk glibly about. We speak of health insurance, meaning sickness insurance; of health benefits, meaning sickness benefits; health plans and surveys, meaning sickness plans and surveys. People talk about health education, health courses, health books; I have taken the courses, read the books; you learn about vaccinations, contagion, and diseases. What health actually is, apparently no one knows; certainly it is more than freedom from disease or ability to go to work. The best definition appears to be one which a small boy used to define money: "It's something we ain't got much of."

The less health we have, the less money we will have. It is said that 60 per cent of the savings of people sixty years old are spent on a search for health; but 60 per cent of the people sixty years old have no savings. Their sickness bills are paid by you and me. Our taxes pay for the county and state hospitals and homes for the chronically ill, as well as for institutions for the insane and feeble-minded. It is your tax money and mine which pays for schools, whether the children attend or not, are mentally alert or not, or the teachers eat breakfast or not.

In addition to the taxes, there are the fund-raising campaigns: the heart fund, the polio fund, the cerebral palsy fund, the cancer fund, and numerous others. Money-raising has become big business, for which experts are trained. To my knowledge, no money has yet been raised for the purpose of what I call prevention. The native races studied by Drs. Price and McCarrison did not "prevent" tuberculosis by early X-rays, or cancer by free clinics where frightened people could be examined; they used constructive methods.

Unless something is done and done quickly toward real prevention, I think we can expect still more irritability, fatigue, mental sluggishness, psychological maladjustment, faulty posture and bone structure, crooked and decayed teeth. We can expect more surgery: more tumors, cancers, gall bladders and prostates removed, more sinuses scraped, more hysterectomies performed. As things are now, I cannot see how an increase can be prevented in the incidence of cancer, ulcers, high blood pressure, heart and kidney diseases, diabetes, muscular dystrophy and atrophy, multiple sclerosis, cerebral palsy, and many other diseases, some still unknown and unnamed. How sincerely I hope I am wrong!

Can you hear the arguments being raised? Diagnostic methods are better. People are living longer, we are told, into the heart-disease-, diabetes-, nephritis-, cancer-susceptible age. Granted that these arguments contain some truth, but not all the truth. Before Iron Curtain days, it was known that the Bulgarians lived to be older than other peoples in the world without these diseases. When grains were unrefined in Denmark from 1914 to 1920, people lived longer, into the "disease-susceptible age," and had fewer of these diseases. Diagnostic methods are better, yes; they are now so good that a tremendous increase in cancer among babies and small children has been diagnosed. A year ago a young woman sat beside my desk, sobbing, sobbing, sobbing. Her three-year-old child, a little girl whose picture she showed me, had just died of cancer; another child of less than two and still another of scarcely five were then dying She herself wanted to die; she said so repeatedly. Yet she came asking for help for her two dying children. I wish I could have helped her six years earlier.

To my way of thinking, our national health began to decline at the onset of the Industrial Revolution, when families began to move from self-sustaining farms into crowded cities. It declined still further with the invention of machinery for milling grains, and with each new method of processing foods, each new trick for forcing hybrid crops to yield higher tonnage per acre on worn-out soil. New problems arising every year make sound nutrition more difficult to apply, or prevent its application.

The technical knowledge for halting this decline is at our fingertips as never before. Every person wishes to feel well, to stay young; persons aware of sound nutrition are eager to apply it. But we need men and women with courage and willingness to be leaders, to set the example, and to educate, probabaly in the face of ridicule, cynicism, and criticism. I hope enough fine men and women can be mobilized for this purpose. I believe they can.

CHAPTER 28

WHEN ABILITY BECOMES RESPONSIBILITY

MANY people agree with me that something should be done quickly about our national malnutrition. I ask them who should do it. Some say the universities, some the Department of Agriculture, the Public Health Departments, the schools. I cannot believe that any of these organizations will solve the problem.

The persons who in my opinion will save our nation are those marvelous individuals who rush in where wise men fear to tread. These wonderful people often do not know enough to believe it when the wise men tell them that something cannot be done. Sometimes they cannot even understand why it cannot be done.

One such person was an author who bought several worn-out farms in Ohio; the wise men said the land could not pay taxes. This author had no degrees in agriculture and did not consider himself a farmer; he had lived in France and watched the peasants there, and he had ideas and was willing to study and work. He changed that eroded, worn-out land into a paradise where springs, long dried up, bubbled again, with lakes where you could swim on hot days and where delicious fish almost jumped into the breakfast frying pans. He let wild roses and berries grow along fence rows. Small animals hid there to have their babies; hunting was always good. Quail and other birds nested in the bushes, feeding their young on worms and insects which the educated wise men said must be killed with poison

Shobharani

sprays. The paradise he created is now a mecca; thousands of farmers become pilgrims to learn wholesome farming methods which the money they have spent on taxes has not given them. This author has done tremendous good for nutrition, which starts with the soil. I hope some day I can know Mr. Bromfield well enough to call him Louie.[1]

Another remarkable person refused to believe the wise men who said it could not be done; he manufactured electrical equipment in New York City. Somehow he became interested in farming and moved onto worn-out land in Pennsylvania; he believed in soil bacteria, compost heaps, and lowly earthworms. When his health and the health of his family improved as his soil improved, it occurred to him that other people might want to know about his methods. First he published a magazine on gardening by biological methods and then one on farming.[2] This man had the courage to stick to his convictions, although the agricultural colleges said that what he said was poppycock. Several of these colleges set out to prove him wrong. Can you guess what they are finding out? That he has been right all along. I have never met this man, but I admire his courage; he has done much for nutrition.

Perhaps I love these "fools" who rush in because I have always been one of them. If you have become interested in nutrition, you will be one of us too; you cannot help yourself. Genuine interest in nutrition gives everyone a sort of divine itch, virulently contagious. It is like health, which is a million times more contagious than disease. The first thing you know, you have everyone around you scratching. This is the way it works.

At first there usually comes a trial-and-error period which varies depending on how genuinely you want to help others

[1] See footnote 5, p. 266
[2] See footnote 6, p. 267

and/or how much you have been helped by nutrition. The more enthusiastic you are, the more hot water you get yourself into. You may use the Prussian-commander technique: "You have to eat these hotcakes. They're blown up vitamin pills, full of wheat germ, soy flour, powdered milk, the works." The hotcakes may be more delicious than any your family ever tasted, but they go uneaten while you writhe in defeat. Perhaps you try the eager-beaver attack next: "Mary, you've got to take brewers' yeast! Deficiencies stick out all over you. Let me see your tongue. Oh, darling, you are a mess!" Mary is a little cool after that; her deficiencies become more severe. Next you use the blunt approach: "You don't eat liver every morning for breakfast? Huh! You're as inefficient as a horse and buggy." After a period of being an antagonizer par excellence, it dawns on you that no one enjoys criticism or advice; that every person has received an overdose of both as a kid and will take no more. You give up your talk-too-much technique and proceed with a sort of personal underground movement, silently conducted, which is the point where the less eager person starts in the first place.

You quietly improve your own nutrition; not your husband's or wife's or children's, just your own. Gradually you make changes. You buy better food every time you go to market. You get nuts for the kiddies instead of candy, make lollipops of pure fruit juices instead of buying ones of colored water and sugar. Perhaps you investigate a source of milk safe to use unpasteurized, or find hens associating with roosters and allowed the freedom of a barnyard. You locate supplies which must be purchased outside your community. You are more careful in selecting foods in restaurants and in planning and preparing delicious meals at home. Possibly you or even your husband starts baking homemade bread of stone-ground fresh wheat. When this art is mastered, you give slices or loaves to neighbors and relatives; they may start making bread or beg you to make enough to sell them. You discover the fun of having the youngsters say, "Gee, Mom, these are the best waffles you have ever made." Even after your husband finds out that they are full of wheat germ, which he tells you he "hates," and after he says that you will be putting ground glass into his food next, you give him butterscotch brownies at the following meal; he eats them to the last crumb, never dreaming they are made entirely of wheat germ.

When you have conquered the home front, you volunteer for the refreshment committee and serve some really good cookies at the P.T.A. or the Women's Club tea; you improve the food at Scout meetings and birthday parties; or you put some Christianity into a few church suppers. If you are a man, you work on the Breakfast Club or Rotary or Kiwanis luncheon menus. In case you are an executive, you realize the stupidity of paying for inefficiency produced under your own nose by mid-meals of coffee, soft drinks, and doughnuts, and you see that nuts, delicious milk drinks, "hopped-up" ice cream, and fresh fruits are made available. Perhaps you give a talk to some organization about high-protein breakfasts, fluoridation of water, the use of iodized salt or nutritious lunches carried from home. The local paper hears about your talk and wants copy, so you find yourself writing a food and nutrition column. Some people may call you a crackpot or food faddist; you expect that and shrug it off.

If you have a child in school, you start getting the candy bars and soft-drink machines out of the corridors. You nose around the cafeteria, see the huge tubs of potatoes peeled one day and soaking until the next, the mountains of white bread, the oceans of sweet gelatin desserts made sweeter by juices left over from canned fruits used in cobblers; you go before the P.T.A., you give the principal and/or the school board a bad time, or you run for the school board yourself.

After you have applied personal nutrition for awhile, you feel it and look it. You hear yourself exclaiming, "I never felt better in my life!" Your friends who did not want advice now want what you have, the sparkle, the pep, the glow you radiate. They start asking you questions. Soon their reports come back: they are not tired any longer; the leg cramps or headaches have disappeared; their constipation is gone. You glow with pride, and your snowball gains momentum. They ask you to talk to their friends who have problems. The itch spreads; more and more people begin scratching.

Your educational campaign with the children starts paying dividends, just momentary flashes at first, like feminine fireflies calling their lovers. "We have better food than other people, don't we, Mommie?" My son, sitting at a restaurant counter next to a woman drinking a soft drink, came out with this one, "Don't you know that will hurt your teeth? I'll drink it if you like, and you can save your teeth." Barbara brings her doll's bottle to me, 1/8 inch across at the top, "Mommie, put yeast in my baby's formula." You will hear similar comments. The older children bring their friends with pimples and menstrual cramps to you. You feel happy inside, knowing some day you will have beautiful grandchildren.

Perhaps you start a nutrition cooking school in your home; several friends of mine have, charging a fee for each person who attends. One girl, infected with a splendid case of divine itch, charges, but her fee is not monetary. She agreed to teach four of her friends how to make whole-wheat bread provided each of them would teach four friends who would agree to teach four of their friends. Soon the lessons included the making of yogurt, high-protein custard, cookies prepared with vegetable oil, and meat loaf fortified with powdered milk and wheat germ. Spirited discussions of nutrition take place at each lesson. The chain of her Magnificent Obsession continues to lengthen.

You may get interested in the 4H Clubs, an organization of farm youngsters thousands strong, to whom practical nutrition could be so easily and wonderfully taught and applied. You read the surveys showing that the health of farm children is inferior to that of city children, an ironical twist of fate which you realize should not be so; you know that a few itchy fools could quickly change that. Perhaps you become a leader of a garden club and teach biological methods and the nutritive value of the foods; or you help the little girls make breads, muffins, and cookies of whole-wheat and soy flour. You teach them to put some meaning into their 4Hs by allowing their *hearts* to feel the need for alert *heads* to direct capable *hands* into helping build national *health.*

Perhaps you put in an herb garden or plant a few vegetables among your flowers. If you have more land, you may go in for compost heaps and real vegetable and fruit gardening. Or, perhaps you move to the suburbs, buy a cow or goat, and value the milk and manure equally. Maybe you already live on a farm; gradually you change to biological methods. In any case you have your garden soil analyzed, add the trace minerals needed,[3] and return as much humus to the soil as you can. You read books on gardening[4] or farming[5] with biological methods and subscribe to maga-

[3] Trace minerals can be obtained from Nutritional Concentrates, Inc., Agricultural Division, 3090 West Liberty Avenue, Pittsburgh 16, Pennsylvania, or the Inland Fertilizer Company, 4134 Bandini Street, Los Angeles 23, California. Information concerning the mineralization of farm lands can be obtained from the research organization of the American Farm Bureau: American Farm Research Association, 300 Schultz Building, Lafayette, Indiana. For soil analysis, see footnote, p. 208.

[4] Thomas J. Barrett, *Harnessing the Earthworm* (Sun Valley, California: Dr. T. J. Barrett, 1948); Sir Albert Howard, *Soil and Health* (Devin Adair Company, 1947); J. I. Rodale, *Pay Dirt* (Devin-Adair Company, 1949); Leonard Wickenden, *Make Friends with Your Land* (Devin Adair Company, 1949).

[5] Louis Bromfield, *Pleasant Valley, Malabar Farms* and *Out of the Earth* (Harper and Brothers, 1945, 1948, 1950, respectively); *Hunger Signs in Crops* and *Mineral Nutrition in Plants and Animals*, see ref. 1, p. 200.

zines.[6] You give some of your fruits and vegetables to your friends and neighbors, let them see how delicious such foods can be, and get them interested in putting in a garden of their own. Thousands of gardeners and hundreds of farmers all over America are already using biological methods. Even some of the largest truck farmers are adding trace minerals to their land and as much humus as they can procure; they find that it pays because less produce is destroyed by insects and the food has much better keeping qualities.

You may have considered opening a small business and have wondered what would be best. The people you have given vegetables to like them so much that you may open a roadside stand; or you convert a front room into a small restaurant where you serve wonderful vegetable soup with stock you have to cut with a knife, your fresh vegetables added after the customer is seated; or your specialty may be slow-roasted meats and delicious cooked vegetables or a tossed salad seasoned with your fresh herbs.

Maybe a specialty food shop interests you even if you have no garden. The first thing you do is to learn to prepare some food better than anyone else in your part of the country; then you convert that front room into a place like the famous New York Central oyster bar, for example. People do not want big meals; they want delicious, filling meals. Think of the business a small specialty restaurant could do on a cold rainy day serving nothing but delicious soup and hot homemade bread; or a restaurant with a sign, "The Best Waffles in the World," their product coming up to expectations, served with creamed chicken or turkey and a beverage, nothing more. I should like to find a place which serves only a delicious tossed salad with piping-hot cheese blini, made fresh for each customer instead of warmed over as in

[6] *Organic Gardening* and *Farming* (Emmaus, Pennsylvania: The Rodale Press); *The Land* (Columbus, Ohio: Friends of the Land).

the restaurants which serve them at all. If 100,000 or more such specialty food counters could be opened across the country, motoring would be a pleasure.

Perhaps you start selling homemade bread, cookies, nutbreads, or cakes made of whole-wheat flour, wheat germ and other health-building ingredients; I know of several women who are doing that. One of them makes the best orange nutbread I have ever tasted. One acquaintance is now in the health-candy business, making delicious candies of such ingredients as powdered milk, honey, nuts, and peanut butter. Another man is making pure orange juice lollipops without added sugar; he supplies all the stores and schools in a moderately large city, his business far surpassing his expectations. A number of couples have opened small bakeries, using only health-building ingredients. Still other families have started health-food stores; every county seat needs at least one such store. A boy I know of is putting himself through college by raising goats and selling goats' milk. Aside from supporting themselves with such businesses, these people are spreading the itch.

You find yourself wanting to learn more. You get such books as *The Wheel of Health,*[7] *Tomorrow's Food,*[8] *Body, Mind and Sugar,*[9] *Nutrition and Physical Degeneration,*[10] *Our National Malnutrition,*[11] and *Diet Prevents Polio.*[12] You may subscribe to *Modern Nutrition,*[13] *The Journal of Applied*

[7] G. T. Wrench, *The Wheel of Health* (Milwaukee, Wisconsin: Lee Foundation of Nutritional Research, 1945).

[8] N. Philip Norman and James Rorty, *Tomorrow's Food* (Prentice-Hall, Inc., 1947).

[9] *Body, Mind and Sugar,* see ref. 3, p. 14.

[10] *Nutrition and Physical Degeneration,* see ref. 1, p. 254.

[11] D. T. Quigley, *Our National Malnutrition* (Milwaukee, Wisconsin: Lee Foundation of Nutritional Research, 1948).

[12] B. O. Sandler, *Diet Prevents Polio* (Milwaukee, Wisconsin: Lee Foundation of Nutritional Research, 1951).

[13] *Modern Nutrition, The Journal of Applied Nutrition,* and information concerning the American Nutrition Society and the American Academy of

Nutrition,[13] and to Carlton Fredericks' *Nutrition News.*[14] All of these you circulate among your friends; they borrow them again to lend to their friends who buy them to lend to their friends. Together you get your local library to order these books and to keep them prominently displayed. Soon you find yourself and your friends giving book reviews. You may long for company and join the American Nutrition Society or the American Academy of Nutrition [13] or even start a chapter of your own. Perhaps you go to a national convention where you meet wonderful physicians, dentists, agriculturists, chemists, laymen of every variety, all of whom think and feel as you do; you leave with your head in the clouds, determined to work harder than ever.

It soon gripes you that your money supports schools run so inefficiently because of poor nutrition. You dream about nutrition being taught in every classroom. That was the dream of the late Dr. Mary Swartz Rose, too. I studied under her and observed classes she herself often taught in a grade school near Columbia University. The fifth grade that year was studying calcium; they learned about milk, bones, and teeth and brought real teeth and bones to class; they soaked bones in acids to observe the bone base. They made milk drinks for parties; they raised white rats, some on milk, some without. They learned more about calcium than most adults know. The sixth grade was studying vitamin A, and they also had rats with and without this vitamin. They had parties with carrot-stick refreshments and ate dried apricots instead of candy. They learned a great deal; they loved it and went home to teach their parents about nutrition.

Suddenly you realize that every teacher in every public school in America could teach nutrition in one way or an-

Nutrition can be obtained from 6238 Wilshire Boulevard, Los Angeles 48, California.

[14] *Nutrition News,* The Institute of Nutrition Research, Inc., 62 West 45 Street, New York 19, New York.

other; you quickly lend your books and magazines to teachers. Once interested, a teacher cannot help teaching nutrition even if she tries. She lives it and saves herself much fatigue; then she finds herself helping her students to feel better. Her work soon becomes easier because they are more alert. By this personal method many teachers are already doing a corking good job in nutrition education, although they do not consider that they teach nutrition at all. Some day such teachers will publish in the teachers' magazines their experiences and methods which will serve as a guide and inspiration for other teachers.

Next you think of the potentialities of the school cafeteria managers and the foods teachers. If you can get them personally interested, you know the rest will follow. Once enthusiastic, a foods teacher could not look herself in the mirror if she used the disease-producing methods which many such teachers do now. She holds a vision of the future of the students in her classes, so soon to be husbands, wives, and parents. She visualizes healthy mothers, their pregnancies a joy, their deliveries easy, their children beautiful. She knows that these boys and girls, once taught nutrition, will produce tomorrow's leaders, thinkers, and doers.

