SUN COOKED FOOD

CHRISTIAN

Sincerely yours

Eugene Christian

EUGENE CHRISTIAN

Suncooked Food

A TREATISE ON HOW TO GET THE HIGHEST FORM OF HUMAN ENERGY FROM FOOD

SIXTH EDITION

RETITLED AND REWRITTEN TO KEEP PACE WITH PROGRESS

BY

EUGENE CHRISTIAN

AS THE BUILDING MATERIAL IS, SO THE STRUCTURE MUST BE

CHRISTIAN'S SCHOOL OF APPLIED FOOD CHEMISTRY
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DEDICATION

To the Women of America who shall Mother
the Sons of Our Glorious Country,
I Most Affectionately Dedicate This Work

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WHY THIS BOOK WAS WRITTEN

Some years ago I became so impaired in health as to almost totally disqualify me for the performance of my daily work. A study of my condition convinced me that it was caused mainly, if not wholly, by incorrect habits in eating. This caused me to enter into a very careful and studied series of personal experiments with various forms of diet. At first these experiments were confined entirely to cooked foods, because at that time I accepted implicitly the common theory that foods could be predigested and improved by heat. Necessity had not required me to think otherwise. Failing utterly to regain my health, or even improve my condition upon a diet of cooked foods, my attention was turned toward natural food, that is, food in its uncooked or elementary state. Less than a year of study and experimenting with this system of feeding resulted in complete recovery from all digestive disorders, and my restoration to perfect health. The results of my experiments led to an investigation of the subject from a purely scientific viewpoint. Many people, suffering from various stomach and intestinal disorders, submitted to a trial of my theory, concerning their habits of eating and drinking, with the result that in every instance health, strength and vitality came to those who followed my suggestions.

In order to bring this theory more conspicuously before the public, Mrs. Christian and myself gave, to a large number of invited guests, a seven-course dinner or banquet of uncooked foods. This banquet received much attention by the New York press, and was widely commented on throughout this country and abroad. The flood of inquiries concerning the use of uncooked foods, which followed this publicity, gave me a substantial hint of the great interest the public is taking in the question of natural dietetics.

A second elementary food banquet spread a few months later was given still wider publicity, and brought forth inquiries in such volume that it became impossible to answer them. Therefore, as a labor-saving method of making reply, and in order to place intelligently before the public the results of my work and experiments, I decided to incorporate them in pamphlet form. But it was soon discovered that this was inadequate, and the first edition of "Uncooked Foods" was the result.

EUGENE CHRISTIAN.

January, 1904.

WHY THIS BOOK WAS REWRITTEN

Five years have passed since the first edition of "Uncooked Foods" appeared from the press. The work has passed through several editions and many thousand copies have been distributed throughout the English-speaking world. The book has been severely criticised and generously praised. The *London Mail* declared it to be a hundred years ahead of its time, while some doctors said it was the vaporings of a diseased imagination. However, the demand for the book constantly increased.

When I began my investigations in the field of food science, there was absolutely no information available for the searcher after dietetic truths, except some sentimental writings on vegetarianism and a few pedantic and uninterpretable government bulletins on calories and carbohydrates. The drug-doctor was supreme, and for anyone else to presume to possess knowledge or give advice concerning matters of health was considered *prima facie* evidence of quackery and charlatanism. And yet, on the great question of human nutrition, the most important factor in the realm of human health, the drug-doctor knew but little. He did not claim to be an authority. He studied drugs, not foods.

Five years ago, the person who proclaimed that foods could be made remedial or curative, or that they were a potent factor in the cause of disease, was branded as a "crank" and faddist. In defense of this theory at that time, I wrote the following lines:

"If I mistake not, this decade will stand out in history as one of the most important since the world began. Its greatest achievement will be that it has put into motion a current of thought on the subject of human food, that will do more for the human race in one generation than all the learning of the musty centuries that have gone into the past."

Half of the decade has passed. Let us weigh this prophecy on the scale of what has since occurred.

Within the last five years the people of the nation have demanded that adulterating and poisoning foods shall cease, and Congress has passed the Pure Food Law and created a commission for its enforcement. True it is, that the law merely insists that things be what they are labeled—pure whiskey and pure bologna are still bologna and whiskey, and still unfit for human food, but the Pure Food Law has shown that the people can be awakened to a recognition of the fact that food as the constructive material of human life needs some consideration. The Pure Food Law is the first step in the right direction. It is the crystallization of the thought that the nation's greatest asset is in the health of the people, and that pure food is the greatest factor in health.

The last five years have witnessed a great popular uprising against patent medicines. People who now indulge in their use are pitied and looked upon as we look upon those who still believe in witchcraft, rabbits' feet or the horticultural influence of the phases of the moon.

Five years ago vegetarianism was considered only from its religious, moral or sentimental aspects, and the average college professor would have flinched from being called a vegetarian as he would from being called an anarchist. To-day vegetarianism, or more properly, the question of the effects of flesh food, is being scientifically studied in many of the best colleges and universities in the land, with the result that flesh foods are now admitted by most up-to-date scientists to be not only unnecessary, but actually detrimental.

A few years ago prohibition was looked upon as a proper thing for the employment of a few idle women and once-a-week preachers, but was considered unworthy of the support of the business interests of the country or the public press. The prohibition territory of the United States was then confined to two or three " crank " States and a few scattered rural counties. To-day the map is reversed, and " wet " territory is in the minority—a great prohibition movement has swept over the country—not because a few women and preachers have approved it, but because the American people are learning that intoxicating liquors are detrimental to health and prosperity. The same general wave of reform that passed the Pure Food Law is passing prohibition laws.