Soon you see the potential good an athletic coach can accomplish. He is already interested in health; his athletes are almost crying for knowledge of nutrition. Without any trouble at all you get him to rush in scarcely thinking of the timid wise men. He gets enthusiastic approval because everyone wants the team to win. Several coaches have told me that the boys make a touchdown for tiger's milk or wheat germ at every football game. I know of one basketball team which won a championship with good nutrition last year; the physician at this school said he could scarcely believe the improvement he found. A university physician gave me an even more glowing report: much less fatigue among the boys; the crew ending the season without enlarged hearts;

broken bones healing more quickly than ever before. These coaches and physicians will be writing articles for their journals before long; they, too, become enthusiastic and cannot help themselves.

After you go to bed, you lie awake thinking that adult education classes in nutrition should be taught in every evening school. You look around for someone to teach such a class, perhaps a physician, a nurse, or the hospital dietitian; after you talk to this person, you go to the principal of adult education, then to your neighbors to be sure that they turn out for the class. If you cannot find anyone else, you study like mad and then offer to teach it yourself. Perhaps you even go back to college for a few courses in chemistry or foods.

You realize that nutrition should be taught in every medical school but feel that you can do nothing about it. Who do you suppose has already forced some medical schools to teach this subject? You have. For example, the reason physicians are giving so many shots of vitamin B_{12} is that patients demand them. If you get enough people interested in nutrition, you will all find yourselves asking your physicians such questions as: "Where am I going to get linoleic acid on a fat-free diet?" "Why aren't you giving the baby any vitamin E?" "Doctor, will you give Johnny a vitamin-C shot?" "How many milligrams of pantothenic acid do you think I should take?" When physicians hear enough questions they cannot answer concerning nutrition, the subject will be taught in every medical school; thousands of practicing physicians are on the staffs of such schools.

If you have any contact with hospitals, you quickly realize that someone should do something about the food they serve. The dietitian's hands are usually tied; she does not see the patients, let alone learn to love them or to feel concerned about their needs. She must meet the budget. Surveys have shown that the meals in approximately two-thirds of the hospitals in the United States do not meet the minimum nutritional requirements set up by the National Research Council in any respect, even calories.

There are three small hospitals I personally know of where a patient has a reasonable chance of recovering rapidly; two are run by physicians who know nutrition. At the third, the Sister Kenny Polio Hospital at El Monte, California, the entire personnel, nurses, physicians, physiotherapists, and kitchen help, were requested to attend a lecture course in nutrition given by Dr. Michael Walsh. Dr. Walsh also helped to supervise the application of nutrition in the meals served the patients and also those for the staff. The health of physicians, who were originally antagonistic to the program, has so improved that they are now enthusiastic.

Often parents have refused to allow their children to stay in a hospital where the food was inadequate. Frequently nutrition-minded people bring good food to a member of their family or a friend in a hospital; the attending physician may be surprised at the speedy recovery, ask questions, and make similar recommendations to other patients. Certain patients in our county hospital are now being given brewers' yeast; everyone able to swallow on the polio ward has vitamin-C tablets handed him almost every hour; I suspect some mother or friend started both practices.

This report is not imaginary. It is what is actually happening all over America. The snowball is rolling on and on. Wonderful "fools," more and more of them, keep rushing in. A big job is being done by big people, the big people who are sometimes mistakenly called the "little" people, by uncommon men so wrongly called, individually, the "common man." I could give you the names and addresses of hundreds of these big people, some of whom have changed the lives of almost everyone in their communities. They are people like Celia Massie in Grants Pass, Oregon, Mildred Hatch at St. Johnsbury, Vermont, Amy Tapping at Plainfield, New

Jersey, Bernice Hicks at Bellingham, Washington, and the Clive McCays at Ithaca, New York. In California Homer Dahlman at Paradise, Eleanor Kingsley at Pomona, Douglas Campbell and Rhoda Kellogg in San Francisco, Alfreda Rook at Vista, Harold Stone in La Habra and Gladys Lindberg in Los Angeles are all doing magnificent work. Making such a list is like sending out wedding invitations; you do not know where to stop. Without any specialized training, any organization, or any particular leadership, without one cent of tax money and without even any work but just a lot of fun, we can collectively solve this problem of America's malnutrition.

Although much is being done, there is still much to do. It cannot be done fast enough. Millions of persons of all ages are still going to suffer needlessly. Spastic, feeble-minded, or disease-susceptible babies are still to be born. Children now fairly healthy will hate ugliness still to be produced or will live out years in iron lungs. Arteries now elastic are still to be filled with cholesterol, mouths to be filled with dentures, and hearts to be filled with dread. If you put your ear to the ground, you can hear the groaning, sobbing and pleading for help, groaning and sobbing which you can prevent, help which you can give. There is work for everyone; every talent is sought. Equally important is the discipline of the scientist, the humanitarianism of the clinician, and the enthusiasm of the amateur.

Every person who has the ability to see our country's need can help to fill that need. It is part of my creed—of my region if you like—that when you have the ability to help our fellow man, that ability ceases to be merely an ability and becomes a responsibility. It is part of my faith that this responsibility will be shouldered by the big people of America.

LIMITATIONS OF ANY TABLE OF FOOD ANALYSIS

Many physicians and nutritionists, including myself, have criticized the use of tables of food analysis. If the limitations of such a table are appreciated, however, it can be used as a general guide in planning a diet. The principal reason is that the nutrients in foods vary widely, depending upon numerous factors: the season in which the foods were grown; the amount of sunshine, rainfall, or water they received; the degree of ripeness or maturity when harvested; the method of fertilizing the soil; and particularly upon the amount of valuable bacteria, fungi, and humus in the soil and the minerals in the topsoil and subsoil. Thus potatoes or bunches of spinach grown in various localities have different nutritive values. Carrots, for example, have been analyzed which contain no vitamin A (carotene) whatsoever. The protein content of wheat, hence of breads and cereals, can vary from 3 to 22 per cent, depending upon the humus content of the soil. The nutritive value of milk, eggs, and meats vary with the diet of the animals which produced them. The losses which occur during harvesting, shipping, storing, processing, marketing, and preparing and cooking foods at home cause the nutritive values to vary much more. Although the analyses of foods in the following table were made at many universities and by reputable laboratories and are correct for the specific samples of food used, the foods you actually serve your family may have a far different analysis.

Another criticism is that such tables leave the impression that the nutrients listed are more important than those omitted: vitamins D, E, K, and P, the many B vitamins, and numerous minerals. One or more of these nutrients may be particularly vital to your individual health. Furthermore, even when a food is known to contain a certain nutrient, there is no assurance that it will be efficiently absorbed into your blood or not destroyed in the body or lost in the excreta.

TABLE OF FOOD ANALYSIS ¶

In the following table, amounts of vitamin B_1 (thiamin), vitamin B_2 (riboflavin), vitamin C (ascorbic acid), calcium, phosphorus, and iron are given in milligrams (mg.). Vitamin A is in International, or United States Pharmacopeia, units.

With the exception of milk, average servings of food are given; weights and measures are of edible portions only. In case of cereals and legumes, raw weights are given with approximate cooked measure. Figures are for pasteurized milk and sulphur-dried fruits. Unless specified, vitamin and mineral contents are for uncooked foods, and allowances must be made for losses during cooking.

Abbreviations Used in Table

* *probably rich source*	c. *standard measuring cup*	med. *medium*	sm. *small*
— *amount insignificant*	oz. *ounce*	ser. *serving*	st. *stalk*
.. *no data available*	in. *inch*	sl. *slice*	T. *tablespoonful*
av. *average*	lg. *large*	sq. *square*	t. *teaspoonful*

Food	*Weight grams*	*Measure*	*Vitamins*				*Calcium mg.*	*Phosphorus mg.*	*Iron mg.*	*Protein grams*	*Calories*
			A units	*B_1 mg.*	*B_2 mg.*	*C mg.*					
almonds	10	10 med.	0	.015	.010	1	25	45	0.3	2	65
apple	100	1 sm.	90	.036	.050	6	7	12	0.3	0	64
applesauce, sweetened	100	½ c.	60	.025	.075	5	10	18	0.4	0	150

apricots, dried	50	8 halves	6,850	.048	.250	0	16	30	0.8	1	102
apricots, fresh	100	6 halves	7,500	.033	.100	4	13	24	0.6	1	70
artichoke, Jerusalem	50	1 med.	200	.075	.015	10	20	47	0.4	1	32
asparagus, bleached	100	8 st.	0	.150	.065	12	21	40	1	2	20
asparagus, green	100	8 st.	1,100	.360	.065	20	21	40	1	2	20
avocado	100	½ med.	500	.120	.137	9	44	42	6.3	2	263
bacon, crisp	10	1½ sl.	0	.027	.007	0	0	3	0.1	2	53
banana	100	1 med.	300	.045	.087	10	8	28	0.6	1	85
barley, pearl	100	½ c. raw	0	.165	0	0	20	181	0.2	4	330
barley, whole	100	½ c. raw	—	2.200	..	0	51	400	4.7	4	310
beans, kidney, cooked	100	½ c.	300	.216	.210	0	46	152	0.6	6	88
beans, Lima, dry, cooked	90	½ c.	0	.300	.250	0	72	386	2.9	8	129
beans, Lima, green, cooked	100	½ c.	900	.225	.250	42	21	130	0.9	7	116
beans, navy, baked	100	½ c.	20	.150	.015	0	52	155	3.8	6	115
beans, string, green, cooked	100	¾ c.	950	.060	.100	8	55	50	1.1	2	43
beef broth	200	1 c.	0	..	..	0	0	..	..	4	30
beef, fat	113	4 oz. or 1 sl.	40	.135	.200	0	12	204	3	19	242
beef, lean	113	4 oz. or 1 sl.	60	.140	.262	0	13	214	3.4	22	190
beet greens, cooked	135	½ c.	22,000	.100	.500	50	94	40	3.2	2	28
beets	100	½ c.	50	.041	.037	8	28	42	2.8	2	40
blackberries	100	¾ c.	300	.025	.030	3	32	32	0.9	0	52

¶ Reprinted with permission from *Vitality Through Planned Nutrition* by Adelle Davis (rev. ed.; New York: The Macmillan Company, 1949).

Food	Weight grams	Measure	Vitamins A units	Vitamins B_1 mg.	Vitamins B_2 mg.	Vitamins C mg.	Calcium mg.	Phosphorus mg.	Iron mg.	Protein grams	Calories
blueberries	100	¾ c.	35	.045	.031	11	25	20	0.9	0	50
bologna	50	10 sl. sm.	0	.255	.200	0	40	102	4.2	8	109
brains, beef	113	4 oz.	54	.168	.360	18	16	340	5.3	11	127
bran, wheat flakes	25	1 c.	25	.240	.080	0	30	305	1.9	1	70
bread, rye	30	1 sl.	—	.066	..	0	12	74	0.6	3	76
bread, white, milk	30	1 sl.	10	.015	.020	0	14	32	0.2	3	72
bread, white, roll	50	1 lg.	12	.024	.025	0	12	40	0.2	4	100
bread, whole-wheat, 100%	30	1 sl.	10	.180	.100	0	22	102	1.1	3	75
broccoli, flower	100	¾ c.	6,000	.120	.350	65	64	105	1.3	2	35
broccoli, leaf	100	¾ c.	30,000	.120	.687	90	262	67	2.3	3	35
broccoli, stem	100	¾ c.	2,000	..	.187	..	83	35	1.1	2	35
Brussels sprouts	100	¾ c.	400	.180	.090	130	27	121	2.1	4	55
buckwheat, whole	100	5 T.	..	.660	..	0	24	306	2.6	12	240
butter ¶	10	2 t., 1 sq.	225	.012	0	0	1	1	0	0	77
buttermilk	960	1 qt.	400	.300	1.850	0	1,200	960	—	30	400
cabbage, inside leaves	100	1 c. raw	0	.078	.075	50	46	34	0.2	2	28
cabbage, Chinese	100	1 c. raw	5,000	.036	.462	50	400	72	2.5	2	30

cabbage, green	100	1 c. raw	160	.090	.150	50	429	72	2.8	2	28
cake, chocolate	50	1 sl.	160	.015	.030	0	21	48	0.4	3	200
cake, devil's food	50	1 sl.	150	.019	.037	0	11	101	2.9	3	177
cake, sponge	25	1 sl.	160	.036	.006	0	18	55	0.8	2	72
candy, chocolate	15	1 piece	—	0	0	0	0	0	0	—	45
candy, chocolate nut	40	1 bar	—	..	..	0	0	—	0	5	219
candy, gumdrop	10	1 lg.	0	0	0	0	0	0	0	1	36
candy, marshmallow	6	1 av.	0	0	0	0	0	0	0	—	20
candy, milk chocolate	50	1 bar	—	0	0	0	10	—	0	4	282
candy, mint	6	1 piece	—	0	0	0	0	0	0	0	20
candy, peanut brittle	25	2 x 3 x ¼ in.	0	.045	.030	0	5	26	0.4	3	115
cantaloupe (see melon)											
carrots	100	½ c. diced	4,500	.070	.075	5	45	41	0.6	1	30
cashew nuts	30	20 nuts	0	*	.076	0	16	160	..	6	202
cauliflower	100	¾ c.	10	.085	.090	75	122	60	0.9	2	25
celery, bleached	100	4 st.	20	.030	.015	5	78	46	0.5	1	19
celery, green	100	4 st.	640	.030	.045	7	98	46	0.8	1	19
celery root	100	½ c.	..	..	..	2	47	71	0.8	3	38
cereal, whole-wheat, cooked	100	⅔ c.	7	.140	.030	0	10	98	1.4	3	100
chard, leaves, cooked	100	½ c.	15,000	.450	.165	37	150	50	3.1	2	25
cheese, American	40	2 x 1 x 1 in.	1,000	.018	.200	0	380	274	0.4	12	160
cheese, Cheddar	30	2 T.	500	.045	.650	0	254	181	0.1	7	100

¶ Summer butter may supply 5 to 10 units of vitamin D per square.

Food	Weight grams	Measure	Vitamins A units	Vitamins B_1 mg.	Vitamins B_2 mg.	Vitamins C mg.	Calcium mg.	Phosphorus mg.	Iron mg.	Protein grams	Calories
cheese, cottage	100	½ c.	180	.018	.250	0	240	263	—	20	100
cheese, cream	20	1 T.	3,500	.010	.112	0	127	104	—	2	75
cheese, Swiss	30	1 sl.	660	..	.150	0	330	281	0.4	10	135
cherries, stoned	100	12 lg.	259	.051	—	12	19	30	0.4	1	90
chestnuts, fresh	20	6 nuts	0	.048	..	0	7	19	0.8	—	37
chicken	113	4 oz.	0	.140	.180	0	14	232	3.1	18	125
chocolate malted milk	350	13 oz.	2,260	.333	.532	0	390	306	1.1	11	514
chocolate milk shake	350	13 oz.	1,240	.168	.432	0	390	300	0.9	10	472
chocolate pudding ¶	125	½ c.	592	.015	.150	0	149	164	—	5	272
chocolate, sweetened	30	1 oz.	0	.025	..	0	27	130	0.7	—	170
clams	113	6, or ¾ c.	20	.021	.015	15	95	93	4.2	14	100
Coca-cola	200	7 oz.	0	0	0	0	0	0	0	0	135
cocoa †	150	1 c.	300	.030	.150	0	186	62	0.4	5	135
coconut, dried	20	3 T.	..	.015	.025	0	12	31	0.4	1	130
cod-liver oil, U.S.P.‡	15	1 T.	10,000	0	0	0	0	0	0	0	100
cod fish	113	4 oz.	10	.150	.192	0	12	120	0.6	16	70
coffee, liquid	200	1 c.	0	0	0	0	0	0	0	0	0

collards, cooked	100	½ c.	6,300	.130	*	70	207	75	3.4	3	41
cookie, molasses	25	1 lg.	—	—	..	0	39	25	1.5	2	100
corn, canned, yellow	100	½ c.	900	.130	.120	4	6	103	0.4	4	120
corn, on cob, yellow	100	1 med.	860	.209	.055	8	8	103	0.4	3	90
corn oil	11	1 T.	0	0	0	0	0	0	0	0	100
corned beef	113	4 oz.	..	..	*	0	13	119	6.8	16	196
cornflakes	20	¾ c.	0	.020	.020	0	10	38	0.1	2	100
cornmeal, white	100	½ c.	0	.110	.082	0	16	152	0.5	8	270
cornmeal, yellow	100	½ c.	500	.110	.100	0	16	152	0.9	8	272
cottonseed oil	11	1 T.	0	0	0	0	0	0	0	0	100
crab	113	⅔ c.	..	.135	.420	12	17	181	0.1	16	80
crackers, graham	20	2	0	.048	..	0	4	20	0.2	2	84
crackers, soda	12	2 lg.	0	0	0	0	2	10	0	1	53
cranberries, sauce	100	¾ c.	30	0	0	6	13	11	0.4	—	300
cream, table, 20%	60	4 T.	510	.030	.090	0	45	40	—	2	105
cream, whipping, 40%	60	4 T.	1,020	.030	.090	0	38	36	—	1	240
cream soup, spinach §	150	¾ c.	4,800	.087	.150	2	157	144	3.5	5	150
cream soup, tomato §	150	¾ c.	1,100	.096	.150	3	130	140	0.6	4	141
cucumbers	100	1 med.	35	.060	.054	12	10	21	0.3	1	15

¶ 100 grams milk, ¼ egg.
† 100 grams milk.
‡ Supplies 1,700 units of vitamin D.
§ ½ c. milk, whole, 3 T. vegetable.