Until a few years ago consumption was treated with drugs, and the patient zealously guarded from exposure; to-day he is sent into the open air and instructed to sleep in tents in winter and under the canopy of blue in summer. All drugs are eliminated, and exposure to out-door air, moderate exercise and pure food is the universal remedy—the remedy that cures. Nearly every State in the Union now has a society for the study and prevention of tuberculosis; and these societies are not controlled by the medical profession, but are philanthropic organizations working to place this information within the grasp of everyone who will learn.

Athletics and out-door life are becoming more popular each year, and in our more progressive cities the physical welfare of children is receiving much attention from municipal governments.

A few years ago those who attempted to regain health by any means except medicine were considered "cranks," if not a little "off" mentally. They are still considered "cranks," but the word now means thought, progress and sometimes genius.

Medical laws, to prevent the practice of drugless methods of healing, are still on the statute books, but they have been defeated in the Supreme Court of many States, and are exceedingly unpopular and rapidly taking their place back with the blue laws of the days of sorcery and witchcraft.

To-day natural methods of treating disease, especially by diet, are being recognized by the more resourceful thinkers of the country. Dr. Harvey W. Wiley, chief of the Federal Bureau of Chemistry, a graduate M. D., and the best-known chemist in this country, in a recent article, in the *New York Medical Journal,* said: "There is an increasing belief in the medical profession, and this belief is founded on substantial evidence, that diet is an important factor in the production and cure of disease. . . . A perfectly healthy, well-nourished organ becomes infected with any disease germ with great difficulty; in other words, it is self-protective. Granting this, therefore, it is self-evident that the food or diet must play a most important part in the prevention of disease."

Dr. Wiley closes this article with a most significant prophecy: "I must also be allowed to say that the most preposterous dicta that I have ever heard concerning diet have come not from teachers of dietetics and cooking but from physicians themselves. In the progress of medical education, the near future, in my opinion, will see the professorship of dietetics in medical schools advanced to the same rank as that of medicine, and I am even going further than this and say, that the practice of medicine in the future will be largely a practice of dietetics."

Indeed, so wonderful has been the progress in the last five years that my original work on uncooked foods seems sadly out of date.

It is to keep pace with progress, and to give to humanity the results of five years' study and practice in the field of applied food chemistry, that this volume has been rewritten. If it gives to men more strength, more vitality, more endurance; if it gives them more health and less disease, more sympathy, more affection and more love; if it gives them higher senses of mercy and justice, which flow more freely from a fountain of robust health; if it contributes one degree to the elevation and freedom of woman; if it gives her one hour more of pure air and sunshine; if it gives her new thoughts, new dreams, new hopes, with which she may endow the race to be: if it takes her from within four dark walls, hung with pots and strewn with bones, to gardens and fields where nature's bounteous store of purple and red is swung with prodigal hand in sunshine and autumn leaves; if it brings her more youth and years, less sorrow and tears; if this book, in the least, lightens the leaden load that has been laid upon woman by our civilization; if in all the world it changes one hour of suffering to an hour of joy, the writer will be abundantly repaid.

EUGENE CHRISTIAN

August, 1909.

INSTINCT VS. CUSTOM

Among all civilized people eating is controlled largely by custom, convention or race habit.

Because of man's inventiveness, the human species differ from other types of animals in being governed less by instinct and more by custom or race habits. Some customs are good—some are bad—some indifferent. All told, these customs and habits, which each child learns anew from its parents and playfellows, form what we call civilization.

All wars, all political and religious disputes that have played over the map of the world have been but the clashing of various customs. The use of written language is a custom—a good custom, for it develops the human mind, enables us to learn more, to think more deeply, and to live and love more fully. Fashions in dress are customs—for the most part senseless customs, good, so long as they please ourselves and our friends; bad, when they injure our bodies or when we use them to display wealth or allow them to occupy time and thought that could be devoted to better things.

In eating, drinking and drugging, the liability of custom to become harmful is much greater than in other human habits. Between the customs of dieting and of drugging, there is this sharp distinction: Food is necessary to human life; appetite for food is an instinct, and conventional diet is natural instinct gone wrong through acquired custom. But drugging is wholly unnecessary—it meets no natural need and can only interfere with nature's fixed and unchangeable plan—it is an acquired habit fastened upon the human race by those who do not really believe in it, except as a means of livelihood.

The fact that a vast majority of human ills are directly traceable to man's habit of feeding is evidence that custom furnishes him no safe guide.

Human progress can be measured by the radical departures and the distance we have traveled from custom. The world's greatest souls which have led us toward the light have been martyred and ostracised because of our blind fear of departure from precedent, habit and custom.

We are accustomed to look upon nature as perfect, and to accept whatever is as best; but this view is not strictly correct. Nature or evolution is, by natural selection, constantly approaching perfection, for the imperfect and inharmonious are continually being eliminated by her laws.

The perfection of nature is not so much in the perfection of the plan as in the adaptation of one thing in nature to fit into and work with another thing. A food chemist might plan a diet containing all the elements of which the human body is composed. His nitrogen he could get from the air, his carbon from charcoal, his sulphur from crude brimstone, and his iron from the scrap heap. But such a diet would be useless because the human body has not been adapted to digest and assimilate these elements in this form.

Science, freed from all prejudice and dogmatism, first studies the adaptations in nature, the relation of natural food to the digestive and metabolic processes of the body, which for long ages has been fitting itself to subsist upon these foods. After learning from nature the needs of the body, science strives to select foods that shall most nearly conform to these processes of nutrition. For illustration: Nature presumed that man would thresh grain and hull nuts with his hands—science does it by machinery and leaves man's hands free to build aëroplanes or wireless telephones. But where science says that mills should be substituted for teeth and malt for saliva, it interferes with processes that cannot be so easily readjusted.

We should learn from rather than follow nature. The plant to live needs water. Nature gives it water, sometimes too much, sometimes too little. Man regulates nature. He builds a dam and catches the water in seasons of plenty and feeds it to the plant in seasons of drought. He underdrains the soil so that the plant gets the proper amount of water at the proper depth; and he protects the surface of the soil from the excessive evaporating power of the summer sun by mulching the ground with a tilth of crumbly loam. The plant now produces thirty, sixty and a hundred fold more than it would under its natural conditions and environment.

Suppose, again, that man concluded that the temperature of this earth was too low, and by artificial means raised it to 120 degrees.

"How absurd," you say. "It would be unbearable and kill off half the human race"—and so it would. But suppose man had been so constituted that such an abnormal temperature gave temporary pleasure or conformed to some foolish custom. In that case roasting would have become fashionable, even though it killed half the race, for such has been the case with intoxicants, stimulants, drugs, narcotics, tobacco, meats and mushy starch foods.

If men were able to adapt their bodily inheritance to new conditions as readily as they do their clothes, houses or vehicles, athletics would have no other use than that of a sport. As it is, we are equipped with the same kind of breathing, running and fighting mechanisms as were used by our Neolithic ancestors. It is a proposition of "vested interests." When we try to substitute another method of locomotion or a new plan of digestion to the neglect of the one with which nature has fitted us, conditions develop which we call disease, and we name them gout, rheumatism, consumption, obesity or some Latin word ending in i-t-i-s. If it is a matter of flabby arms or legs, weak heart or lungs, athletics will build up the muscles and put the machine in good running order. If the trouble is with the digestive, assimilative or excretory organs, a proper selection and combination of food will decidedly lessen the dangers of congestion, which we are pleased to call disease.

The man who follows custom in dietetic

matters is almost sure to go wrong. If some scissors expert, who called himself a scientist, should put all the foolish dietetic customs of man in a big book and label it "Catholiconocea" or a "Martha Washington Cook Book," the man who read it, would differ from the man who received his education on his grandmother's knee, only in knowing more wrong ways of eating.

He who learns of nature and her laws of adaptation cannot go very far wrong, for nature feels her way. She does not develop a set of teeth and a stomach to match them which can only assimilate predigested food; nor an appetite and digestive organs adapted to an anthropoid diet, with the kidneys of a vulture. He who goes first to nature and learns of her requirements and her harmonies, and then brings into play a constructive scientific mind, seeking the best material out of which to build the human body, or the most natural method of combining and proportioning food according to age, climate and work, can add the constructive forces of reason to the constructive forces of nature, and make man, in things physical as he is in things psychical, the paragon of animals.

COOKING

All matter is composed of little electrical charges called ions. These ions are grouped in certain fashions to make the atoms of the chemical elements; and these atoms, in turn, are arranged in various combinations which determine the chemical compounds or substances of which the sea, earth and air, tadpoles, albatrosses and automobiles are composed. The manner in which these ions and atoms are combined determines which elements or compounds are formed. Two ions chased by four abreast, followed by three more driving tandem, may be hydrogen, and six hydrogen atoms around two of carbon, with an oxygen atom circumnavigating the whole, form alcohol; and three billion molecules of alcohol, four billion of water and one of common sense, make a "plain drunk." All these myriads of little eddies of electricity are in never-ending motion, whirling, turning and revolving in their orbits like an infinite swarm of tiny comets, moons and suns.

Just as the difference in the way in which these minute particles of matter are combined constitute the substances they form, so does the rate at which they move constitute what we call temperature. The form of motion and the rate of motion are intimately related. Certain forms of motion, and hence certain forms of matter, can exist only at certain temperatures. In the hottest stars we find only hydrogen and helium and the lighter elements. As the stars cool, nickel, iron and other metals are formed; much later, when the cooling process has progressed far enough so that the motion or temperature is slowed down to something near the temperature we have on this earth, carbon, oxygen and nitrogen, the elements of life, are formed.

But these life elements cannot combine to form the life substances until a temperature below the boiling point of water is reached.

At a temperature between 32° and 150° F., all the life on this globe was created. Were the temperature of the earth to pass again without that range, all life would perish, for this is the only range of temperature at which that most complex of chemical compounds, protoplasm, the essential substance of every living cell, can exist.

In all that great range of temperature, from the hottest stars down to the absolute zero of interstellar space where the lightest of gases freeze as hard as steel, only in the one brief span of a hundred degrees, scarcely one-hundredth part of the whole, can life exist; while warm-blooded life, which is the highest form, can exist only within a range of ten degrees or twelve degrees. We are even alarmed if the clinical thermometer shows a change in the temperature of our blood of two degrees.

Aided by the energy of sunlight, the vegetable or plant takes inorganic matter and converts it into organic or living matter, such as is found in leaves, fruits, nuts, cereals—the natural foods of man. It is only through this process that mineral elements can become a part of animal life.