Food	Weight grams	Measure	Vitamins A units	Vitamins B_1 mg.	Vitamins B_2 mg.	Vitamins C mg.	Calcium mg.	Phosphorus mg.	Iron mg.	Protein grams	Calories
custard ¶	130	½ c.	918	.048	.225	0	134	175	0.7	7	126
dandelion greens, cooked	100	½ c.	20,000	.190	.270	100	84	35	6	3	45
dates, dried, stoned	100	15 med.	155	.060	.054	0	70	56	3.5	2	347
doughnuts	100	2	190	.018	.087	0	21	55	1.6	7	481
duck	113	4 oz.	..	.360	..	0	10	200	2.3	21	159
egg, whole	50	1 av.	600	.065	.150	0	32	112	1.5	6	75
egg white	30	1 white	0	.005	.050	0	4	5	0	3	12
egg yolk	20	1 yolk	600	.060	.100	0	28	107	1.5	3	58
eggplant	100	½ c.	70	.042	.036	10	11	31	0.5	1	15
endive	100	10 st.	15,000	.058	.072	20	104	39	1.2	1	8
escarol (chicory)	100	¾ c.	23,000	.075	.250	7	29	27	1.5	1	20
farina, raw, refined	20	3 T.	0	.010	0	0	5	25	0.1	2	72
figs, dried	30	2 sm.	15	.015	.032	0	54	38	0.7	1	103
figs, fresh	50	2 lg.	50	.037	.030	1	26	18	0.4	1	42
fish (average)	113	4 oz.	16	.148	.220	0	12	128	1.6	21	140
flour, buckwheat	113	1 c.	0	.300	..	0	11	193	1.3	6	387
flour, rye	113	1 c.	0	.171	.072	0	18	289	1.4	9	388

flour, soybean	113	1 c.	..	.650	.370	0	200	450	7.4	37	379
flour, wheat, fortified †	113	1 c.	0	.450	.220	0	270	90	3.3	10	354
flour, wheat, refined	113	1 c.	0	.070	.054	0	20	90	1	10	354
flour, wheat, whole-grain	113	1 c.	42	.450	.160	0	45	423	5	12	361
frankfurters	113	2 links	0	*	..	0	7	117	1.6	14	244
gelatin, dried	10	1 T.	0	0	0	0	0	17	..	8	34
gingerale	200	7 oz.	0	0	0	0	0	0	0	0	90
goose	113	4 oz.	..	.150	..	0	10	175	2.4	22	153
gooseberries	100	¾ c.	150	.150	..	25	40	50	0.4	1	37
grapefruit, fresh	100	½ med.	20	.070	.060	45	21	20	0.2	0	36
grapefruit juice, fresh	240	1 c., or 8 oz.	50	.075	.144	108	42	40	0.4	1	72
grapefruit juice, canned	240	1 c., or 8 oz.	50	.065	.144	72	42	40	0.4	1	100
grape juice, canned	100	½ c.	0	.020	.020	0	11	10	0.3	0	60
grapes	100	1 sm. bunch	25	.030	.024	3	19	35	0.7	1	80
guavas	100	1	200	.156	.105	125	15	16	3	1	56
haddock	113	4 oz.	7	.120	.198	0	18	197	0.5	17	72
halibut	113	4 oz.	0	.120	.222	0	20	200	1	19	121
ham	113	4 oz.	0	.800	.225	0	13	54	5.7	20	248
heart, beef	113	4 oz.	..	.660	.900	4	12	129	3.7	17	96
herring	113	4 oz.	200	.120	.330	0	23	246	0.6	19	394
hominy, white	100	½ c.	0	.054	0	0	12	112	0	0	355

¶ ½ c. milk, whole, ½ egg.
† Fortified flour means that iron, thiamin, and niacin have been added to refined flour.

Food	Weight grams	Measure	Vitamins A units	Vitamins B_1 mg.	Vitamins B_2 mg.	Vitamins C mg.	Calcium mg.	Phosphorus mg.	Iron mg.	Protein grams	Calories
honey	25	1 T.	0	0	0	1	0	6	0.1	0	101
huckleberries	100	½ c.	100	.045	.021	8	25	20	0.2	1	60
ice cream, commercial	100	½ c.	170	.036	.150	0	202	74	0.6	2	208
jams	50	4 t.	0	0	—	0	—	—	—	0	176
jellies	50	4 t.	0	0	—	0	—	—	—	0	156
jello ¶	200	¾ c.	0	0	0	0	0	0	0	2	112
kale, cooked	100	½ c.	20,000	.189	.570	96	195	67	2.5	4	45
ketchup, tomato	20	1 T.	—	..	..	—	3	8	0.2	—	21
kidney, beef	113	4 oz.	1,100	.300	2.520	10	9	182	4.2	15	137
kohlrabi	100	½ c.	..	.030	.120	50	195	60	0.7	2	32
lamb chop	113	2 chops	0	.300	.330	0	21	180	3.3	20	359
lamb, roast	113	4 oz.	0	.225	.320	0	21	180	1.7	22	225
lamb's-quarters (greens)	100	½ c.	19,000	.180	.600	82	180	70	2.6	4	55
lard	30	2 T.	2	.051	.009	0	0	0	0	0	270
leeks	100	½ c.	20	.150	..	24	58	56	0.6	2	40
lemon juice	50	4 T.	0	.024	.002	25	11	6	0.3	0	20
lentils, cooked	100	½ c.	200	.378	.390	0	20	77	1.7	9	115

lettuce, green	100	10 leaves	2,000	.075	.150	7	49	28	1.5	1	10
lettuce, white	100	¼ head	125	.051	.062	5	17	40	0.5	1	10
lime juice	50	¼ c.	65	..	..	18	28	17	—	0	20
liver, beef	113	4 oz. or 1 sl.	9,000	.300	2.500	30	11	368	9.2	20	140
liver, calf	113	4 oz. or 1 sl.	7,000	.250	2.250	25	8	420	9.4	23	148
liver, chicken	113	4 oz. or ½ c.	8,000	.210	..	25	..	..	..	20	130
liver, lamb	113	4 oz. or 1 sl.	9,000	.300	2.500	20	8	400	7.9	20	120
liver, pork	113	4 oz. or 1 sl.	6,000	.450	2.500	12	10	370	8.1	20	150
lobster, canned	100	½ c.	..	.150	.156	5	18	188	0.9	16	84
loganberries, canned	100	1 c.	..	.033	..	35	35	24	1.3	1	64
macaroni, white, cooked	100	¾ c.	0	.005	0	0	24	119	0.1	3	130
macaroni, whole-wheat	100	¾ c.	0	.410	.160	0	45	423	5.1	4	130
malted milk, dry	30	2 T.	2,040	.330	.200	0	..	..	..	2	82
mandarin (orange)	100	2 sm.	150	.080	.150	46	45	21	0.5	0	61
margarine	28	1 oz.	..	0	0	0	—	3	0.1	—	261
marmalade, orange	25	1 T.	..	0	..	0	8	3	0.1	—	85
mayonnaise	15	1 T.	—	..	.007	0	2	—	—	—	100
melon, cantaloupe	150	½ sm.	900	.090	.100	50	32	30	0.5	1	44
melon, honey dew	150	¼ med.	100	..	..	90	..	..	..	0	35
melon, watermelon	300	1 med. ser.	450	.180	.084	22	33	9	0.6	0	90
milk, condensed	100	½ c.	680	.096	.420	0	300	235	0.3	9	326
milk, dried, skim	100	10 T., or ½ c. rounded	0	.340	1.960	0	1,220	850	0.5	35	350

¶ Made with water.

Food	Weight grams	Measure	Vitamins A units	Vitamins B1 mg.	Vitamins B2 mg.	Vitamins C mg.	Calcium mg.	Phosphorus mg.	Iron mg.	Protein grams	Calories
milk, evaporated	100	½ c.	680	.056	.390	0	250	200	0.5	8	150
milk, fresh, dry feed	960	1 qt.	800	.240	1.500	2	1,100	930	1.6	33	660
milk, fresh, green feed	960	1 qt.	3,500	.600	2.100	12	1,220	960	2.8	33	660
milk, fresh, skim	960	1 qt.	30	.300	1.925	11	1,220	960	0.4	34	370
milk, fresh, whole, average	960	1 qt.	2,920	.300	1.900	10	1,200	930	2.2	33	660
milk, goat	960	1 qt.	1,630	.547	.950	12	1,152	960	2	32	672
molasses, blackstrap	20	1 T.	0	.490	.580	0	259	35	9.6	1	52
molasses, blackstrap, fortified ¶	20	1 T.	0	1.049	.580	0	259	35	9.6	1	52
molasses, dark, unrefined	20	1 T.	0	0	0	0	40	8	1.4	—	57
molasses, light (corn syrup)	20	1 T.	0	0	0	0	2	1	0	0	59
muffin, bran	35	1 lg.	20	.150	.040	0	26	24	0.4	1	120
muffin, wheat-germ †	35	1 lg.	25	.450	.062	0	26	24	0.6	1	120
mushrooms	100	¾ c.	0	.160	.070	2	14	98	0.7	4	36
mustard greens, cooked	100	½ c.	11,000	.138	.450	125	291	84	9.1	2	25
mutton, leg	113	4 oz.	0	.360	.330	0	10	270	3	20	191
oatmeal, cooked	20	½ c.	0	.190	.075	0	4	79	1.4	4	80

okra	100	½ c.	440	.126	..	17	72	62	2.1	2	24
olives, green	25	5	50	0	0	0	40	4	0.6	—	35
olive oil	15	1 T.	0	0	0	0	0	0	0	0	135
onions, dry	100	2 sm.	0	.042	.125	2	41	47	0.3	1	45
onions, fresh	100	4 med.	60	.042	.125	7	41	47	0.4	1	42
orange	100	1 med.	190	.090	.075	50	44	18	0.4	—	50
orange juice, canned	240	1 c. or 8 oz.	460	.225	.230	80	90	45	0.9	1	110
orange, fresh	240	1 c. or 8 oz.	460	.200	.230	120	90	45	0.9	1	110
oysters	100	7 med.	250	.225	.540	3	33	156	5.8	6	50
parsley	50	½ c.	8,000	.057	..	70	23	15	9.6	20	24
parsnips	100	½ c.	100	.120	..	40	60	76	1.7	2	65
peaches, dried	25	3 halves	1,000	.020	.050	0	12	19	0.6	1	77
peaches, white, raw	100	3 halves	100	.025	.065	6	10	19	0.2	1	50
peaches, yellow, canned	100	2 lg. halves	600	.024	.060	8	10	19	0.3	1	50
peaches, yellow, raw	100	1 lg.	1,000	.025	.065	9	10	19	0.3	1	50
peanut butter	34	2 T.	120	.210	.200	0	24	132	0.6	9	203
peanuts	20	18 nuts	70	.225	.110	0	15	73	0.4	5	110
pears	100	1 med.	17	.030	.060	4	15	18	0.3	0	60
peas, dried, cooked	20	½ c.	520	.142	.162	0	17	80	2.8	12	173
peas, fresh, cooked	100	½ c.	1,500	.390	.250	20	28	127	2	7	100
pecans	33	10 lg.	90	.100	.075	0	29	112	0.8	3	229

¶ Fortified by adding 30 milligrams of thiamin to a pint of molasses.
† 1 T. per muffin.

Food	Weight grams	Measure	Vitamins A units	Vitamins B$_1$ mg.	Vitamins B$_2$ mg.	Vitamins C mg.	Calcium mg.	Phosphorus mg.	Iron mg.	Protein grams	Calories
peppers, green	100	1 med.	700	.025	.025	125	12	28	0.4	1	25
peppers, pimiento	100	2 med.	500	..	..	200	6	26	0.4	1	23
persimmon, Japanese	150	1 lg.	1,600	..	..	40	22	21	0.2	2	116
pickles, cucumber	30	4 sm.	0	0	0	0	3	2	0.4	0	26
pie, apple ¶	100	1 lg. sl.	45	.018	.025	2	8	39	0.2	3	274
pie, apricot ¶	100	1 lg. sl.	3,700	.018	.050	3	11	45	0.4	3	274
pineapple, canned	100	2 sl.	25	.075	.025	10	8	26	0.1	0	65
pineapple, fresh	100	⅔ c.	30	.100	.025	38	8	26	0.2	0	57
pineapple juice, canned	240	1 c. or 8 oz.	60	.105	.060	25	20	69	0.2	0	129
plums	100	3 med.	130	.120	.056	5	20	27	0.5	1	80
potatoes, sweet	100	1 med.	3,600	.155	.150	25	19	45	0.9	3	130
potatoes, white, baked	100	1 med.	0	.200	.075	20	13	53	1.5	3	92
potatoes, white, raw	100	1 med.	0	.220	.075	33	13	53	1.5	3	90
potatoes, yam	100	1 med.	5,000	.180	.360	6	44	50	1.1	2	150
pork chops	113	4 oz. or 2 chops	0	.540	.312	0	16	180	2.5	14	340
pork chops, lean, cooked	113	4 oz.	0	.800	.225	0	18	180	5.7	23	240
pork sausage	113	6 links	0	.445	.300	0	7	116	1.6	10	402

prunes, dried	50	6 med.	1,500	.075	.325	4	27	57	1.5	2	173
pumpkin	100	½ c.	2,500	.056	.057	8	23	50	0.9	1	27
rabbit	113	4 oz.	0	.033	.072	0	20	201	0.6	20	192
radishes	100	15 lg.	0	.030	.054	25	21	29	0.9	1	22
raisins, seeded	30	¼ c.	30	.024	.050	0	20	44	0.9	1	105
raspberries, fresh	100	½ c.	260	.021	..	30	41	38	0.8	1	45
red-palm oil †	15	1 T.	50,000	0	0	0	0	0	0	0	100
rhubarb	100	½ c.	650	.024	.024	12	48	18	0.5	1	20
rice, brown, cooked	30	¾ c.	20	.190	.075	0	22	112	1.6	4	117
rice, polished, cooked	30	¾ c.	0	0	0	0	3	33	0.2	2	117
rice, puffed	10	½ c.	0	—	0	0	1	9	0.1	1	35
rutabagas	100	¾ c.	25	.075	.120	26	74	56	0.7	1	36
salsify (oysterplant)	100	2 roots	0	..	..	7	60	53	1.2	3	78
sardines, canned	50	4	200	.090	.370	0	170	195	1	13	103
sauerkraut	100	¾ c.	20	.008	..	5	45	29	0.3	2	28
salmon, canned ‡	113	4 oz.	250	.160	.100	0	26	250	1.2	22	203
scallops	113	4 oz.	..	..	..	3	115	338	3.0	16	81
shredded wheat	30	1 biscuit	0	.450	.130	0	15	141	1.5	3	108
shrimp	30	6 med.	25	.090	.065	2	32	78	0.9	8	27
soybeans, dried, cooked	100	½ c.	10	.525	.300	0	104	300	4	20	108

¶ ⅓ c. fruit in a slice.
† Imported from India and Africa for making soaps and candles.
‡ Supplies 400 units of vitamin D.

Food	Weight grams	Measure	Vitamins				Calcium mg.	Phosphorus mg.	Iron mg.	Protein grams	Calories
			A units	B_1 mg.	B_2 mg.	C mg.					
soybeans, dried, uncooked	100	½ c.	25	1.312	.750	0	260	750	10.1	51	270
spaghetti, white, cooked	100	¾ c.	0	.005	0	0	25	26	0.2	3	127
spaghetti, whole-wheat, cooked	100	¾ c.	0	.410	.160	0	45	423	5.1	4	127
spinach, cooked	100	½ c.	11,000	.090	.312	30	78	46	2.5	2	25
squash, Hubbard, cooked	100	½ c.	4,000	.050	.075	3	19	15	0.5	1	46
squash, summer, cooked	100	½ c.	1,000	.040	.050	3	18	15	0.3	1	15
steak, beef	113	4 oz.	40	.150	.250	0	12	222	3.4	21	156
strawberries, fresh	100	½ c.	100	.025	..	50	34	28	0.6	1	30
sugar, brown	12	1 T.	0	0	0	0	15	2	0.4	0	50
sugar, white, refined	12	1 T.	0	0	0	0	0	0	0	0	50
syrup, maple	25	1 T.	0	0	0	0	25	4	0.8	0	64
sweetbreads, beef	113	4 oz.	..	.330	.510	0	15	595	1.6	14	310
tangerine	100	2 med.	300	.120	.054	48	42	17	0.2	1	42
tapioca, cooked	30	½ c.	0	0	.040	0	7	30	0.5	—	118
tea, liquid	200	1 c.	0	0	0	0	0	0	0	0	0

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tomatoes, canned	100	½ c.	1,000	.075	.050	20	10	29	0.5	1	25
tomatoes, fresh	100	1 med.	1,500	.110	.050	25	11	29	0.4	1	20
tomato juice, canned	240	8 oz.	3,700	.195	.125	48	21	38	1	2	48
tongue, beef	113	4 oz.	..	.285	.264	0	8	200	6	16	226
turnips, cooked	100	½ c.	0	.062	.062	22	56	47	0.5	1	33
turnips, raw	100	1 med.	0	.065	.062	30	56	47	0.6	1	33
turnip tops, cooked	100	½ c.	11,000	.060	.450	130	347	49	3.4	2	28
tuna, canned	30	¼ c.	20	.030	..	0	10	99	0.5	9	64
turkey	113	4 oz.	0	.150	.240	0	30	420	4.5	24	153
veal chops	113	4 oz. or 2 chops	0	.227	.298	0	12	220	2.8	19	209
veal, cutlets	113	4 oz.	0	.160	.360	0	15	228	3	20	184
veal, leg, cooked	113	4 oz.	0	.120	.400	0	16	240	3	23	180
walnuts, black	30	¼ c.	40	.110	..	0	..	..	2	0	222
walnuts, English	30	¼ c.	30	.130	..	0	22	100	0.5	5	197
watercress	25	¾ c.	1,250	.030	.090	15	40	11	0.8	0	6
wheatena, cooked	20	½ c.	7	.290	.030	0	10	77	1.1	2	73
wheat germ	100	½ c.	400	2.600	.750	0	71	1,050	7.5	24	220
white fish	113	4 oz.	..	.120	..	0	25	263	0.4	22	150
yeast, brewers', dried	45	1 heaping T. or 90 tablets	0	4.056	2.175	0	49	945	7.9	20	80

INDEX

Absorption of food: advantage of slow, 13; completeness of, 88; decreased by niacin deficiency, 92; increased by pantothenic acid, 88
Acetone, 14
Acetone bodies, 141; detoxification of, 141
Acids: absorption of vitamins which are, 74; essential fatty, 35-39, breakdown of, 164, deficiencies of, 37-39, destruction of, prevented by vitamin E, 163, function of, 35, 37, in butter, 43, in lecithin, 78, relation to lecithin production, 41, sources of, 36, 43, 227, unsaturated, 216, 228; from fat, 14, 35-40; sources of, 36; *see also* Arachidonic; Citric; Folic; Hydrochloric; Lactic; Linoleic; Linolenic; Lipoic; Malic; PABA; Pangamic; Pantothenic; Pyruvic; Uric
Acne rosacea, 96
Addison's disease, 88
Adolescents: awkwardness of, 75; iodine requirements of, 197; iron requirements of, 191; menstrual problems of, 168; need for vitamin D of, 152-53; need for vitamin E of, 161; supplying vitamin D for, 154; *see also* Boys; Girls
Adrenal deficiency, 86
Adrenal exhaustion, 86
Adrenal glands, 14, 216; as source of pantothenic acid, 86; damage to, 86, 88; dietary needs of, 89; effect of coffee on, 17, of smoking on, 17, of vitamin-E deficiency on, 164; fat necessary for, 35, 36; hemorrhages in, 78; iodine in, 193; pigment deposited in, 164; vitamin E in, 160; water retention and hormone from, 217; *see also* Hormones, adrenal
Adrenalin, 216, 249
Adults: source of vitamin D for, 154; toxic dose of vitamin D for, 152; vitamin-A requirements for, 58; vitamin-D requirements for, 152
Advertising: influence of, 4-5
Age, old: appearance of, 85; atherosclerosis not disease of, 81; "brown atrophy" of, 164; relation of faulty diets to bone porosity of, 157, 159; visual difficulties of, 98-99; vitamin A for, 58; vitamin-C deficiency in, 138; vitamin-C requirements of, 136; *see also* Youth, retention of
Aging: early, 88; effect of, on vitamin-E requirements, 161; not a natural process, 253; relation of, to vitamin E, 165-66, to onset of menopause, 168, to protein intake, 26, 27
Agriculture: relation to social welfare, 213
Air swallowing, 175-76
Alameda County Hospital: heart study at, 80
Albumin: effect of inadequate protein on, 24, 30; importance of, in withdrawing wastes from cells, 214; production of, 219; relation of, to urine collection, 24
Alcohol: relation of, to B-vitamin requirements, 121, 122; relation of nutrition to consumption of, 239-42
Alcoholics Anonymous, 240, 241

Alcoholism, 239-42
Alertness: mental, 75, 103, 201
Alfalfa: protein content of, 212
Alkalinizing preparations, 190
Allergies: amounts of vitamin C given for, 144; vitamin C and, 140
Allergins, 132; list of, 140; protection against, 217; relation of vitamin C to, 140
Alpha tocopherol, *see* Vitamin E
Aluminum, 207
American Medical Association, 176; approval of iodized salt by, 196
Amino acids: essential, 28-30; formation of, 28; for repair, 27; from body tissues, 27; how made, 28; in proteins, 29-30; liberation of, during digestion, 26-27; mixtures of, 30; names of, 28; need for all together, 31; nitrogen content of, 26; nonessential, 28; number of, 26; obtaining adequacy of, 34; specific lacks of, 30; storage of, 27
Anemia: blackstrap given for, 188; caused by deficiency of, cobalt, 200, copper, 204, folic acid, 74-76, hydrochloric acid, 189, niacin, 92, PABA, 72, pantothenic acid, 85, protein, 21, 22, vitamin B_6, 82, 83, B_{12}, 74-76; caused by refining of foods, 188; definition of, 187; multiple causes of, 186; pernicious, 74, 75; symptoms of, 187
Animals: deficient in, biotin, 68-69, cobalt, 199, copper, 204, pantothenic acid, 85-86, vitamin B_2, 96, vitamin E, 163-65, 168-70; knowledge gained from, 124; relation of nutrition to alcohol consumption of, 239-40; salad oil for, 39; *see also* Tissue, animal
Ankles: enlarged, 167; swelling of, 24, 25, 39
Antibiotics, 142; harm of, 61, 70, 72; produced by soil molds, 210
Antibodies: effect of vitamin C on, 139; function of, 22; limitation of, 27; production of, 22, 27, 30, 219
Antienzymes. 51, 52
Antioxidants: in fats, 41, 43; value of, 42
Anus: inflammation of, 92
Appetite: destroyed by sugar, 60; effect of hot weather on, 17, of inositol on, 71; lack of, 10; relation of evening meal to, 16
Apricots: value in producing hemoglobin, 189; vitamin A in, 59
Arachidonic acid, 35
Arginine, 28, 30
Arsenic: as a trace mineral, 207; sprayed on foods, 210; vitamin C and, 140, 147
Arteries: cholesterol in walls of, 41; function of, 218; hardening of, 78; plugging of, with cholesterol, 81
Arteriosclerosis, 78
Arthritis, 139; amounts of vitamin C given for, 144, 147; calcium for, 179-80; relief of pain of, 178
Ascorbic acid, *see* Vitamin C
Aspirin, 144; destruction of vitamin C by, 141; toxicity of, 140-41
Asthma: vitamin C for, 147
Atabrine: as stressor agent, 68; jaundice caused by, 169; toxic effects of, 169
Atherosclerosis: death from, 81; incidence of, 78-79; medical treatment for, 80; peripheral, 172; relation to heart attacks, 78-81
Attractiveness: retention of, 32
Aureomycin, 142; destruction of valuable bacteria by, 61; produced by soil molds, 210
Australia: cobalt deficiencies in, 199; health studies in, 254
Automobile accidents: relation of, to low blood sugar, 17, 18, to vitamin-A deficiency, 49
Avidin: relation of, to biotin, 69
Avocados, 36; as source of fat, 43
Awkwardness: vitamin B_{12} and, 75

B vitamins: absence of single deficiencies of, 66; antistress, 67-68; caution against undervaluation of, 124-30, overestimating capsules of, 130; dangers of taking separately, 118; deficiencies of, multiple, 61-66, 87, produced by taking a single B vitamin, 100-01; diets high in, 80, 84; eczema and, 83; effects on, of rancidity, 42, of sleep, 62; effects of deficiency of, on hair, 72, 73, on intestinal tract, 71; excretion in urine, 65; from liver, 111; from natural foods, 107-16; gas indicating lack of, 65; given for heart conditions, 80; how to obtain, 107; ignorance concerning, 124; importance of yogurt in supplying, 61-62; in rice polish, 109; inability of body to store, 65; judging adequacy of intake of, by tongue, 63-65; labels of, misleading, 117; lack of, 186, as cause of anemia, 186, as cause of alcoholism, 240, from diabetic diets, 81; lesser known, 68-78; need for, all of, 83, by cells, 62-63, greater by men, 125, increased, 60; number of, 60; obtaining supply of, when traveling, 119; possible harm from, 117, 118; produced by intestinal bacteria, 61, 64; proportions of, in tissues, 117-18; relation of, to carbohydrate intake, 120, to coffee consumption, 121, to energy output, 120, to fatty-acid intake, 38, to liquid intake, 121-22, to mental alertness, 104, to size, 120, to stress, 120-26; requirements of, 119-23; sources of, 61, 227; supply of, meager, 60; synergistic action of, 66, 79, 100-01; synthetic *vs.* natural, 73; tablets of, 117-19; taking of, without calcium, 184; test of adequacy of intake of, 123; tongue changes indicating lack of, 64-65; value of, in correcting excessive menstruation, 191; variations in, 122, in deficiencies of, 63; yeast as source of, 102, 112; *see also* Biotin; Cholin; Folic acid; Niacin; PABA; Pantothenic acid; Vitamin B_1; B_2; B_6; B_{12}; B_{13}; B_{14}; B_{15}; Vitamins, antistress

Babies: egg white in formulas for, 69; nursing of, 255; oils for, 41

Bacon, 32, 42, 43; rancidity of drippings of, 42

Bacteria: debris of, 91; effect of vitamin C on, 139; harmful, destruction of, 75; intestinal, 35, 36, as source of B vitamins, 61, 67, destruction of, by antibiotics, 61, 70, food for, 45, growth of, related to vitamin-A intake, 51-53, harm to, by refined carbohydrates, 190, production of biotin by, 70, of folic acid by, 74, relation of, to tongue, 64, value of, in iron absorption, 189; lactic acid produced by, 110; living on gum tissue, 134; putrefactive, 23, 92; soil, importance of, 209; undesirable, on tongue, 64, 91

Balance: loss of sense of, 75

Baldness: possible relation of, to coffee intake, 121, to inositol intake, 71

Balfour, Lady Eve, 213

Bang's disease, 212

Basal metabolic rate, *see* Metabolic rate

Basal metabolism, *see* Metabolism

Baths: effect of, on vitamin-D production, 150

Beans, 26, 29, 32; as source of sugar, 46, of vitamin B_1, 101

Beauty, 192, 246-48

Bees: destruction of, 210; food of queen, 86; value of, 210

Beets, sugar: betaine in, 77

Behavior: problems of, 75

Benzedrene, 183

Beriberi, 63; heart disease as cause of death from, 124

Betaine, 79

Bile: importance of, in vitamin absorption, 40; production of, 219; role of, in absorption of vitamin D, 154, of vitamin E, 160; salts of, importance in absorption of fat, 40, of vitamin A, 56; stimulation of production of, 39

Biotin, 68-70; effect of antibiotics on production of, 70; relation of, to avidin, 69
Blackheads, 50
Blackouts, 10, 17, 18, 88, 89, 122
Blackstrap molasses, *see* Molasses, blackstrap
Bladder, urinary, 51, 52; function of, 216
Blindness, night, 48-49
Blood: amino acids in, 27; anemia among donors of, 187; B vitamins in, 61; clotting of, 24, 178-79; count, 187, 191; essential fatty acids in, 36, 37; fat carried in, 40; formation of, 27; iodine in, 193; mineral oil in, 40; white cells in, 23
Blood calcium: effect of, when high, 175, when extremely low, 177; fall of, prior to menstruation, 177; relation of, to cramps, 177, to convulsions, 177, to ovarian activity, 177, to spasms, 177, to tetany, 177
Blood cells: red, breakdown of, 190, deficiency of, in anemia, 187, life span of, 190, number of, 187, 191, role of copper in producing, 204, where made, 187; white, 22-23, action of, 23, vitamin A and, 54
Blood pressure: explanation of, 21; high, 256, absence of, 255, 256, decreased incidence of, 61, 173, vitamin-E content of usual diet for, 173, vitamin E used in treating, 172; importance of, to cell, 214; low, effect of diet on, 21, production of, 102, relation of, to protein intake, 21-22; normal, action of, 24; production of, 78
Blood sugar: average fasting level of, 10; drop in, caused by essential fatty-acid deficiency, 39; effect of rapid increase in, 13; importance of, 9-19; level of, factor in alcoholism, 240; quantity of, 219; relation of, to energy production, 9-10, 193; relation of levels of, to physiological symptoms, 10, 11, 16-19
Blood vessels: breaking of, 133; cholesterol deposits in walls of, 81; in cheeks, 96; in cornea, 96; walls of, 132, 133
Blue Mondays, 90, 91
Body: seen as a whole, 236; needs of, seen as a whole, 236
Boils, 50
Bone meal, 181; where to purchase, 119
Bone powder, 181; where to purchase, 119
Bones: abnormalities of, in babies, 153; as source of calcium, 181; base of, 20, 132; broken, 151, 156-59, 251, case histories of, 157-59, healing of, 135; calcium in, 175; continuous change of, 184-85; difference in mineralization of, 157; effect of age on, 157; fluorine in, *206*, *207*; fractures of, *151*; fragility of, in potassium deficiency, 201; infection of (osteomyelitis), 158; jaw, calcification of, as index of skeletal health, 156, changes of, during pyorrhea, 154, destruction of, around teeth, 134, importance of, in anchoring dentures, 154-56; long, storage of minerals in, 184; manganese in, 205; nutritional needs of, 158-59; osteomalacia of, 151; osteoporosis of, 151; pelvic, 20; powdered, 115; porosity of, 157, 184; precarious condition of, 184; relation of vitamin A to, 54, of vitamin C to, 133-34; structure of, excellent, 254, faulty, 256
Books on nutrition, 268
Boys: faulty posture of adolescent, 170; incidence of goiter among, 196
Brain: abnormal changes in, 163; cholesterol in, 41; energy source for, 10; lecithin in, 41; need for sugar by, 14; senile softening of, 81; structure of, 20; undersupply of oxygen to, 187-88
Brains: as source of cholin, 77; cooking of, 111; liquefied, 111; protein content of, 33

Bread: wheat germ, 108; white, as source of sugar, 46, emotional attitude toward, 6, protein content of, 32, refining of, as cause of anemia, 188, loss of magnesium from, 202, vitamin E in, 161; whole-grain, advantages of using, 60-61, value of, 60; whole wheat, 226, fortified with powdered bone, 181, freezing of, 107, homemade, 108, inositol in, 70, vitamin B_1 in, 101, vitamin E in, 162
Bread-making, 108, 263-64
Breadstuffs: former value of, 60
Breakfast: buffet, 16; importance of, 9-19; of coffee, 11; on Indiana farm, 16; relation of, to well-being during afternoon, 12; Scandinavian, 16; studies of, 11-18; suggestions for, 229; typical American, 11, 13
Breasts: normal development of, 166
Breath: shortness of, 102, 187
Brewers' yeast, *see* Yeast, brewers'
Bromfield, Louis, 213, 261-62
Bromide poisoning: jaundice caused by, 169; vitamin C and, 140; vitamin E helpful in, 169
Bromine, 207
Bronchial tubes, 52
Bruise: as danger signal, 138; relation of, to vitamin-C intake, 133; significance of, 133, 138, 148
Buerger's disease, 172
Bulk: sources of, 229
Burr, George O., 37
Businesses supplying nutritious foods, 267-68
Butter, 36; compared to margarine, 43; rancidity of, 42; storage of, 56; vitamin A in, 41, 48, 54; vitamin E in, 162
Buttermilk, 26, 226; calcium in, 185, absorption of, 182; churned, 180; cultured, calcium in, 180; protein content of, 32; value of, in iron absorption, 189

Cabbage, 131, 137
Cactus juice, 255-56
Cake mixes, 42
Calcium: absorption of, 74, 92, 149, 151, 152-53, 154, 158, 176, 181-82; amount of, in blood, 184, needed daily, 185; as protection to cells, 180; deficiency of, as cause of "indigestion," 176; diet supplemented with, 102; effect of, on dental health, 154-55, 180, on muscle tone, 180, on menopause symptoms, 153, 177, on relaxation, 175, 176, 178, 216; effect on, of candy, 182, of vitamin D, 149, 151-52; extent of deficiencies of, 152, 180; gluconate, 115, 183, absorption of, 181; importance of, in arresting pyorrhea, 155, 180, in healing, 135, in maintaining skeletal health, 180, in preventing decay, 180; lack of, and cataract formation, 179; lactate, 181, 183, used to relieve pain, 178; loss of, in fat-free diet, 182-83; losses of, from body, 152, 153, 177, 182-83; milk as only source of, 180; quantities of, supplied by milk, 185, used before delivery, 178; reaction with acids, 154; relation of, to air swallowing, 175-76, to cramps, 177, to nervousness, 154, 156, 175, 176, 177, to phosphorus, 180, 182, 183, to vitamin C, 132, 134, 148, 179, 180, to vitamin D, 149, 180; removal of, from bones, 184; retention of, 153, 183; salivary, 154; salts of, 181, 183, excretion of, 183, where to buy, 119, with trace minerals, 228; solubility of, 152, 176; sources of, 180-81, 228; storage of, 184; tablets of, for arthritis, 178, 180, for dental pain, 178, for headaches, 178, for itching of hives, 178, for pain in general, 178, for pain of childbirth, 178, 180, for relief of insomnia, 176, for slow clotting time, 179, where to buy, 119, with trace minerals, 228; use of, to decrease clotting time, 179, in relieving pain, 178; value of, in clotting

Calcium (Cont.)
blood, 178-79; *see also* Blood calcium
Calories: amount of, from refined foods, 60; derived from fat, 35; former *vs.* present consumption of, 60; relation of intake of, to need for B vitamins, 124
Cancer, 61, 256; expected increase in, 259; fear of, 168; freedom from, 255, 256; growth of, in biotin deficiency, 68; in babies, 259; per cent of, among African natives, 256; produced by arsenic, 210
Canker sores, 91
Capillary beds, 24
Capillaries: function of, 218-19
Carbohydrates: breakfast high in, 12; effect of, on metabolism, 13; meals high in, 12; refined, interference of, in absorbing iron, 189; relation of, to insulin shock, 14
Carbon dioxide, 24, 176
Carbuncles, 50
Carotene: absorption of, 55-56; conversion of, to vitamin A, 48; requirements of, 58; sources of, 48, 54, 55; *see also* Vitamin A
Carrots: carotene in, 54, absorption of, 56; carotene lacking from, 55
Cartilage, 132; relation of calcium to, 180, of vitamin C to, 180
Cataracts, 30; associated with vitamin-B_2 deficiency, 97, with calcium deficiency, 179; vitamin C and, 135
Cathartics: harm of, 23-24
Cattle: deficiency of, in cobalt, 199
Caution: need for, concerning B vitamins, 124-30
Celiac disease, 74
Cells: action of minerals in, 216-17; brain, energy for, 104; differentiation of, 220; effect of single B vitamins on, 66, of vitamin-A deficiency on, 51-53; energy production in, 216; enzymes in, 215-16; fatty acids for, 36, 37; how supplied, 214; importance of, 218; need for B vitamins, 62-63, for protein, 20-26; nerve, damage to, 75; nucleus of, 214; organs as servants to, 218-19; processes of, 214-18; repair of, 20, 27; selection of amino acid by, 27; selectivity of, 217; similarity of, 220; water balance of, 217; *see also* Blood cells
Cellulose, 55-56
Cereals, 29, 226; advantages of use of whole grain, 61; amino acids from, 30; as source of vitamin B_1, 101, of vitamin E, 162; cooked, 32, in milk, 109; former value of, 60; fortified with powdered bone, 181; germ of, 29; packaged, effect of eating, 11, 12; powdered milk added to, 109; prepared, 32, 33, lack of vitamin E in, 162; protein content of, 32; protein inadequacy of, 33; refined, as sources of sugar, 46, as cause of anemia, 188, causing magnesium loss, 202; wheat germ added to, 109; whole-grain, 109
Cerebral palsy, 255
Charm, 192
Cheerfulness, 10, 12; increase in, 93; relation to adequate nutrition, 254, to intake of B vitamins, 104
Cheese, 26; American, 32; as source of fat, 43; calcium lost in making of, 180; cheddar, 32; completeness of protein in, 29; cottage, 32; hydrogenated, 42; processed, 42; protein content of, 32; salty, for hot weather, 202; Swiss, 32; vitamin E in, 162
Chemicals: effect of, on vitamin-C requirement, 147; harmful, protection against, 217; relation of, to stress, 67; toxic effect of, 141
Chest: normal width of, 166
Chicken, 33
Childbirth: value of calcium during, 178, 180
Children: behavior problems of, 75; efficient energy production of, 243; excessive growth of, 166-67;

need of, for vitamin A, 58, for vitamin D, 150; normal blood for, 191; prevalence of faulty posture among, 170; stunted growth of, 75
Chin: trembling of, 84
China: yogurt used in, 62
Chlorine, 199, 200, 201; shift of, 217; *see also* Salt
Chlorophyll: magnesium as component of, 202
Chocolate bar: sugar in, 45
Cholesterol: amount of, obtained in diet, 41; circulation decreased by, 81; diets, high in, 80, restricting, 80; effect of cholin on, 41; homogenization of, 41; in arteries, 41; in blood, decrease of, 79, 80; in egg yolk, 80; plugging of arteries with, 81; produced by liver, 41, 219; relation of cholin to, 78-81; relation of, to dimness of vision, 81, to leg pain, 81, to leg cramps, 81; uses of, 41
Cholin: cirrhosis of liver and, 81; deficiency of, 77-78; effect of, on vitamin-A storage, 56; function of, 77-81; in lecithin, 78; in soy flour, 109; in treating heart disease, 79-81; lecithin as source of, 41; needed by adrenals, 89; proportion of, to other B vitamins, 118; relation of, to atherosclerosis, 78-81, to betaine, 77, to coronary disease, 41, to fat intake, 77, to methione, 77; value of, in calcium retention, 183
Chorea, 83
Chromosomes, 214
Cigarettes: effect of, on adrenals, 17, on blood sugar level, 19
Cincinnati: incidence of goiter in, 196
Circulation: relation of cholesterol deposits to, 81
Cirrhosis of liver, 81
Citric acid, 46, 182
Citrus juices: amount needed daily, 138; value of, in iron absorption, 189; *see also specific juices*
Clubs, 4H: need of, for nutritional instruction, 265-66
Cobalt: effect of adding of, to soil, 199; in the cell, 215, 217; lack of, as cause of anemia, 186; paralysis from lack of, 199
Coffee: effect of, on adrenals, 17, on blood sugar level, 17; loss of B vitamins from drinking of, 240-41; relation of intake of, to requirements of B vitamins, 121, 122
Cold creams, 41
Colds: amounts of vitamin C given for, 144; discomfort from, 194; effect of, on symptoms of vitamin-B_1 deficiency, 103; extreme, as stressor agent, 68; vitamin C and, 140
Colitis, 256; spastic, 177
Collagen, 131, 134, 135, 138, 139
Collapse, 62
Colloids, 215
Colon: effect of inadequate protein on, 23
Colostrum, 224
Columbia University, 62
Coma, 175
Conception: relation of essential fatty acids to, 39, of PABA intake to, 73
Confusion, mental, 191, 248
Constipation, 23, 119; caused by deficiency in, inositol, 71, niacin, 92, potassium, 201, vitamin B_1, 102, 103; definition of, 105; excessive fat as cause of, 182; relation of, to energy production, 105; spastic, 177
Convulsions, 151; from magnesium deficiency, 202, 203; relation of, to calcium deficiency, 177
Cookies, 108; of soy flour, 109
Cooking: hydrogenated fats for, 35; influence of, on carotene absorption, 56; losses during, 201, 202, 205, 222
Cooling system, 15
Copper: deficiency symptoms in animals, 204; lack of, as cause of ane-