As the life substance can exist only within a limited range of temperature, when we apply artificial heat to our food in the process of cooking it results in such a change as destroys the elementary plant form, and the mineral elements return to their inorganic condition. A leaf of cabbage, if immersed in water that can easily be endured by the bare hand, will wilt, showing that part of its cellular life is destroyed at that temperature.

The degree of heat necessary to change the chemical properties of a substance depends upon the substance. Gold may be heated in a furnace to the highest temperature which human ingenuity can attain, and it will still come out gold; but let a young housewife get her biscuits a few degrees too hot and they will come out of the oven a radically different substance from what she had planned.

Sugar may be heated 200° or 300° without change. Starch begins to change at a much lower temperature. Proteid or protoplasm, the most essential substance in animal life, is the most susceptible of all, and coagulates at about 160° into a hard mass that cannot again be brought back into its original form. Living proteids undergo some change even at a lower temperature, for death, which is merely a chemical change, will ensue immediately if the temperature of the human brain be raised 10°.

The heat can be increased until all plant life is destroyed. This becomes important when we remember that animal life is supported and entirely constructed from plant life. The living plant possesses all the elements from which animal life is made, yet millions of people insist on eating supercooked foods. They insist on wheat being made into zwieback, which might be described as ashes held together by a little gluten, without ever spending one moment in thinking of the real difference in food value between this suff and the grain in its original state.

Of all the curious customs into which people have evolved, cooking seems to possess the least excuse for existence. It has made of woman a slave. It has made of the stomach a potpourri for everything living or dead. It is the chief cause of mixing unharmonious foods, which is the principal cause of overeating, which, in turn, is the genesis of nearly all stomach and intestinal disorders. It has changed man into an omnivorous, and in some cases into a carnivorous animal.

"Why destroy the plant life before feeding it to the animal? In what possible way can the application of heat improve it?" Our education, our science and learning are of small value if they do not teach us how to build the highest form of animal life from the material used.

In the evolution of mankind the application of heat to food is comparatively of recent origin. Man probably began his cooking experiments by warming cold foods at his camp fire. As heat volatilizes the odorous substances in many foods, the custom of heating became popular owing to the pleasant odors or flavors produced by the process. The habit of cooking spread as many other novel and interesting customs have spread, regardless of whether the results were beneficial or harmful.

Chemical Changes that Occur in Cooking

The question of whether foods should be eaten cooked or uncooked can best be answered by studying the chemical and mechanical changes produced in the process of cooking and their consequent physiological effects.

Cooking may be grouped into two classes, designated as moist heat and dry heat.

Sugars are not chemically affected by boiling with water. Starch, in the presence of boiling water or steam, absorbs from three to five times its bulk of moisture, and changes into a pasty or semi-dissolved mass.

In the presence of dry heat, sugars are converted into a brown substance known as caramel. Starch, when heated to a temperature of 300° to 400° without the presence of water, is changed into dextrine, of which toast and zwieback are examples.

Fats are not changed chemically by heating at the temperature of boiling water, but the globules are melted and the hot fat spreads in a film over other material which may be present. By dry heat, fats are chemically decomposed, forming irritating vapors. The odors of frying are due to the presence of small quantities of these vapors. In larger quantities and with greater heat, these substances are excessively irritating, as every housewife knows who has allowed grease to burn in a skillet.

The chemical changes produced by heating proteids are of much more importance than the changes in other food groups. Simple proteids are coagulated at a temperature of about 160°. This form of change is very familiar to all in coagulation, which occurs in the boiling of eggs. This change in proteid material continues with the application of prolonged heat or higher temperatures until the proteid is converted into a dark, brittle mass, which is wholly insoluble and indigestible.

If the reader will take the white of an egg and bake it for some time in an oven, he can observe very readily the coagulation and hardening of the proteid. The chemical nature of these changes is one of great complexity. The molecules combine with each other, forming almost indestructible substances. The combined or coagulated forms of proteid are represented in nature by horns, hoofs, finger nails, hair, and are indigestible and non-nutritious.

The statement is frequently made that starch of grain cannot be digested without cooking because the cells enclosing the starch grains have indigestible or insoluble cellulose walls. The old theory held that it is necessary to expand the starch and rupture or tear down these cell walls by cooking, thus freeing the contents so that the digestive juices may act upon the enclosed starch granules. This is a beautiful theory, but, as a matter of fact, the conception is wholly erroneous. The cell walls on the interior of the grain kernel are very filmy, and in the mature grain scarcely exist at all. The analysis of wheat flour shows only a trace of cellulose and fiber. Were these cellulose walls within the wheat grain, as this theory commonly teaches, flour would show a liberal quantity of cellulose. This theory as to why starch should be cooked furnishes an excellent illustration of the ease with which a groundless statement or theory may spread, simply because it seems to explain some popular prejudice.

In the process of cooking, many of the salts, which are combined with the organic constituents of food, are freed or rendered inorganic, which makes them of little or no value in the nutrition of the human body.

Inasmuch as the majority of people think cooking necessary to health, forgetting probably that about half of the food consumed in the world at the present time is taken in its natural or uncooked state, it may be well to mention other views advanced by those who, believing that the present diet of cooked grain is better for the modern man than an elementary diet, attempt to give a natural explanation. One theory is, that while cooked foods were originally detrimental, yet, by continued evolution, man has become fitted for such a diet and unfitted for a natural diet. This is but another form of the old belief in the inheritance of acquired characteristics. This belief has been steadily losing ground among evolutionists; for there is no more reason to expect that a modified function of the stomach would be inherited than there is to believe in the inheritance of small feet among the Chinese ladies, or flat heads among certain tribes of Oregon Indians, just because these organs are mutilated by local custom.

The best light of scientific knowledge now leads us to believe that the healthy child of to-day, in its capacity for nutrition, is practically like the primitive child, and is well fitted to subsist upon a varied diet of natural foods.

Cooked Foods for Animals

It is only natural that people should reason that if, as commonly held, man owed much of his superiority over other animals to the use of cooked food, animals other than man should be benefited by a change to a cooked bill of fare. So about twenty or thirty years ago many farmers put their hogs, chickens, cows, horses and sheep on a cooked bill of fare; and the more enthusiastic feeders claimed beneficial results. Later, various government experiment stations took up the subject and made numerous careful and complete tests of the effects of cooked and uncooked food upon animals. The results did not show the expected thing. On the contrary, the cooking of foods for animals proved detrimental, and the decision of the government investigators was that cooking food for stock was, at its best, a wasteful fad owing its origin to a wrong theory. The custom has now become almost entirely obsolete.

If cooking is good for man, who formerly subsisted on uncooked foods, and bad for other animals which also subsist upon such a diet, the only explanation is that the Creator contemplated cook stoves when He made man, and planned his organs for the forthcoming change. For those whose analogy of creation is that of a child building a play house, this explanation may suffice, but to the mind which grasps the conception of creation by universal and unchanging laws such childish philosophy can only be a matter of amusement.

"Raw" Foods

Foods that have ripened and been brought to a state of maturity by nature cannot consistently be called "raw." The origin of this word was the effort to describe something that was unfinished, crude and rough, or in some way objectionable.

Think of applying this ugly word to a

luscious bunch of purple grapes swinging to and fro in bowers of green; or to a hickory-nut that has ripened in the top of a mountain tree, and whose life-giving properties have been filtered through a hundred feet of clean, white wood. Or to a delicious apple, or peach, reddened, ripened and finished; born from the fragrant blossom and nursed and nurtured to maturity by the soft beams of the life-giving sun.

These things are finished, ready for use; they are perfect, they are not raw, they are done; and when they are changed by fire they are undone. In the true sense of the word, cooking that which nature has ripened really renders it raw—hopelessly raw. The Standard Dictionary says that "raw" means "uncooked" but dictionaries are made by men. They record as true whatever becomes customary; if custom makes an error, then the dictionary records that error and people swear it is true because it is in the dictionary. If custom were to make "wise" mean "foolish," the dictionary would " back it up," and wise men would be fools. Language is a thing of growth and development. It is a mechanical effort to express our emotions, our hopes, fears, joys, sorrows and sympathies. Language is continually being born and continually being buried.

An uncooked beefsteak could, with much consistency, be called raw. It looks raw and tastes raw. In the sense that the shoulder of a horse from which the skin has been worn by a rough collar is raw, so is an uncooked beefsteak raw. We cannot accept the sweeping statement that all things are raw that are not cooked, though a thousand dictionaries were to say so. The word raw cannot be made to truthfully describe fruits, nuts, plants and grains in a perfect state of maturity. These were evolved by perfect laws or created by some supreme intelligence. They were sown with prodigal hand over the face of the earth; here they have blossomed and matured; they have been finished by nature, and no care-worn and misguided housewife can, with a blackened skillet filled with hot hog fat, possibly improve them.

WHY SUNCOOKED FOODS

If there was nothing else to recommend the use of suncooked foods except simplicity and economy, it would be quite enough. There is nothing more complicated, more laborious and more nerve-destroying, than the preparation of the alleged good dinner. There is nothing simpler, easier and more entertaining than the preparation of an uncooked dinner. The largest eating place in New York could be operated from an ice box and a pantry, were the cooking habit abolished. This, in all probability, will be done some time within the lifetime of the present generation, when people learn the true relations between food, energy and health.

In order to gain some conception of the number of articles used in the preparation of a Thanksgiving dinner, the author took a very careful inventory during its preparation, from the kitchen of a large New York hotel, to which he had entrée. The total was 192, while dozens of articles, such as catsups, sauces, mayonnaise dressings and chow-chows were counted as one. Such things were composed of from two to half a dozen different ingredients, which, if they could have been ascertained, would have run the grand total up, in all probability, to 250 different articles.

Is this not a hint from which anyone at all gifted with the power of analysis might draw a few deductions that would explain why it is that nearly all diseases, common to civilized man, have their origin in the stomach and intestinal organs?

All these food materials must be carried in stock by somebody. They are first collected from the place of their growth and brought to storehouses, factories, packing houses, mills and cookeries. They are put into casks, hogsheads, barrels, kegs, jugs, bottles, tin cans, bags, intestines of animals, and every conceivable thing that will hold liquid, powder, grain and piece matter, and are carted to some place of storage, sold by commission men, resold to jobbers, again carried in stock for a time, sold to dealers, where they are again held up, and finally sold to the consumer, who has no conception of their age or source of production, and but little knowledge of their value as food.

All this is extremely complicated and expensive. It costs money every time these vast cargoes are stopped and stored, and more every time they are moved. Every day added to their age renders the majority of them more valueless as food and more expensive as commodities. Not content with this aged, unnatural, pickled and preserved condition, the housewife lays hold of them and proceeds to give them their finishing touch by fire. On the checkered highway of man's curious doings, there is indeed nothing more strange than this.