Copper (Cont.)
mia, 186, 204; uses of, in the body, 204
Corn: inositol in, 70; sugar in, 45
Corned beef, 33
Cornmeal, 93
Cornstarch: inositol by-product of, 70
Coronary occlusion, 41, 124; development of, 81; incidence of, 78; studies of patients surviving attacks of, 79-81
Coronary thrombosis, 41, 124; development of, 81; incidence of, 78; studies of patients surviving attacks of, 79-81
Corpuscles, *see* Blood cells
Cortisone: effect of, 14; purpose of, 89, 216
Cosmetics, 41
Cottage cheese, *see* Cheese
Council on Pharmacy and Chemistry, 58
Cramps: abdominal, 202; back, 202; foot, 177; leg, 177, 202; menstrual, 177; muscular, 151, 177, 202
Cravings: for alcohol, 239-42; for nutrients, 246; for sweets, 225
Cream, 36; vitamin A in, 41, 48
Cretin, 192
Crying: relation of, to niacin deficiency, 92
Cysts, 52
Cytochrome, 188
Cytoplasm, 215

Dandruff, 51
Dates: sugar content of, 45
DDT, 147
Deaths: caused by, cold, 171, diabetes, 81, heart disease, 80, pellagra, 90, salt loss, 201; major cause of, 78; rate, 80, expected increase in, 259, fall of, in Denmark, 61, from heart disease, decrease in, 124; reduction of, 80
Debris, bacterial, 91
Deliciousness of food, 109; importance of, 4
Delinquency, child: absence of, in isolated groups, 255
Delusions: resulting from niacin deficiency, 92
Dental erosion, 154
Dentin, 155
Dentists, 87, 155, 156, 178
Dentures: fitting of, 155-56; number of people using, 159; relation of, to malnutrition, 155-56
Depression, mental, 104; caused by anemia, 191, by deficiency in biotin, 69-70, in niacin, 91, in vitamin B_1, 102, in vitamin B_6, 81; relation of, to blood sugar level, 10, 19; relief of, 153, 177
Dermatitis: caused by deficiency in, biotin, 68, inositol, 71; seborrheic, 82; *see also* Eczema
Development, mental, 193
Diabetes: cholesterol deposits and, 81; dangers of inadequate diet for, 81; death from, 81; decreased incidence of, 61, 173; gangrene of, 81, 172; high-fat diets for, 43; inadequacy of diet for, 81, 173; increased by refined foods, 204; treated with vitamin E, 173; zinc deficiency in, 204
Diarrhea: caused by, excessive salt intake, 202, niacin deficiency, 90, 92, vitamin-E deficiency, 163; in infants, 90, 93; loss of vitamin C during, 145; relation to psychological disturbances, 92; water retention and, 25
Dietary: basic foods for, 226-29; methods of improving, 234; rules in planning, 226; suggested menus for, 229-30
Dietetics: definition of, 3
Diets: American, 183; English, 61; fat-free, harm of, 40, 43, 56, 61, 99, 182, effect of, on calcium absorption, 182; for women with nosebleeds, 179; high-fat, harm of, 81; high-protein, 5; hospital, inadequacy of, 82; inadequate in vitamin B_1, 102; national, deficient in cholin, 81; "normal," 240; used

in treating atherosclerosis, 80; vegetable-juice, 110; vitamin-E content of, 173; without milk, danger of, 61
Digestion: abnormalities of, 91-92; amino acids freed by, 26-27; completeness of, 88; disturbances of, caused by deficiency of, potassium, 201, vitamin B_1, 104-05, prevention of, 234, tongue changes indication of, 65; effect of heat on, 176; efficiency of, indicated by tongue, 65; improved by pantothenic acid, 88; juices of, decreased flow of, 92, 104-05, 225; normal process of, 23; of proteins, 26-27; relation of protein intake to, 23-24
Digestive tract: abnormalities of, 91-92, 104; effect of psychological factors on, 225; function of, 219
Digitalis, 79
Dinners, 15; criticism of, 16, 19; suggestions for, 16, 230
Diphtheria: vitamin C and, 140
Disease: absence of, in isolated groups, 254-56; Addison's, 88; Bang's, 212; Buerger's, 172; Celiac, 74; decreased incidence of, 61; expected increase in, 259; "genetotrophic," 240; hoof-and-mouth, 212; investigations of, 256; of the whole body, 236; relation of vitamin A to, 52; resistance to, in relation to soil, 209, 212; self-production of, 224; sliding scale of, 224; treated with vitamin E, 172-73; vitamin C and childhood, 140, 146, needed during, 139, 140; water retention in, 25; *see also under specific diseases*
Dislikes for food: emotional, 6-7; overcoming, 4
Disposition: effect of calcium on, 175, 185; relation of adequate nutrition to, 254, of blood sugar level to, 10, 11
Divorces: relation of blood sugar to, 17
Dizziness: from anemia, 187; from niacin deficiency, 92; from salt deficiency, 202
Dogs: hair color and, 73
Dreamers, 213
Dressing, French, 48
Drinking: problem of, *see* Alcohol
Drowsiness, 16
Drugs, 132; detoxification of, 142, 147; effect of, on vitamin C, 140, on calcium retention, 183; relation of, to stress, 67, 68; toxicity of, 140-41; vitamin E as a detoxifying agent against, 169
Dusts: allergies to, vitamin C and, 140
Dystrophy, muscular: absence of, in isolated groups, 255; among families, 171; death from, 171; development of, under field conditions, 170; experimentally produced, 169; in humans, 170-72; incidence of, 170; lack of prevention of, 171-72.

Ears: eczema behind, 82; infections of, and vitamin C, 140; middle, effect of vitamin-A deficiency on, 52
Eating: emotional attitude toward, 6-7; habits, 16, 17; faulty habits, 74, relation to national problems, 17-19
Eczema: allergic, effect of vitamin C on, 140; caused by deficiency in, B_6, 82, 83, biotin, 68, fat, 37, 39, inositol, 71, PABA, 72-73, pantothenic acid, 85, 87, 88; corrected by B_6, 82, 83; induced by taking cheap B vitamins, 118; relation of egg white to, 69
Edema, 30, 39; in tongue, 64
Efficiency: during afternoon, relation of breakfast to, 12; effect of mid-meals on, 15; maximum production of, 19; relation of, to blood sugar level, 16-19
Eggs: "allergy" to, 69; as source of niacin, 90; best production method for, 235; completeness of

Eggs (Cont.)
protein in, 29; diets high in, 80; diets restricting, 80; effect of, in preventing afternoon fatigue, 12; fertile, 110; protein content of, 15, 32; value of, for breakfast, 11, in producing hemoglobin, 189, of fertility of, 235; vitamin A in, 54; vitamin-E content of, 162
Egg white, 29; avidin in, 69; cooking of, 69
Egg yolk, 29; as source of cholin, 77; cholesterol in, 80; cholin in, 80; diet high in fat from, 80; fat of, 36, 43, 80; lecithin in, 41, 80; vitamin A in, 41, 48
Elbows: roughness of, 50
Emotions: changed by niacin deficiency, 90-91; toward eating, 6-7
Encephalitis, 142
Encephalomalacia, 169
Endurance: relation of, to nutrition, 254, 255
Enemas: harm of, 24
Energy: effect of, on blood sugar, 14; efficient production of, 10, 11, 13; fat as source of, 35, 40; faulty production of, 10, 11; from fat alone, 14; improvement in, 89; increased by pantothenic acid, 88; output of, relation to need for B vitamins, 120; production of, 9-19, 242-43, in cell, 215-16, elimination as index of, 105; reason for wasting, 175; relation of, to heat, 243, to blood sugar level, 9-19, to vitamin B, 104, to vitamin-E intake, 163; role of vitamin C in, 141; sugar used for, 47
Enzymes: action of, 27; destruction of, 136; destruction of vitamin C by, 136; formation of, 27; how named, 215; in digestion of food, 22; in energy production, 22; inactivation of, 136; limitation of, 27, 65; magnesium necessary for, 202; production of, 220; reversible action of, 136; role of, in tooth decay, 154; structure of, 215; tablets of, when to take, 233, where to buy, 110; tongue changes and, 65; work of, 215; zinc necessary to, 204
Epilepsy, 83
Epinephrine, 216
Exercise: effect of, on blood sugar, 14, 17, on symptoms of vitamin-B_1 deficiency, 103; need for, 236; relation of, to vitamin requirement, 120
Exhaustion: as problem in alcoholism, 241; from salt deficiency, 201; relation of, to blood pressure, 21, to blood sugar, 10, 11, to vitamin-A deficiency, 50, to vitamin-B_1 deficiency, 103
Excitability: relation of, to vitamin-B_6 deficiency, 82, to magnesium deficiency, 202-03
Eyebrows: eczema in, 82
Eyelids: effect of vitamin-A deficiency on, 56
Eyes: bloodshot, 30, 96-99, correction of, 96-97, relation of, to amino-acid deficiencies, 97; burning of, 96, 99; cataracts in, 98; color of, 215; convulsive winking of, 84; effect of vitamin A on, 49-51, 95; formation of cataracts in, 30; infections of, 135, 163; inflammation of, 135; inositol deficiency and, 71; itching of, 96; lens of, vitamin C in, 135; nervous tics of, 84; "old-age" symptoms of, in children, 99; puffiness under, 24; relation of enzymes to, 98; symptoms of, during vitamin-B_2 deficiency, 95-97; vitamin C and infections of, 140; watering of, 96, 99; *see also* Cataracts
Eyestrain: resulting from vitamin-A deficiency, 50

Factor N, 240
Fad: yogurt as, 61
Faddism: harm of, 3-4
Faddists, 110
Fainting, 10, 18
"Falsies": need for, 166

Farming: by biological methods, 261-62, 266-67
Fat: absorption of, 40; absorption of vitamin A and, 56, of vitamin E, 160; acetone formed from, 14; advantages of, 40; amount needed, 43; antioxidants in, 41, 43; as cause of constipation, 182; effect of lack on gall bladder, 40; for dinner, 15; for lunch, 15; formation of, from sugar, 13, 14, from protein, 28; how carried, 77; hydrogenated, 36, cooking, 42; hydrogenation of, 170; importance in vitamin absorption, 40; in cell, 215; incomplete burning of, 141; liver storage of, 40; loss of, per week, 25; meals high in, 12; neutral, 40; oxidation of, 14; rancidity of, 36, 41-42; rapid formation of, 39; relation of intake to cholin, 41, 77-81, to vitamin-D absorption, 154; retention of, 31; role of, in calcium absorption, 182; satiety value of, 39; sources of, 43; types of, 35-36; used in forming amino acids, 28; uses of, 35; value of, 35-44, in bile production, 39, to health, 35-44; vegetable *vs.* animal, 36, 42-43
Fatigue, 100, 115, 119; absence of, 255; as a stressor agent, 67; as symptom of Addison's disease, 88; calcium deficiency as cause of, 175; caused by, anemia, 22, 187, 191, faulty enzyme production, 22, low blood pressure, 21-22, PABA deficiency, 72, too much sugar, 13, vitamin-B_1 deficiency, 102, 103; during hot weather, 201; effect of, on digestion, 226; in biotin deficiency, 69; of eyes, 49; prevention of, 9-19, 119, 122-23, 175; produced by deficiency of vitamin B_1, 102, 103; relation of, to blood sugar, 10, 11, 12, 17; relief from, 104; remedy for, 17; role of vitamin C in preventing, 141; value of calcium in recovering from, 180
Fatty acids, *see* Acids, essential fatty
Feet: cramps in, 81, 177; pain in, 81, 87, 88
Ferrous chloride, 190
Ferrous sulfate, 190
Fertility: relation of vitamin E to, 163, 165; restoration of, 165
Fertilizers, chemical, 235; disadvantages of, 209-10
Fevers: action of vitamin C on, 142, 143, 146-47
Figure: goiter-belt, 195
Fingernails: brittle, 187; ridging of, 187
Finns: calcium intake of, 185
Fish, 26, 29, 151; as source of fat, 43, of glycogen, 46, of niacin, 90, of vitamin E, 162; betaine in, 77; cod *vs.* halibut liver oils, 41, 55, 151, 227, capsules, when to take, 59; ocean, as source of iodine, 196; protein content of, 33; vitamin A in, 48, 55; vitamin D in, 149
Fissures: in tongue, 63
Flatulence, 23, 92, 105; tongue changes indicative of, 65
Florida: cobalt deficiencies in, 199
Flour, 29; cottonseed, 32, 34; "enriched," 107, 188; losses during refining, 107, 162; organically grown, 107; refining of, 86, 107, 109; soy, 32, 34, 107, 109, as source of antistress vitamins, 68, of protein, 32, nutrients in, 109, how to use, 109; white, 32; whole-grain, vitamin E in, 162; whole-wheat, 32, disadvantages of machine ground, 107, how to keep, 108, iron content of, 188, pastry, how to use, 108, stone-ground, where to buy, 107, 108, 119
Fluorine: effect of, on teeth, 205; excretion of, 206; toxicity of, 205
Folic acid, 74-75; anemia and, 74; dangers of giving alone, 75; effect of heat on, 74; hair color and, 74; lack of, as cause of anemia, 186; proportion of, to other B vitamins. 118; tongue changes

Folic acid (Cont.)
and, 64; tongue changes in deficiency of, 74
Food and Drug Administration, 154, 176, 233
Food and Nutrition Board: criticism of, 32; recommendations of, 31
Foods: advantages of unrefined, 254, 259; allergies from, effect of vitamin C on, 140; arsenic sprayed on, 210; dislikes of, how formed, 225; digestive breakdown of, 23; consumption of, relation to energy production, 9-19, to blood sugar level, 9-19; economy of, 231; habits concerning, how formed, 225; harmful bacteria in, 75; hydrogenated, 42; importance of flavor of, 4, of preparation of, 222, 223, of selection of, 222, 223; negative attitude toward, 5; nutritive value of, in relation to soil, 209-13; poisons carried into, 210; poor keeping qualities of, 210; protein content of, in relation to soil, 212; psychological attitude toward, 6-7, 225; refined, dangers of using, 201, keeping qualities of, 5, overemphasis on, 5; refining of, losses during, 235; salty, for hot weather, 202; standards for selecting, 4; supplements for, criticism of, 232-33, how to keep, 234, suggestions for, 230, 232, when to take, 230, why necessary, 234-35; unrefined, importance of, 226, nutrients in, 9; wholesome, definition of, 222, 234-35
Food shops, specialty, 267-68
Forehead: oiliness of skin of, 97
Forgetfulness, 104; as symptom of anemia, 188, 191, of niacin deficiency, 90; produced by deficiency of vitamin B_1, 102
Fowl, 26; as source of fat, 43; protein content of, 33
Fox, silver: hair color of, 73
Fructose, 45, 46; absorption of, 45
Fruit: and daily dietary, 227; as source of starch, 46, of sugar, 45, 46, of vitamin E, 162; availability of iron from, 189; citrus, 131; dried, effect on teeth, 45; effect of chopping on vitamin-C content of, 136; flavor of, in relation to soil, 210-11; for mid-meals, 15; of high nutritive value, production of, 212; "organically grown," 110, 211; signs of mineral deficiencies in, 200; sour, value in iron absorption, 189
Fruit juices: vitamin C in, 137; *see also* Grapefruit; Orange
Frying: loss of vitamin E from oils used in, 142
Fund-raising: campaigns for, 259
Fungi: in soil, importance of, 209

Gaining, 246
Galactose, 45
Gall bladder: emptying of, 39; lining of, 51
Gall stones: formation of, 40
Gangrene: diabetic, 81, 172; relation of cholesterol deposits to, 81
Gardening: by biological methods, 266-67
Gas: caused by, inadequate protein, 23, lack of B vitamins, 65, 113, niacin deficiency, 92, yeast, 93, 113; pain, 105; prevention or correction of, 233-34; tongue changes indication of, 65
Gelatin, 29; inadequacy of, 33
Genes, 214, 215, 216
Genitalia: eczema around, 88
Girls: incidence of goiter among, 196; normal blood count of adolescent, 191; normal hemoglobin of adolescent, 191
Glands, *see* Adrenal, Parathyroid, Pituitary, Sex, Thyroid
Glasses: for eyes, 98
Globulins: blood, 22
Glucose: absorption of, 45; conversion of, to energy, 104, 215; formation of, from protein, 28; in the cell, 215; sources of, 45, 46

Glutamic acid hydrochloride, 233, 244
Gluten, 109
Glycerin, 35, 40; obtained from fats, 46
Glycogen: acids as source of, 46-47; as source of sugar, 14, 45, 46; breakdown of, 216; damaged storage of, 77; digestion of, 46; formation of, 13; in the cell, 215; relation of insulin to formation of, 13
Glycoginases, 216
Goiter, 193-96; detection of, 193-94; disappearance of, 194; found in fish, 196; incidence of, 196; possible symptoms of, 194-95; prevention of, 195-97; surgical removal of, 196-97
Gonads, 249
Gout, 139; amounts of vitamin C given for, 144
Graciousness, 10, 213; importance of, on digestion, 226
Grades: improvement of, 75
Grains, 26, 60; advantages of using unrefined, 61, 173, 259; nutritive value of, in relation to soil, 212; refining of, 60
Grapefruit juice: vitamin C in, 136, 137
Grouchiness: effect of calcium on, 175
Growth: effect of lack of B vitamins on, 62, of thyroxin on, 193, of yeast on, 75, of vitamin B_{12} on, 75; retardation of, 37
Guavas, 131, 137
Gulf of Mexico, 196
Gums: bleeding of, 134; changes in during pyorrhea, 134, 155, during vitamin-C deficiency, 134; infections of, 134, 155; relation of niacin to, 134, of vitamin A to, 134; of vitamin C to, 134; swollen, 91

Hair: coarseness of, 86; color of, 215; color, loss of, 73, 74, 85, 86, 87, 89, 100, 121, 204; dullness of. 163; effect on, of deficiency, of biotin, 68, of fatty acid, 37, 39, of vitamin A, 51; falling of, 100, 163; growth of, 71; inositol deficiency and, 70-71; loss of, 72; relation of protein intake to, 20, 21; restoration of color of, 73, 89
Hamburger, 33
Hands: "liver spots" on, 165; trembling of, 84
Harvard University, 52; breakfast study made at, 12
Harvesting: effect on vitamin C, 136
Hatreds: as stressor agents, 67
Hay fever: vitamin C and, 140
Headaches: associated with iodine deficiency, 194; calcium used to relieve, 178; migraine, 178; production of, 103; relation of, to blood sugar, 10, 11, to deficiency of iodine, 194, of niacin, 92, of vitamin A, 49, of vitamin B_1, 106
Healing: after surgery, 135; of broken bones, 135; relation to vitamin-C intake, 134-35; speed of, 135
Health: absence of statistics on, 256, 258; achievement of, 220; appearances of, during stress, 68; biochemistry as study of, 221; definition of, 258; degrees of, 224; evidence of positive, 61; goal of, 237; influence of vitamin A on, 58; investigations of, 254-56; knowledge of, how gained, 124; money spent for, 258; more contagious than disease, 262; not a happenstance, 253; of the whole, 236; production of, 224; reasons for decline in, 260; requirements of, 25, 26; relation of, to health of cell, 218, to soil, 209-13; rewards of, 238, 239-53; vision of, 237, 253
Health-food stores, 109-10
Heart: abnormalities of, in biotin deficiency, 68, in vitamin-B_1 deficiency, 102, 103, 105; as source of vitamin B_1, 101; attacks, advantage of. 126, decrease in, 80, relation of, to atherosclerosis, 78-81,

Heart (Cont.)
to low blood sugar, 18; continuous work of, 62; damage to muscles of, 78; deficiency signs first appear in, 62; distress around, 69, 102; failure, from stress, 68; function of, 218; hemorrhages in, 78; irregular beat of, 201; muscles, damage to, 85, 201, degenerative changes in, 164, inositol concentrated in, 71, irritation of, 105; pain, relief of, 79; palpitations of, 10, 18, 102, 103, 187, 192; pigments deposited in, 164
Heart disease: absence of, 255, 256; caution concerning, 124-30; danger signals of, 128; deaths of leaders from, 126-28; decrease in deaths from, 124, in incidence of, 61, 173; desirable diets for, 80; experimental production of, 169; how produced, 124; inadequacy of diet for, 173; incidence among men, 125, among women, 125; medical treatment for, 79, 80; predicting deaths from, 125-26; production of, 102, 222-23; relation of stress to, 125; statistics concerning, 126; treatment of, 78-81; use of vitamin E in treating, 164, 172
Heat: cramps, 201, 202; effect of, on folic acid, 74; extreme, as stressor agent, 68; formation of, 215-16; relation of, to energy, 242-43
Heatstroke, 201-02
Hemoglobin, 187; anemia resulting from lack of, 187; foods stimulating production of, 189; percentage of, 187; purpose of, 187
Hemorrhages: as cause of anemia, 187; as nosebleed, 179; in bone marrow, 133; in heart muscles, 86; in intestines, 163; in kidneys,

Heredity: as factor in determining nutritional requirements, 240
Hips: changes in, 167-68; normal width of, 166
Histidine, 28, 30
Hives: calcium to relieve itching of, 178; vitamin C and, 140
Homosexuality: absence of in isolated communities, 255
Honey: sugars in, 45
Hoof-and-mouth disease, 212
Hormones: adrenal, 17, 35, 36, injections of, 88, relation to cholesterol, 41; formation from proteins, 24, 27; gonadotrophic, 249; inactivation of, 220; limitation of, 27; ovarian, possible results of deficiency of, 167, 168, relation of, to calcium utilization, 177; relation to cholesterol, 41; sex, 35, 164, 248, 249, effect of giving, on pigmentation, 164, 165, on prostate, 165, on testicles, 165, effect of nutritional deficiencies on, 249, fats necessary for, 35, 36, normal production of, 166, 248, 249, relation to cholesterol, 41, to excessive growth, 167, to fat, 249, to protein, 249; thyroid, as stressor agent, 68
Hospital: mental, improved diet in, 93
Hostility, 92
Hotcakes, 108; of soy flour, 109
Hot flashes: effect of calcium on, 153, of vitamin D on, 153
Howard, Sir Albert, 210, 213
Humans: experimental deficiencies produced in, of biotin, 69, vitamin B_1, 101-03, vitamin B_2, 196; pantothenic acid deficiency in, 86-87
Humus, 212, 213; importance of, 209-10
Hunger: relation of, to blood sugar, 10, 11, 16
Hunzas: health of, 255
Hydrochloric acid: added to tiger's milk, 115; destruction of vitamin C if lacking, 135; effect of lack of, 74, 92; faulty production of, 92, 103, 104; lack of, as cause of anemia, 189, in folic acid deficiency, 74; necessary for calcium

absorption, 158, 181, 182; neutralization of, by soda, 176; role of, in absorbing, calcium, 180-82, iron, 189, trace minerals, 207; supplements of, 233; tablets of, where to buy, 110, 119; tongue changes and, *65*
Hydrogen: added to fats, 42

Iceland: yogurt used in, 62
Idiot, 192
Illness: amounts of vitamin C given for, 144; calcium absorption during, 177; failure to produce, in animals, 212; price of, 257-59; probability of, 223; vitamin C needed during, 139, 140
Impetigo, 50
Indians: health of, 255-56
"Indigestion": from eating rapidly, 176; from potassium deficiency, 201; relation of, to protein intake, 23
Inefficiency: produced by high carbohydrate meals, 10-14
Infections: amounts of vitamin C given for, 144; as a form of stress, 67; of lungs, in biotin deficiency, 68; of eyes, 135; relation of, to antibodies, 22, to phagocytes, 23, to protein intake, 22, 23, to vitamin-A deficiency, 51-54; susceptibility to, 30; vitamin C needed during, 139, 140
Injuries: healing of, 134-35
Inositol, 70-72; amount recommended, 72; effect of, on appetite, 71; given in treatment of coronary disease, 79; in soy flour, 109; lecithin as source of, 41; proportion of, to other B vitamins, 118; relation of, to coronary disease, 41, to elimination, 71, to eyes, 71, to hair, 70-71, to heart, 71, to skin, 71; sources of, 70
Insanity, 202, 203; relation of, to niacin deficiency, 92; possible relation of magnesium to, 203
Insomnia: amount of calcium to relieve, 176; caused by deficiency, of calcium, 176-77, of niacin, 92, of potassium, 201, of magnesium, 203; correction of, 92, 203; effect of warm milk on, 176; relation of, to vitamin-B_6 deficiency, 81, 82, 203
*Insulin: function of, 216, 219; over*production of, 13-14, 241; production of, 13; relation of zinc to, 204, 217; shock, production of, 14, 17-19, self-induced, 14, symptoms of, 14
Internal organs, 20; displacement of, 23
Intestines: bacteria in, B vitamins produced by, 38, 61, destruction of, by antibiotics, 61, by sulfonamides, 61, fat necessary for, 35, 61, importance of yogurt in supplying, 61-62; destruction of vitamin C in, 136; "growling" of, 10; inflammation of, 88; large, faulty contractions of, 105, purpose of, 105; tract of, inflammation of, 92, slowed contractions of, 104, vitamin losses in, 42; walls of, hemorrhages in, 133, muscles of, 23
Invalids: from heart disease, 78; recovery of, 79
Iodine: amount in blood, 193; amount of, needed to correct goiter, 197; lack of, as cause of anemia, 186, as cause of goiter, 193-96, during adult life, 192, during pregnancy, 192; losses from body, 196; need of, by thyroid, 193; protein-bound, 193; requirements of, 197; sources of, 196; symptoms of lack of, 194-95; where found, 196
Iron: absorption of, 74, 92, 189; cause of deficiency in, 188; inorganic, absorption of, 190; harm of refined carbohydrates to, 189; lack of, as cause of anemia, 186; losses of, during refining, 188; type of anemia resulting from lack of, 187; requirements of, 191; sources of, 186, 188, 228; storage of, 190; where used in body, 188

Irritability: caused by calcium lack, 175, 177, by deficiency of vitamin B_1, 102, by magnesium deficiency, 202, 203; relation of, to blood sugar level, 10, 11, 17, 19, to niacin deficiency, 92, to vitamin-B_6 deficiency, 82, 85; relieved by calcium, 153, 175, by vitamin D, 153
Isolencine, 28, 30
Itch, divine, 262, 265

Jaundice, 169
Joints: hemorrhages in, 133
Jolliffe, Norman, 60, 101
Journals, medical, 40
Juice, *see* Cactus; Grapefruit; Orange; Tomato

Kidneys: absence of diseases of, 256; as source of antistress vitamins, 68, of cholin, 77, of folic acid, 74, of niacin, 90, of pantothenic acid, 86, of vitamin B_1, 101, of vitamin B_{12}, 74; completeness of protein in, 29; damaged, 37, 78, 86; disease of, decreased incidence of, 61; effect of vitamin-A deficiency on, 52; enlargement of, 201; fat as support of, 40; function of, 24, 27, 219; hemorrhages in, 78; how served, 111; stones of, formation of, 181; tubules of, 78; value of, in hemoglobin production, 189; vitamin A in, 54
Korean War, 256
Kwashiorkor, 256

Lactation, 37; need for iodine during, 197
Lactic acid, 45, 46, 154; accumulation of, 104; value of, in iron absorption, 189
Lactose: in powdered milk, 45; relation of, to vitamin B_2, 99; value of, 45, in calcium absorption, 182; *see also* Milk, sugar
Lamb: leg of, 33
Lapland: yogurt used in, 62
Lard: fatty acids in, 36; hydrogenation of, 42
Lassitude: caused by salt deficiency, 201; relation of, to blood sugar level, 10, 11, 17
Laxatives: effect of, 23; mineral oil, 40, 41
Lead poisoning: vitamin C and, 140, 144
Leaves: green, folic acid in, 74
Lecithin, 38; added to tiger's milk, 115; apparent function of, 41; composition of, 78; diets high in, 78, 80; production of, 219; relation to cholesterol, 41, 78
Legs: cramps in, 81, 141, 177, 202, caused by fat-free diet, 182, relief of, 153; decreased circulation in, 81; enlargement of, 167; pain in, 81, 103; swelling of, 24, 25, 39
Lens: vitamin C concentrated in, 135
Lentils: as source of sugar, 46, of vitamin B_1, 101; proteins in, 29
Lethargy: from toxic dose of vitamin D, 175
Leucorrhea: relation of, to vitamin-A deficiency, 52
Libido: relation of, to nutrition, 249
Life: expectancy, 222; sedentary, 60; span, 257, influence of royal jelly on, 86, of vitamin A on, 58, increase of, 86, 166, 174, relation of, to food preparation, 222, shortening of, 223
Ligaments, 132; relation of, to protein intake, 23
Light: effect of, on utilization of vitamin A, 49; ultraviolet, production of vitamin D by, 149-50
Limestone: as source of calcium, 181
Lind, James, 131
Lindberg, Mrs. Gladys, 203, 241, 273
Linoleic acid, 35, 36, 82; danger of deficiency of, 43; desirability of diets high in, 80; destruction of, prevented by vitamin E, 160; value of, in calcium retention, 182
Lipase, 39

Lipoic acid, 67
Lips: atrophy of, 95, 100; changes of, during vitamin-B_2 deficiency, 94-95; soreness of, 81; trembling of, 84
Liquids: sources of, 229
Little-leaf disease, 204
Liver, 226; advantage of raw, 111; as source of B vitamins, 61, 66, 68, of cholin, 77, of folic acid, 74, of glycogen, 46, of inositol, 70, of niacin, 90, of pantothenic acid, 77, 86, of vitamin B_2, 96, of vitamin B_6, 77, of vitamin B_{12}, 74; cholesterol production in, 41; cirrhosis of, 81; completeness of protein in, 29; concentrates of, 112; dead cells in, 77; desiccated, 90, 112, amount equivalent to fresh, 112, where to buy, 110, 119, tablets of, 112; diets high in, 80, restricting of, 80; effect of fat deposits on, 77; effect of, on calcium retention, 183; fatty degeneration of, 81; functions of, 219; how to prepare, 111; human, vitamin A in, 53; lecithin in, 41; manganese stored in, 205; nucleic acid in, 86; pathological changes in, 85; polar-bear, 55, toxicity of, 57; production of albumin by, 24, of cholesterol by, 41, of lecithin by, 78; protein content of, 33; raw, for pernicious anemia, 199; retention of fat in, 31, 77; role of, as detoxifying agent, 219; storage, 219, of glycogen in, 13, of iron in, 190, of protein in, 27, of vitamin A in, 57; value of, in producing hemoglobin, 189, 190, under conditions of stress, 68; vitamin A in, 48, 54, 55, 57; vitamin B_1 in, 101; vitamin E needed for normal function of, 169
Liver concentrate, 79
"Liver spots": effect of injection of sex hormones on, 165; possible relation of vitamin E to, 164-65; relation of age to, 165
Longevity: relation of vitamin A to, 54
Los Angeles County Hospital: heart study at, 79
Lugol's solution, 197
Lumbago, 106
Lunches, 15, 16, 19; suggestions for, 230, 231
Lungs: effect of vitamin-A deficiency on, 52; function of, 219; infections of, in biotin deficiency, 68; lining of, 51; phagocytes in, 23
"Lullaby pills," 177
Lymph: fat carried in, 40; nodes, 164; white blood cells in, 23
Lysine, 28, 33; effect of heat on, 29

Macaroni, 32; as source of sugar, 46; prepared for diabetics, 109; whole-wheat, 109
Magazines: on nutrition, 268-69
Magnesium, 202, 215, 217; losses of, during refining, 202; possible relationship of, to insanity, 203; source of, 202; symptoms of deficiency of, 202-03
Malic acid, 46
Malnutrition: definition of, 218; extent of, 224
Maltose, 46
Manganese, 205
Mannose, 45
Margarine, 36, 42; compared to butter, 43
Marrow, bone, 74, 75; abnormal changes in, 163; function of, 219; hemorrhages in, 133; production of blood cells in, 204, 219; storage of iron in, 190
Mayonnaise, 36, 42, 43
McCarrison, Sir Robert, 151
Meals: carbohydrate, 12, 14; criticism of American, 15-16, 19; high in protein, 12, in fat, 12; protein content of, 13; relation to well-being, 11-14; suggestions for American, 16
Meats: 26, 29, 137; availability of iron in, 189; as source of fat, 43,

Meats (Cont.)
of glycogen, 46; boned, 33; entire diet of, 254; fat of, 36; glandular, 29; muscle, 29, 54, 86; protein content of, 33; vitamin-E content of, 162
Medicine, purpose of practice of, 7
Memory: improvement of, 88, 104
Men: calorie intake of, 60; middle-age spread in, 167-68; requirements of vitamin A for, 58
Meningitis, 142, 146
Menopause, 165; danger of fat-free diet during, 182; menstrual problems of, 168; middle-age spread following, 167; need for iodine during, 197, for vitamin D during, 153, 154, for vitamin E during, 165; onset of, 165, 168; prevalence of anemia at, 191; recurrence of menstruation after, 168; relation of aging to onset of, 168; relation of "liver spots" to, 165; relief of abnormalities during, 177-78, 179; supplying vitamin D during, 154
Menstruation: anemia resulting from, 187; blood losses during, 191; cycle, early cessation of, 165; difficulties of, 39; effect of vitamin-A deficiency on, 52; excessive, 168; fall in blood calcium preceding, 177; headaches during, 194; iron requirements varying with, 191; irregular, 165, 168; recurrence after menopause, 168; relief of pain during, 177; scanty, 168
Mercury: in body, 207
Metabolic rate: description of, 242; established by breakfast, 229, 243; lowering of, 102-03, 193; normal range of, 193, 197; symptoms of low, 194-95
Metabolism: correction of low, 242; definition of, 218; effect of eating too little on, 246, of foods on, 13, 218, 243; importance of nutrients on, 243, of lack of iodine on, 193, 194, 243; tests for, 12, 242, 243
Methionine, 28, 30; as a detoxifying agent, 168, 169; relation to cholin, 77, to fat retention, 31
Methods of applying nutrition, 6
Mice: hair color of, 73
Mid-meals, 15; criticism of, 16; in afternoon, 16, 230; suggestions for, 230, 264
Milk, 26; amount needed to prevent vitamin-B_2 deficiency, 96; amount recommended, 226; as source of calcium, 176, 180, of vitamin B_2, 94; completeness of protein in, 29; cows', vitamin E content of, 162; effect of, in preventing afternoon fatigue, 12, of canning on, 29, of drying, 29; for mid-meals, 15; fortified, 11; homogenized, 54, 226; human, vitamin-E content of, 162; natural "pasteurization" of, 235; niacin lacking from, 90; nutrients harmed by pasteurization of, 235; of high nutritive value, production of, 212; powdered, 26, 34, as source of lactose, 45, calcium content of, 185, danger of, without fat, 183, protein content of, 32, use of, restricted on fat-free diet, 99; protein content of, 15, 32; psychological reasons for disliking, 7; skim, danger of taking without fat, 183; sour, bacteria in, 110; soy, 99; sugar, 45, as stressor agent, 68, relation to vitamin B_2, 99, value of, 61, value of, in aiding iron absorption, 189, *see also* Lactose; value to dietary, 34; variation in calcium content of, 185; vitamin C lacking from, 137; vitamin D in, 149; when disliked, 34; whole, vitamin A in, 54; *see also* Tiger's milk
Minerals: added to soil, 213; deficiencies of, 200-07; failure to dissolve, 105; importance of, 205-07; in fruits, 200; in soil, 209; in vegetables, 200; increased in foods, 212; quantity of, in relation to soil, 209; soils depleted of, 208-10; storage of, 219; trace,