We have in this country hundreds of different articles of food which can be most advantageously used without cooking; yet the cook intrudes his art, bakes, boils, stews, broils and heats these things until their original elements are wholly changed, and many of them are rendered almost totally valueless as food.

Thus robbed of their elementary and delicious flavors, the cook endeavors to make them appeal to the sense of taste by mixing, jumbling together, spicing and using decoctions called extracts, of the properties of which he knows absolutely nothing, until the original substance is so disguised that it cannot be recognized in taste, color or flavor. Food partaken of in this condition cultivates and appeals to an artificial, perverted and depraved taste, and leads its possessor in exactly the opposite direction from that which he must travel to secure the best nutrition and the highest degree of energy or health. Those who enjoy their eating most and who have reached the highest standard of health and physical development, have succeeded in reducing their diet to less than a dozen articles.

It seems that everything in connection with the affairs of civilized people conspires to recommend this simple method of living. In the selection and preparation of our food lies the controlling factor of health. Taste is the thing that controls selection. It should be studied and carefully encouraged towards nature's best and most nutritious things. If given a chance it will lead us into perfect obedience to nature's great dietetic laws.

THE SELECTION AND PREPARATION OF FOODS

In the adoption of suncooked foods, more care in selection is required than when they are to be cooked, for, in the process of cooking, mixing and dressing, the real quality, taste and flavor of the articles becomes changed, lost and dissipated. The most inferior articles of food can be cooked and artificially flavored, as they usually are, and still appeal to and satisfy the taste. A famous French chef once served a pair of old kid gloves under a fanciful name, and the strange dish was very highly complimented and sought after.

In all public eating places the special duty of the chef and steward is to use left-over foods. They are hashed, minced, flavored, spiced and peppered until the smell from the fermented or decayed portions is so concealed that they cannot signal the olfactory nerves. By such recourse the most inferior and unhealthy articles can be used—a thing impossible with foods in their natural or elementary state.

When using suncooked foods the senses of sight, smell and taste demand the best, and it is only fair that these senses should be consulted and satisfied. It is as criminal to deceive our taste and sight in matters of food as it is to obtain money under false pretenses from our friends; and the penalty for this wrongdoing is even more certain to be paid. We often escape justice in deceiving our friends, but never in deceiving ourselves. We cannot jump our bail with nature. We are always caught and punished, for two crimes instead of one.

One may be thoroughly convinced that the theory of suncooked foods is correct, but if such articles are selected as do not conform or appeal to the taste, the effort will prove futile. Food should be selected that has ripened on the parent stalk or tree, in the sunshine, as far as possible. Those who are acquainted with the curative and life-giving properties of air and sunshine will readily perceive why the selection of thoroughly ripe and full-grown articles is so necessary.

In selecting an apple of a red variety, get a deep, rich red. The deep red color indicates that the fruit has ripened on an outer twig of the tree, exposed to the sunlight, while the paler colors show that it has ripened under cover of foliage. This rule should be observed in the selection of all fruits, berries and melons of every kind, as far as possible, the rule being that whatever color is selected, it should be as pronounced as possible. In other words, get the best.

Many good women have spent the best part of their lives, and volume after volume has been written in the endeavor to tell the world how to prepare foods. The very words, "prepare foods," suggest to the mind that they are not right; that nature has not finished her work; that something must be done to them before they are fit to be taken into the human body; the words suggest that they must be fixed, mixed, pealed, hashed, mashed, smashed, bruised, ground, shredded, heated, steamed, baked, boiled, oiled, roasted, toasted, greased, sweetened, soured, fermented, raised, mushed up, wet up, dried out, or in some way changed from the way in which they were handed to us by the provident hand of nature.

The securing of food is the chief business of every living thing on this globe. The necessity of doing this has shaped to a very large degree both the body and the mind. It made for man hands suitable for plucking fruit, nuts and things that grew above his head high up in the air and sunshine. It gave to the lion claws and tusks to catch and tear his food. It gave to the hog a snout with which to root in the ground. It gave the stork and the crane legs adapted to wading. It gave to the giraffe a long neck with which to reach buds and leaves. It gave to the honey bee an organ to collect honey, a sack in her own body to carry it; and intelligence enough to make her cell in which to deposit it for future use.

Food, taken as nature made it, will produce a natural being. When it is changed, mixed, distilled and concentrated, it is unnatural and it will necessarily produce an unnatural being. For man is merely the net product of his food and, as is his food, so he must be. There is no problem in philosophy more obvious than this.

It may be argued that our present methods of feeding are the product of heredity, and with the long ages we have changed the artificial into the natural. This is not true, because the ultimate end of artificialism, that is, the violation of natural law, is extermination.

There is no such thing as getting used to the wrong thing.

A human being can never get used to whiskey and tobacco. They will stimulate the nervous system above par, only to drop it farther below each time they are touched. They leave their withering trail through the body and brain of the real man, and sink lower and lower each day the hopes, aspirations and emotions. They cover the faculties with a callous veneering that finally becomes impervious to the sweetest senses of the human heart.

Foods should be changed as little as possible from their elementary condition. The idea of preparing foods should be allowed to fade entirely from the human mind. It is well to remember that they have been prepared once by infallible laws and all animal life evolved to fit them, and now the funny little biped called man proposes to change all this.

When the average mind first considers uncooked food, it is apt to think only of the conventional diet in an uncooked state, raw meat, wheat, corn, potatoes, beef, poultry, fish and the limitless number of things that are repulsive to the mind and taste until they are in some way changed.