200-07, absorption of, 207, deficiencies of, in soil, 208, 210, in cells, 215, 217, importance of, in energy production, 243, increasing food content of, 212, powder of, 228, sources of, 228, storage of, 219, tablets of, 228; *see also* Cobalt; Copper; Fluorine; Magnesium; Manganese; Zinc
Minnesota: incidence of goiter in, 196; University of, 37
Miscarriages: treated with vitamin E, 172
Molasses, blackstrap: amount available, 188; as source of calcium, 180, of inositol, 70, 71; danger of using too much, 188; iron content of, 188; losses in refining, 188; value of, 60
Molds: in soil, importance of, 209, 210
Moodiness: relation to blood sugar level, 10
Morale: increase in, 79
Morgan, Dr. Agnes Fay, 75
Morrison, Dr. Lester M., 79, 80
Mouth: cracks in corners of, 95, 100; soreness of, 81, 91
Mucus: membranes, effect of vitamin-A deficiency on, 51-52, health of, 51; normal secretion of, 51
Muffins, 108
Mumps, 146
Muscles, 20; atrophy of, 170, description of, 171; co-ordination of, 75-76; cramps in, 151; loss of elasticity from, 20, 27; of heart, damage to, 85; pain of, in biotin deficiency, 69; pigment deposited in, 164; protected by fat, 40; protein content of, 20; relation of vitamin E to normal development of, 170; relaxation of, 85, value of calcium in, 175, 176, 178, 180; spasms of, 75; tone of, importance of calcium in maintaining, 180, possible relation of vitamin-E deficiency to, 170
Mycorrhiza relationship, 209
Myohemoglobin, 188
Myxedema, 192

Nails, 20, 21, 51
National Research Council, 5, 131; attitude of, toward vitamin D, 149, 152; recommendations by, of iron, 191, of protein, 31, of seven basic foods, 160, of vitamin A, 54, of vitamin C, 136
Nausea: caused by deficiency, of biotin, 69, of salt, 202, of vitamin B_1, 103, 106, of vitamin B_6, 81; relation of, to blood sugar, 10
Neck: examination of, 193-94; fullness of, 193
Nephritis: production of, 78
Nephrosis: production of, 78
Nerves, 35; as cause of tenseness, 10, 11; cholesterol in, 41; copper necessary for, 204; damage to, and vitamin-B deficiency, 83; disorders of, 92, 202-03; effect of low blood sugar on, 10, 14; energy source for, 10, 106; injury of, in vitamin-E deficiency, 163, 164, 169, 170; protected by fat, 40; relaxation of, 85, 156; tics of, 84-85
Nervousness: caused by deficiency, of magnesium, 202-03, of niacin, 92, of potassium, 201, of vitamin A, 49, of vitamin B_6, 81, 82, 83, 85, by excessive fat, 182, by excessive thyroid, 192, 195; effect of calcium on, 153, of vitamin D on, 153; relation of, to calcium deficiency, 156, 182, to eating habits, 17, 83, 85, 203
Neuralgia, 106
Neuritis: degree of pain of, 106; forms of, 106; improved by pantothenic acid, 88; produced by vitamin-B_1 deficiency, 103; relation to vitamin-B_1 deficiency, 105-06
Niacin, 63, 90-95, 96; as "morale" vitamin, 91; coated tongue and, 91; digestive disturbances and, 92; lack of, as cause of anemia, 186; personality changes during deficiency of, 90-91; proportion of, to

Niacin (Cont.)
other B vitamins, 118; relation of, to health of gums, 134, to mental symptoms, 92-93, to tryptophane, 93; sources of, 90; symptoms of deficiency of, 90, 92
Niacin amide, 90; *see also* Niacin
Nickel: in body, 207
Nicotinic acid, 90; *see also* Niacin
Nitrogen, 28; in proteins, 26; in urine, 27
Nitroglycerin, 79
Noise: as stressor agent, 67; sensitiveness to, 102
Noodles, 32; as source of sugar, 46; whole-wheat, 109
Nose: cracks at base of, 97; eczema on, 82; lining of, 51; oiliness of skin of, 97
Nosebleed, 179
Nucleic acid, 214; in liver, 86, 214; in royal jelly, 86; in yeast, 86, 214
Nucleotidases, 216
Nucleotides, 214
Nucleus, 214
Numbness, 102
Nut butters, 36, 42; raw, 110
Nutrients: co-operation between, 217, 235-36; discarding of, 60; duties of, 217; in refined foods, 9; in unrefined foods, 9; increased need for, during stress, 67; number lacking simultaneously, 223-24; number of, 9; passage of, through walls, 200
Nutrition: aids in applying, 226; application of, 6, 261-73; as a means to an end, 237; attitudes of physicians toward, 7; deficiencies in, single *vs.* multiple, 9; definition of, 3; failure to see as a whole, 237; goal of, 237; improving your own, 263; information on, inaccuracy of, 5; need for application in hospitals, 271-72; need for instruction on, in medical school, 271; needs, hereditary variations of, 240; part-smartness in, 236-37; persons doing outstanding work in, 272-73; program, basic foods for, 226-29, rules in planning, 226; purpose of, 7; reason for personal application of, 237; reasons not applied, 3, 9, 224-25; relation of, to youthfulness, 250-53; rewards of, 3, 8, 237-39, 253; seen as a whole, 236-37; teaching of, in schools, 269-71; variations of requirements of, 231, 232; vision of, 237
Nuts: as source of fat, 43, of niacin, 90, of vitamin B_1, 101; fatty acids in, 36; for lunches, 111; for mid-meals, 111; protein in, 26, 29, 34; rancidity of, 42; salted, for hot weather, 202; unheated, 110

Oatmeal: as source of inositol, 70; vitamin E in, 162
Obesity, 17, 35; multiple causes of, 245-46
Ocean: as source of iodine, 196
Odor: of mouth, 91
Oil: corn, 36; cottonseed, 36, 162; effect of heat on, 162, of refining on, 41, 162, of soap on, 150, of water on, 150; fish-liver, 36, 227; for babies, 41; hydrogenation of, 162; lecithin in, 41, 78; mineral, harmful effects of, 40; olive, 36, 162; peanut, 162; of skin, conversion to vitamin D, 150, effect of vitamin-A deficiency on, 50, 53; quantity needed daily, 227; rancidity of, 41-42; salad, 36, 38; sources of, 227; soybean, 36, 78, 162, 173; unprocessed, 110, 227; vegetable, amounts recommended, 43, as sources of fatty acids, 36, 227, of vitamin E, 162, calories supplied by, 80; vitamin-E content of, 162, 173; volatile, 176
Orange juice, 144, 182, 227; canned, 137; frozen, 137, 227; sugar in, 137, 227; vitamin C in, 136, 137
Osteomalacia, 151-52
Osteomyelitis, 158
Osteoporosis, 151; extent of, 156-57
Ovaries: damage to, by iodine deficiency, 195; iodine in, 193
Overeating, 39

Overweight: fat deficiency as cause of, 39, 243-44
Ovulation, 37
Oxygen: carried by hemoglobin, 187, by enzymes, 215; combined with fat, 36; decreased need for, 172; effect on vitamin C, 136, of vitamin-E deficiency on, 163; increased need for, 163; lack of, as cause of heart fatalities, 172, as stress agent, 68; nutrients destroyed by, in body, 160

PABA, 72-74; as antigray-hair vitamin, 73; effect of, on eczema, 72-73; proportion of, to other B vitamins, 118; skin pigmentation and, 73; symptoms of deficiency of, 72
Pain: at dentist's, 178; freedom from, during delivery, 178; from swallowed air, 176; in legs, 81; of arthritis, 178; of headaches, 178; sensitiveness to, 163; use of calcium to relieve, 177
Palsy, 83, 85; cerebral, 255
Pancreas: effect of vitamin-A deficiency on, 52; overstimulation of, 14; role of, in insulin production, 13, 14; zinc in, 204
Pangamic acid, 67
Panic: resulting from biotin deficiency, 69
Pantothenic acid, 77, 252; absorption of food increased by, 88; digestion increased by, 88; energy increased by, 88; enzyme action of, 215, 216; need for, by adrenal glands, 89; painful feet and, 87; proportion of, to other B vitamins, 118; relation of, to Addison's disease, 88-89, to hair color, 73, 85-87; royal jelly as source of, 86; sources of, 86; symptoms of deficiency of, 85-86, 87; tongue changes in deficiency of, 64-65
Para amino benzoic acid, *see* PABA
Paralysis agitans, 83, 85
Parasite: nervous system as, 14
Parathyroid glands, 184
Paupers, 60
Peace: of mind, 236; sense of, 85
Peanut butter, 32; as source of fat, 43, of vitamin B_1, 101; hydrogenation of, 42
Peanuts: as source of pantothenic acid, 86; protein in, 29
Peas, 26, 29, 46, 101
Pellagra, 63, 90; anemia as symptom of, 74; as cause of death, 90, 93; relation of inadequate protein to, 93; symptoms of, 92; treated with yeast, 93
Penicillin, 142, 210
Peppers, bell, 131, 137
Persimmon: vitamin C in, 137
Personality, 192; changes in, 104, from deficiency of niacin, 90, of vitamin B_1, 102
Perspiration: loss of salt through, 201-02
Pesticides, 147
Pets, 39
Phagocytes, 23; action of, 23
Phenobarbital, 79
Phenylalanine, 28, 30
Phosphatase, 215
Phosphorus: as part of cell structure, 216; excretion of, 183-84; importance of, 180, in fat transportation, 77; interdependence of, with calcium and vitamin D, 184; sources of, 183, 228; storage of, 184, in cell, 215; role of, in calcium absorption, 182, in calcium retention, 183
Physicians, 83, 255; attitudes toward nutrition, 7; fatalistic, 80
Piecrust, packaged, 42
Pigment: bile, 190; composition of, 164; copper essential to formation of, 204; deposits of, 164-65; from too much fluorine, 205; relation of, to protein deficiency, 164, to vitamin E, 164-65
Pigmentation, 164-65; of skin, 88
Pimientos, 131, 137
Pimples, 50, 51
"Pink toothbrush": significance of, 133

Pituitary glands, 249; effect of vitamin-E deficiency on, 163; functions of, 219; vitamin E in, 160

Plants: copper deficiency in, 204; health produced in, 212; protein content of, 209, 210, 212; protein synthesis in, 26; relation of soil to mineral content of, 209, 210; vitamin content of, 209; zinc deficiency in, 204

Plasma, 24

Pleurisy: relief of pain of, 178

Pneumonia, virus, 142

Poison ivy, 140

Poison oak, 140

Poisoning, *see* Bromide; Lead

Poisons, 132; chemical, vitamin C and, 140; detoxification of, 139-42; protection against, 217; sprayed on food, 210, 212, 235, 261-62

Polio: absence of, in isolated groups, 255; annual increases of, 257; blood protein in, 25; child suffering from, 143; importance of vitamin C at onset of, 144; relation of, to blood sugar, 17; treated with vitamin C, 142-43; vitamin C and, 140

Pollens: allergies to, vitamin C and, 140

Polyneuritis, 252

Popcorn, 42; dispensers of, 42

Pork: as source of vitamin B_1, 101

Portland, Oregon: incidence of goiter in, 196

Postmen, 87

Posture: adequate nutrition and, 234; correction of faulty, 20-21; "internal," 23; possible relation of vitamin E to, 170; prevalence of faulty, 170; relation of, to protein intake, 20; value of calcium in maintaining, 180

Potassium, 199, 200-01; functions of, 216, 217; partial deficiency of, 201; value of, 200

Potato chips, 42, 162, 202

Potatoes: as a source of vitamin C, 137; sweet, sugar in, 45, vitamin A in, 54

Pregnancy: anemia during, 74; danger of fat-free diet during, 182; following onset of menopause, 168; requirements during, of iodine, 192, 197, of iron, 191, of fats, 38, of minerals, 151, of vitamin D, 153, 154, of vitamin E, 161; toxemia of, 30

Pressure, osmotic, 200

Price, Dr. Weston A., 254

Prostate: effect of vitamin-A deficiency on, 52; enlargement of, 165; infection of, 140

Proteins: adequacy of diets in, 31, 34; advantages of adequate intake, 21-26; amino acids in, 26; and blood, 24, 27; animal *vs.* vegetable, 29; as body structure, 26-34; as constituent of body tissue, 20-26; breakdown of, 216, in body, 219; breakfast high in, 12; completeness of, 29-30; content of, in diets, 56, in plants, in relation to soil, 209, 212; continuous need for, 27; deficiency of, as cause of anemia, 186, in low-income groups, 31, of long standing, 32, in relation to cholin, 77; definition of complete, 29; effect of, on antibody production, 22, on metabolism, 13, on phagocyte production, 23, on speed of digestion, 13; energy production from, 28, expense of, 13, 28; fate of excess, 27, 28; fatigue, effect on, 16; formation of, 26, 30; grams necessary to produce efficiency, 15; importance of, in healing, 135, in maintaining normal metabolic rate, 193, in urine collection, 24; in body, 26; incomplete, 29-30, 32-33, mixtures of, 29; intake of, adequacy of, 34, overestimation of, 5-6, 34, value of milk and, 34; judging adequacy of intake of, 20-21; meals rich in, 12, effect of, on absorption, 13, on metabolism, 13; measure of, 15; neutralization of acids and alkalis by, 24; nitrogen in, 26; number of, 26; quality of,

31; recommended amounts of, 31, 32; relation of, to calcium retention, 183, to digestion, 23-24, to energy production, 15, to fatigue, 16, to resistance to disease, 22-23; requirements of, 31, 32; sources of, 32, 227, 228-29; storage, 27, 28, 30; synthesis of, 26; variations of, 26
Protoplasm, 215
Psoriasis, 38
Psychiatrist, 245, 246, 255
Psychology of individual: effect of, 239, on digestion, 225-26; nutrition and, 70; relation of B-vitamin intake to tests of, 104; upsets of, as stressor agent, 67, in relation to blood sugar, 19
Puberty: need for calcium during, 177, for iodine during, 195
Pulse: relation of pyruvic acid to, 105; relation to vitamin-B_1 intake, 105
Puffed wheat, 33
Putrefaction: in intestine, 64
Pyorrhea: experimental production of, 134; pockets, 134; recovery from, 134; vitamin C and, 134; vitamin D and, 155
Pyridoxin, 186, *see also* Vitamin B_6
Pyruvic acid, 104, 105, 154

Rabbit, 33
Raisins: sugar content of, 45
Rats: hair color of, 73
Rectum: inflammation of, 92
Reducing: diets, 24; nutrition program for, 244; psychological factors preventing, 245-46; relation to metabolic rate, 243-44
Refining of foods: losses during, 61, 188, 201, 202, 204, 205, 223
Relaxation: feeling of, 85; muscular, 85
Research: lag in application of, 8
Resentments: as stressor agents, 67
Resistance to disease: relation of protein intake to, 22-23
Respiratory quotient, 39
Rheumatic fever, 30, 140
Rheumatism, 151
Rhinitis: vitamin C and, 140
Riboflavin: *see* Vitamin B_2
Rice, 32, 46, 162; brown, 109, 162; "converted," 109; flakes, 33; how treated, 109; polish, as source of B vitamins, 61, 109, of cholin, 77, of pantothenic acid, 77, 86, of vitamin B_1, 101, of vitamin B_6, 77; vitamin E in, 162
Roasts: protein content of, 33
Rose hips, 131
Royal jelly, 86
Rutin, 145

St. Vitus' dance, 83
Salt: iodized, 186, 227, amount used, 197, goiter resulting from failure to use, 196, value of, 195-96; foods supplying, 202; for normal persons, 202; increased need for, 201-02; symptoms of deficiency of, 201-02; table, 199; tablets, 202
Scallops, 46
Scalp: eczema in, 82
Scarlet fever, 142
Sciatica, 106
Sclerosis, multiple: absence of, in isolated groups, 255
Scrotum: eczema on, 88
Scurvy, 131, 136, 139
Seafoods: as source of iodine, 196
Selectivity: of cell, 217
Senility: relation of vitamin A to, 59
Seeds: as source of vitamin B_1, 101
Sex: increased interest in, 39, 79, 248-50; loss of interest in, 166, 205; secondary characteristics of, 166
Sex glands, 216, 248, 249; pathological changes in, 85; vigor of, 249-50, relation of vitamin E to, 161, retention of, 174; vitamin E in, 160
Shingles, 106
Shangri-La, 213
Sheep: cobalt deficiency in, 199
Shrimps, 33
Shute, Dr. Evan, 172, 173