Instead, picture a dainty table in a quiet corner, covered with spotless linen and laden with milk, cream, pecan meats, walnuts, proteid nuts, almonds, grapes, grape fruit, bananas, pears, apples, peaches, cherries, dates, figs and raisins, luscious red melons and golden canteloupes, lettuce, cucumbers, ripe olives, celery, olive oil, and a dozen other delicious things, all of which, being natural, satisfy hunger, furnish the highest form of nutrition, and quickly appeal to and excite the highest sense of taste and enjoyment. Many good people go through the world from the cradle to the coffin and, after leaving the maternal fount, never enjoy, never taste, one good, clean, pure, delicious, natural meal.

Preparation of Suncooked Foods

The idea of preparing foods is so firmly fixed in the minds of women that the very suggestion of lessening their labors in this direction suggests the idea of limiting the family rations—depriving the table of its pleasure and luxury; therefore, the idea of uncooked food meets with more or less opposition. Experience has shown that men are more willing to accept the elementary food idea than women, particularly when it promises to lighten the labors of their wives, mothers and daughters.

There has been for many thousand years a sort of competition among housewives, hotels and all public and private eating places, as to which could prepare the greatest variety of foods, with the result that the table is held responsible for over 90 per cent of all human ills.

This result is not sufficiently creditable to cause thinking people to clamor for its continuation. It reminds me of the consolation I received once from a gentleman with whom I was playing a game of billiards. It was my off-day. The balls would neither "hit" nor "hurdle" for me, while his plays were all graceful and effective, and I was enjoying the supreme pleasure of seeing him make all the points while I paid for the game. In answer to my complaint upon missing a simple shot, he said, "Oh, that is nothing. I have seen luck run like that for three or four hours and, all of a sudden, get worse."

The best foods need the least preparation. Geographic and climatic conditions, under which most of us live, of course, make harvesting and garnering necessary; and in order to store certain foods for winter use, certain preparations become necessary; but when we come to prepare them for the table the effort should be to bring them back as nearly as possible to their original condition.

All fruits from which the moisture has been removed by dehydration, so that they will keep from season to season, only need to have the moisture again restored to them by being soaked in pure water at about the temperature of the blood. This is the most healthful way evaporated, dehydrated or dried fruits can be prepared.

Food Combinations

Nearly every article of food known, as bad as some of them are, will agree with the stomach if eaten alone or with a few other articles in normal quantities, and in combinations that are chemically harmonious.

When we say that certain things do not agree with us, we mean that we have eaten a combination of things that do not agree one with the other; and the stomach, being the receptacle of this chemical disturbance, is made the sufferer. The question of combinations is extremely important in cooked foods, because the tendency of modern cookery is to mix and jumble together an innumerable number of things, and pour over them condiments, sauces and dressings that are composed of dozens of other ingredients, until it becomes utterly impossible to ascertain by any method of calculation how many different articles compose one meal.

It is always well to observe correct combinations, though this is in reality of secondary importance, for in subsisting on sun-cooked foods the natural tendency is toward simplicity. This is one of the greatest virtues following their adoption. In the beginning many are likely to desire each meal to be composed of a large number of articles. They like to see it spread around;

they want to see the table covered; they want to see it groaning beneath a load, simply because they were raised that way. They have no standard to measure from, except a cooked standard; but this optical appetite soon wears off, and the taste and delicious flavors that are developed by combining two or three things, lead the elementary student to ignore numerical display and make a meal upon three or four articles.

A very delicious taste will be developed by eating fruits and nuts together, care being taken to masticate the nuts thoroughly before the fruits are put into the mouth. If this rule is observed in eating vegetables and nuts, the same delightful taste will be experienced.

There is a popular opinion among the majority of people that appetite, that is, a desire for food, is an evidence of good health. This is one of the serious mistakes into which people have gradually evolved. Irritation of the mucous membrane of the stomach is one of the most serious and unhealthy conditions with which this much-abused organ is afflicted; and while in this condition it calls with ferocity for food, the satisfying of which has killed suddenly hundreds of thousands of people whose death is attributed nearly always by the learned doctors to heart failure. And I agree with them completely. I know of no other way to die except for the heart to fail, and it matters but little whether the "heart failed" on account of being shot, beheaded by a Cuban machete, or on account of an over-loaded stomach—the doctor's "heart-failure" theory is safely correct. The difference between the "learned profession" and myself is, they seem content with the heart-failure theory, while I am trying to ascertain why hearts fail and, if possible, to remove the causes.

The Treating Habit

The treating habit, our prohibition friends say, is responsible for much of the evil of alcoholism.

In eating the treating habit is a little more genteel, but fundamentally the same as in drinking. Eating does and should give us pleasure, and pleasure we like to share; moreover, the accumulation of plenty to eat was the first or primitive form in which wealth was displayed, and the pleasure of possessing wealth is the privilege of showing others that you have as much or more than they. For these reasons, the habit of eating together was inevitable, and the custom of urging our guests to eat more is inherent in the love of display. Thus the "groaning table" came to be the sign of wealth and generosity, and the course dinner with the cooked, spiced and pickled foods is a natural step in the evolution of human vanity.

Look for a moment at a conventional meal and ask yourself the reasons for and the results of each step. Why is the dinner served in courses? Why is one's plate loaded up by another? Why is more put upon his plate than he can or is supposed to eat, and why is it considered a breach of etiquette to refuse something you do not wish, or in any way to utilize your own good taste or judgment in the selection of your foods or the manner in which you eat them?