Sickness: leading cause of, 78; expectancy of, 222, 259
Seizures: epileptic, 83
Silver: in body, 207
Sinuses: effect of vitamin-A deficiency on, 52; lining of, 51; vitamin C for infections for, 140
Size: relation to B-vitamin requirements, 120
Skin, 20; blood vessels in outer layer of, 96; dryness of, 50, 69; effect on, of deficiency, of biotin, 69, of fatty acid, 37-38, 39, of vitamin A, 50-51, 53-54; formation of vitamin D on, 150; lack of pigmentation of, 73, 88; lesions of, associated with vitamin-E deficiency, 163; oiliness of, 97; pigmentation of, 88; vitamin-B_6 needs of, 81-83; wrinkled, 89, relation of protein intake to wrinkles in, 27; *see also* Eczema
Skulls, 157
Sleep: amount needed in relation to vitamin intake, 120; calcium tablets for, 176; drugs needed to induce, 85; increased soundness of, 82, 85; need for, 236
Sluggishness, 194, 195
Smog, 147, 150, 235
Smoke, 147
Smoking, 147
Soap: as cause of constipation, 182; formation of, in intestine, 182; use of, in relation to vitamin-D formation, 150
Soda: harmful effect of, 176, 182
Sodium, 199, 200, 201; functions of, 217; relation of, to water retention, 217; *see also* Salt
Sodium chloride, 199; *see also* Salt
Soil: analysis of, 208; cobalt added to, 199; deficiencies of, transferred to animals and plants, 200, in copper, 204, in iodine, 208, in minerals, 208, 210, in zinc, 204; importance of bacteria in, 209, of humus in, 209, of fungi in, 209, 210, of molds in, 209, 210; mineral depletion of, 210; minerals in, 199, 200, optimum amounts of, 210, 212; poisons sprayed on, 210; relation of, to flavor of foods, 207-08, 210-11; virgin American, 209
Soybeans, 26; as source of calcium, 180, of pantothenic acid, 86, of vitamin B_1, 101; completeness of proteins in, 29; protein content of, 32; salted, 202; *see also* Flour, soy; Oil, soybean
Spaghetti, 109
Spasms: in intestine, 177; muscular, 177
Sperm: mobility of, 31; number of, 161
Spinal cord: changes in, 76
Spleen, 164; function of, 219; storage of iron in, 190
Sprays, poison, 210
Sprue, 74
Starch: as source of hidden sugar, 46; conversion of, to sugar, 13; fat formed from, 37; glycogen as form of, 13; in American diet, 13; overeating of, 39
Statistics: absence of, concerning health, 256; inadequacy of, 256-58; of causes of rejections, 256; morbidity, 257; vital, 173
Sterility: relation of arginine to, 30, of vitamin E to, 163; resulting from manganese deficiency, 205
Sties, 50
Stomach: burning of, by vitamin C, 145; decreased contractions of, 104; inflammation of, 88; muscular walls of, 23, sagging of, 23
Stools: color of, 190; yogurt bacteria in, 62
Strawberries, 131, 137
Strength: relation of vitamin E to, 163; test for, under stress, 68
Streptomycin, 61, 210
Stress: definition of, 67-68; effect of liver during, 68; examples of, 67; increased nutritional requirements during, 68, 120, 223
Sucrose, 45, 46; effect of insulin production on, 13-14

Sugar, 5, 45, 46, 60; absorption of, 46; advantages of slow absorption of, 15; as causative factor in dental erosion, 154, in tooth decay, 154, as source of fat, 13, 37, 47; cheapness of, 13; consumption of, 60; curtailing intake of, 46; digestion of, 46; effect of excessive amounts of, 13-19; emotional attitudes toward, 6; fatty acids made from, 35, 39; formation of, from glycogen, 14, 46, by action of cortisone, 89; granulated, amount in foods, 44-45; hidden sources of, 44-45; purpose of, 47; "raw," 46; sources of, 13, 44-48; starch as source of, 46; *see also* Blood sugar
Suicide, 69-70, 223
Sulfanilamide, 72
Sulfonamides, 61
Sulfur: toxicity of, 209
Sunshine: as source of vitamin D, 150, 151-52
Sunstroke, 201
Suppers, 108; suggestions for, 230, 231
Supplements, *see* Foods, supplements; Vitamins, supplements
Supplies: freshness of, 109; where purchased, 109-10, 119
Surgery: as stressor agent, 67; preparation for, 135
Suspicion, 92
"Swayback" disease, 204
Sweetbreads: protein in, 33; vitamin A in, 54
Sweets: craving for, 10, 17; distaste for, 10; former scarcity of, 60
Swiss: calcium intake of, 185
Sydenstricker, Dr. V. P., 69
Syrup, maple: sugar in, 46

Taste buds: abnormalities in, 63-64, 65, 94
Tea, 121
Teeth: decay of, 188, causes of, 154, 206; free from decay, 254; loss of, 136, from pyorrhea, 134; relation of, to blood sugar levels, 17, to fluorine, 205, to vitamin A, 54, to vitamin C, 132, 133, to vitamin D, 154-55; uncrowded, 254
Temperature: maintenance of body, 40
Tension: possible relation to vitamin-B_6 deficiency, 85; resulting from niacin deficiency, 92
Testicles, 249; atrophy of, 165, 166; degeneration of, 31; effect of removal of, 167; pigments deposited in, 164
Testosterone, 165, 249
Tetany, 151, 177
Thinking: clarity of, 10; confused, 10, 17, 104, 192; improvement in ability of 88, in clarity of, 104; relation of blood sugar to, 10, 17, 19
Threonine, 28, 33
Throat: lining of, 51
Thyroid: relation of, to calcium loss, 183
Thyroid glands, 216; detection of enlarged, 193-94; effect of vitamin-E deficiency on, 163; enlargement of, 193-94; location of, 193; need of, for iodine, 193-94; pathological changes in, 86; storage of iodine in, 193, 197, of manganese in, 205; tablets for, symptoms of overdosage, 195, taking of, 195, 242; *see also* Hormones, thyroid
Thyroxin, 193, 216; iodine content of, 217
Tics, 84
Tiger's milk, 72; recipe for, 114; variations of, 115; soy flour in, 109
Tin: as trace mineral, 207
Tissue: animal, protein in, 26, replacement of, 27; body, effect of cortisone on, 89; connective, importance of, 132, protective role of, 132, relation of, to healing, 134; fluid of, 214; nutrients in fluid of, 217; puffy, 24; scar, relation of vitamin C to, 134-35, strength of, 135
Tomato juice, 131, 137

Tongue: beefy, 64-65, 87, from pantothenic-acid deficiency, 87; changes in, from deficiency of B vitamins, 63-65, of folic acid, 74, of niacin, 91, of vitamin B_6, 81, of vitamin B_{12}, 74, 75; coated, 91; coating of, 64; magenta, 94; protein content of, 33; "strawberry tipped," 91; relation of soreness of, to anemia, 186
Tonsils: vitamin C in infections of, 140
Toxic substances: detoxification of, 139-42
Toxins: action of vitamin C on, 143; protection against, 217
Tranquillity: sense of, 85
Tremors: relation of, to deficiency of magnesium, 202, 203, of vitamin B_6, 83, 84-85, of vitamin E, 163
Trench mouth, 91
Tryptophane, 28, 30, 31; relation of niacin to, 93
Tuberculosis: absence of, in isolated groups, 255; vitamin C and, 140
Tubules: kidney, 78
Tuna, 33
Turkey, 33; yogurt eaten in, 62
Twitches, 151

Ulcers: absence of, in isolated groups, 255; corneal, 50, 53; dangers of high-fat diets for, 81; duodenal, 86, 88; gangrenous, 172; hemorrhaging of, 187; high-fat diets for, 43; in mouth, 91; stomach, 78, 86; vitamin C and, 139
Unco-operativeness, 90, 102
Urea, 24
Uric acid, 24
Urine: B vitamins excreted in, 61, 65; collection of, 24, 30; color of, 190; fluorine excreted in, 206; nitrogen in, 27; salt lost in, 202
Uterus: pigmentation of, 164

Vagina: inflammation of, 92
Veal: chops, 33; cutlets, 33; stew, 33
Vegetables: absorption of carotene from, 55-56, of vitamin E from, 162; amount needed daily, 227; as source of carotene, 48, 54-57, of starch, 46, of sugar, 45, 46, of vitamin C, 137, of vitamin E, 161; effect on, of boiling, 137, of chopping, 136, of growing conditions, 55, 212, of peeling, 136, of soaking, 137; juices of, 56; leafy, iron in, 189, vitamin B_2 in, 94; "organically grown," 110, 211; proteins in, 29-30, 33, 34; relation of soil to nutritive value of, 218-21, to flavor of, 207-08, 210-11; signs of mineral deficiency in, 200
Vegetarians, 34; diet for, 254
Veins: function of, 218
Vigor: influence of vitamin A on, 58; retention of, 32
Vincent's disease, 91
Violence: relation of, to niacin deficiency, 92
Viosterol, 149, 227
Virus, 132, 139, 143
Vision: day, 48, 49; dim, relation of, to deficiency, of cholin, 81, of vitamin A, 48-51, 53, of vitamin B_2, 95, 98-99; failing, 98; night, 48-49
Visual purple, 48
Vitality: lack of, 187
Vitamin A: absorption of, 40; added to margarine, 43; advantages of storage of, 57, 58-59; amounts used to correct deficiencies of, 57-58; animal fats as sources of, 41; correcting deficiencies of, 53; deficiencies of, 48; destruction of, by rancid fats, 42; functions of, 48-53; how formed, 48; in fish-liver oils, 41, 55; influence on, of food handling, 59, of soil, 59, of vitamin E, 56, 59, 160, 163; mineral oil and, 40; recommended daily allowances, 54, 58-59; relation of, to bacterial growth, 51-53, to bones, 54, to gums, 134, to infections, 52-53, to mucous membrane, 51-53, to skin, 50-51, to teeth, 54, to vision, 48-50, to warts, 53,

sources of, 54-55, 226, 227; storage of, 56, 57; variations in requirements of, 58
Vitamin-A acetate, 59
Vitamin B_1: as part of enzymes, 215; cheapness of, 94, 100; danger of taking alone, 100-01; deficiency of, in humans, 101-03; "enriching" foods with, 100; importance in maintaining metabolic rate, 193; proportion of, to other B vitamins, 118; recovery from deficiency of, 103-04; relation of, to beriberi, 63, to constipation, 105, to digestive disturbances, 104, to energy production, 104, 105, 106, to heart abnormalities, 105, to mental alertness, 104, to neuritis, 105; sources of, 101; tablets of, 117, 118
Vitamin B, *see below and also* B vitamins
Vitamin B_2: cheapness of, 94; enzymatic action of, 215; extent of deficiencies of, 94, 98; need for, increased by vitamin B_1, 100-01; proportion of, to other B vitamins, 118; relation of deficiency of, to eye symptoms, 95-96, 98, 99, 100, to formation of blood vessels, 96, to lip changes, 95, to tongue changes, 64, to milk sugar intake, 99; sources of, 94; tablets of, 117, 118
Vitamin B_6, 77, 81-85; deficiencies of, 81-82; eczema relieved by, 83, from deficiency of, 82, 83; epilepsy treated with, 83; possible relation of, to magnesium, 203; proportion of, to other B vitamins, 118; relation of, to niacin formation, 93; royal jelly as source of, 86; sources of, 81; symptoms of deficiency of, 81, 82; tablets of, 117, 118; tics relieved by, 84; tremors relieved by, 83, 84-85
Vitamin B_{12}: amount needed daily, 118; effect of, on growth, 75; cobalt as part of, 199; relation of, to anemia, 74, 186; sources of, 74; tongue changes from deficiency of, 64, 74, 75
Vitamin B_{13}, 67
Vitamin B_{14}, 67
Vitamin B_{15}, 67
Vitamin-B complex, 67; *see also* B vitamins
Vitamin C: action of, as part of enzymes, 215, as a detoxifying agent, 139; amount given before surgery, 135; amount needed during illnesses, 139; as a miracle drug, 143; bruise as deficiency sign of, 133; comfort value of, 145-46; destruction of, 136-37, 141, 145; effect of taking too much, 145, 148; effect of, on allergies, 140, 142, on chemical poisoning, 140, 142, 147, on fevers, 142, 147, on poison ivy, 140, on poison oak, 140, on toxic doses of vitamin A, 57; effect on, of drugs, 140, of freezing, 137, of handling foods, 137, of vitamin D, 152; excretion of, 135, 136, 143, 145; factors increasing need for, 142; functions of, 131; harmlessness of massive doses of, 142; how to dissolve tablets of, 145; illnesses influenced by intake of, 139-40; injections of, 145; lack of, as cause of anemia, 186; losses of, during diseases, 139, during infections, 139; meeting needs for, 138, 148; possible action of, 143; possible destruction of, by iron salts, 190; relation of calcium to, 132, 141, 148, 179, of copper to, 204; relation of, to bones, 133-34, to developing teeth, 133, to gums, 133, to healing, 134-35, to health of eyes, 135, to preventing fatigue, 141, to scar tissue, 134-35; requirements of, 135-36; saturation of, 135, 139; sources of, 131, 136-37, 227; use of, in treating diseases, 142-47, in treating mumps, 146; use of massive doses of, 142, 143, 144, 145, 147; variations in requirements of, 147-48

Vitamin D: absorption of, 40; adults' need for, 151-52; advantages of taking, 154-59; cheapest source of, 154; children's need for, 150; destruction of, by rancid fat, 42; effect of, on absorption of bile, 154, on calcium, 142, 152, 153, on absorption of fat, 154, on menopause symptoms, 153, of toxic dose of, 175; effect of baths on production of, 150, of soap on, 150; formation of, by ultraviolet light, 149; importance of, in healing of bones, 135, in preventing dental erosion, 154-55, in preventing tooth decay, 155; interdependence with calcium and phosphorus, 184; massive doses of, 153-54; mineral oil and, 40; production of deficiency of, 40; quantity of, to aid calcium absorption, 178, 179, used to advantage, 153; relation of cholesterol to, 41; scarcity of, in foods, 149, 152; sources of, 41, 149-50, 227; storage of, 153; symptoms of deficiency of, 152; tablets of, where to buy, 119; toxicity of, 152, 154; value of, 149; when to take, 154

Vitamin E: absorption of, 40, 160; as an enzyme, 160; as a detoxifying agent, 168; concentrates of, from oils, 162-63; daily intake of, 160; destruction of, by rancid fat, 42; 163; effect on, of generous amounts, 166, of heat, 162, of rancidity, 162, 163; influence on vitamin A, 56, 57; limitations of synthetic, 163; milligrams of, relation to units, 163; mineral oil and, 40; multiple functions of, 160; muscular dystrophy as deficiency of, in animals, 169; needs of, during growth, 161, during menopause, 161, during pregnancy, 161; non-toxicity of, 161; quantities in foods, 161-62; pigmentation resulting from deficiency of, 164-65; possible relation of deficiency of, to "liver spots," 164-65, to muscular dystrophy in humans, 170-76, to secondary sex characteristics, 166, to sexual disturbances, 163; relation of, to aging, 168, to heart disease, 169, to liver function, 169, to loss of young, 163, to menstruation, 165, 168, to onset of menopause, 168, to oxygen needs, 163, to sterility, 163, to strength, 163, to vigor, 163, to vitamin A, 163; sources of, 41, 161-62, 228; storage of, 160, 161; synthetic, 163; value of, in correcting excessive menstruation, 191

Vitamin K: absorption of, 40; destruction of, by rancid fat, 42; in vegetable oils, 41; mineral oil and, 40; sources of, 228; value of, in clotting blood, 179

Vitamin P, 145, 228

Vitamins: antifatigue, 67-68; antigray hair, 73; antistress, 67-68, 118; antitoxic, 67-68; as supplements, faulty attitude toward, 5; definition of, 48; destruction of, 74, 104-05; quantity of, in relation to soil, 209; storage of, 77

Vivacity, 192, 247-48

Vomiting: caused by deficiency, of vitamin B_1, 103, 106, of vitamin B_6, 81, of salt, 202; relation of, to blood sugar level, 10

Waffles: wheat germ, 108, 264

Walking: difficulty in, 75; relation of, to vitamin-B_6 deficiency, 82, 85

Walsh, Dr. Michael, 181, 255, 275

Warmth: production of, 15, 243

Warts, 53-54

Waste products, 27; nitrogen in, 27

Water: accumulation of, in tissues, 24, 25; drinking of, relation to heatstroke, 202; excessive drinking of, 37; fluoridation of, 206-07; losses of, 25; solubility of B vitamins in, 65; relation of, to B-vitamin requirements, 121-22, to

sodium retention, 217; retention of, during diseases, 24, 25
Waterlogging, 24-25; from fat deficiency, 39
Weakness: relation of, to blood sugar level, 10, 18, to vitamin-B_6 deficiency, 82; resulting from anemia, 187
Well-being: increase in, 79, 93, 122-23; relation of, to blood sugar level, 11, 12
Weight: gaining of, 81, 195, 218; losses of, 25, 244-46
Wheat germ: as a cereal, 109; as source of B vitamins, 61, 66, of cholin, 77, of factor N_1, 240, of inositol, 70, of iron, 188, of niacin, 90, of pantothenic acid, 77, 86, of vitamin B_1, 101, of vitamin B_6, 77; effect of, on growth, 75, on calcium retention, 183; how to use, 108, 264; and middlings, 162; protein content of, 32, 34; rancidity of, 42; refrigeration of, 108; toasting of, 108; value of, in breadstuffs, 124, 164, in correcting anemia, 190; vitamin E in, 162
Whey: powdered, 45; danger of using, 99
Whistle marks, 95
Whiteheads, 50, 97
Wholesomeness: of food, 222, 234; description of, 234-35; difficulty in obtaining, 234
Williams, Dr. Roger J., 62, 239
Women: calorie intake of, 60; middle-age spread in, 167; Mohammedan, 151; nervous, 176; normal blood count of, 191; normal hemoglobin of, 191
Work: capacity for, 103, 104; increased need for pantothenic acid during physical, 87
World War I, 60, 134
World War II: bone abnormalities during, 153; improved nutrition during, 61; national loaf used during, 162; pantothenic-acid deficiency during, 87; rose hips used during, 131; statistics of, compared to Korean War, 256; studies in defense plants during, 131
Worry: effect of, on digestion, 226; as symptom of niacin deficiency, 90
Wounds, 134, 135
Wrinkles: above mouth, 95; disappearance of, 89, in lips, 94; in skin, 89; relation of, to protein intake, 27, to vitamin-C deficiency, 136
Wulzen factor, 43

X-rays: as stressor agent, 68; dental, 156; of bones, 158

Yeast: brewers', added to infants' formula, 69, 90; as cheapest source of B vitamins, 112; as a "reducing" food, 112-13; as source of antistress vitamins, 68, of B vitamins, 61, 66, of biotin, 68, of cholin, 77, of folic acid, 74, of inositol, 70, of niacin, 90, of nucleic acid, 86, of pantothenic acid, 77, 86, of vitamin B_2, 94, of vitamin B_6, 77, 85, of vitamin B_{12}, 74; completeness of protein in, 29; concentrates of, 112; daily use of, 226; effect of, on calcium retention, 183, on growth, 75; factor N in, 240; gas from, 113; how grown, 112; how to take, 113, 114; importance of, to world nutrition, 112; inexpensiveness of, 34; iron content of, 188; phosphorus content of, 183; powdered, as compared to flake, 113; protein concentrated in, 34; protein content of, 32; tablets of, 112, 113, 117; use of, in treating pellagra, 93; value of, in correcting anemia, 190; danger of using uncooked baker's, 113; mix, 119
Yogurt: absorption of calcium from, 182; added to babies' formulas, 69; amount needed daily, 185; as source of calcium, 180, of valuable bacteria, 61-63, 93; culture

Yogurt (Cont.)
for, where to buy, 110; homemade, 110; how to serve, 110; predigested protein in, 93; production of B vitamins by bacteria of, 98; value of, 93, in aiding iron absorption, 189

Youth, 26, 32; fountain of, 86; prolongation of, 89, 166; relation of, to vitamin-C intake, 136; retention of appearances of, 174, 250-53; stunted growth during, 62

Zinc, 204, 217