Or again, take the customary repast of a family in moderate circumstances—the Sunday dinner of a well-to-do farmer, for illustration. How much of the food prepared is actually eaten? How much of that actually eaten goes to the nourishment of the body and how much is decomposed and forms toxic or poisonous products? How much did the dinner cost? How much would the actual nourishment needed by the diners cost? Why this waste of money, of effort, of health? If the farmer wanted to show off his wealth, why should he not buy an automobile? If his wife wanted to possess an accomplishment, why should she not learn to paint or make a flower garden?

Why do we rank woman according to the number and variety of concoctions which she laboriously prepares to tempt our loaded stomachs till we, like the table, groan? Why not rank our women by their knowledge of the laws of nutrition and health, by their ability to instruct us and our children in what to eat and how to eat it, instead of their insistence in surfeiting our over-burdened digestive tracts with the continual " do have some more "? Why not value our wives by the time they learn to spend out of the kitchen amid books, flowers and music, and with their children, instead of the length of time they stand over the scorching stove and steaming dishpan?

Any law of etiquette that is at variance with the laws of health and happiness, or that infers that your guest has not sense enough to know what he should and should not eat, and especially how much he should eat, is foolish and vulgar; and good taste will be best displayed by its disregard.

The etiquette of the suncooked food table permits each guest to select what he will from the bill of fare provided, and to dictate as far as possible how large a portion shall be served him. Natural foods may, for the most part, be prepared in such form that they are served in dainty portions, of which each may partake of the amount his appetite dictates without waste. Table etiquette based upon a respect for the intelligence and personal liberty of guests instead of upon ostentation and show, should provide foods, from which guests may be served and may eat if they wish, not with foods from which they must be served, and from which they must eat a portion, and leave a portion in order to avoid violating a foolish rule that no one really wishes to obey.

Are you afraid of being thought queer? Then tell your guests in plain language your philosophy of good taste. If you are afraid of being thought stingy, and wish to show off your little accumulation of this world's goods, set your table with a wholesome fruit, nut and salad menu and a bottle of fresh grape juice, and then buy a thousand dollars' worth of orchids to decorate the room or hire Sousa's band to play in the balcony. The perfume of orchids and the divine harmony of music never gave a man hyperchlorhydria or parenchymatous nephritis.

THE EMANCIPATION OF WOMAN

If the study of the natural or elementary food question had for its object nothing more than giving to the human family their birthday of health and years, and aiding their mental faculties in reaching a higher development, it would justify the most profound attention of every thinking woman.

When the house is provided, and the woman who has dreamed of a home is settled therein, it gradually dawns upon her that instead of being a queen she is an imprisoned vassal. She finds that she must stand over a miniature furnace for an hour in the morning and breathe the poisonous odor of broiling flesh, and spend another hour among the grease and slime of pots and dishes, instead of occupying that time walking in the morning sunlight and drinking in nature's purifying air.

The fires of the morning are not out until those for the noon are kindled. The labors from luncheon lap over into the evening, and those of evening far into the night. The throne over which she dreamed of wielding the queenly sceptre has been transformed into a fiery furnace, gilded with greasy pots and plates, blood and bones, over which, by common custom, the dishrag waves as an ensign of her rank and profession.

The home of which she dreamed has laid upon her a confinement and labor but little lighter than that which society puts upon the criminal who has violated its laws.

The picture of a husband and wife growing old together, walking hand in hand up to the noon of life, and turning over the hill toward the evening of old age, is only painted by poets and dreamers, most likely old bachelors and old maids.

The average husband and wife do not grow old together. The wife spends six or seven hours of each day endeavoring to prepare food and create dishes that will appeal to the perverted taste and appetite of her husband, and probably the short-notice "friend to dinner." The anxiety and mental tension that she undergoes from day to day and year to year wear upon her form and face, and like the long dripping of water upon the stone leave their mark of nervous exhaustion and premature old age.

From this deplorable condition of womankind, the use of suncooked or natural foods will bring relief and freedom. In hundreds of cases that have come to my knowledge where this experiment has been honestly tried, it has resulted in a revolution in the household culinary department, and in giving the wife enough mental and physical freedom to permit her to preserve her youthful charms, and to cultivate those higher faculties upon which every woman must depend for attraction and happiness as age advances.

It is utterly impossible for a woman to spend six hours out of twelve in the dense and smoky atmosphere of a kitchen over a roasting fire, breathing air laden with the fumes of burning flesh and steaming foods, and give to her progeny those beautiful faculties which are their birthright, and which have been the dream of her dreams.

It is also impossible for a woman to build her body, brain and heart out of such material as the flesh of dead animals, fermented fruit (wine), fermented bread, and the innumerable narcotics and cooked or devitalized foods with which the average table is laden, and think beautiful thoughts and keep her sympathies and sense of justice and mercy in that beautiful and highly civilized realm where the cultivated and advanced woman, especially the mother, should dwell.

I am convinced—convinced from experience, that great school from which all true knowledge comes—that the first and most important step in nature toward making a perfect woman lies in the selection of the food material out of which the human body and all the restless flood of emotions that ceaselessly ebb and flow in its strange mechanism are made.

Nearly every step in civilization has been taken in the direction of lightening human labor, except in the art of preparing foods. This has been doubled and trebled a thousand times, and laid upon the delicate shoulders of woman.

The railroad train would never have been invented had it not been that man objected to toting burdens on his back. The telephone and telegraph were the outgrowth of man's protest against the courier system. Inventions of all the marvelous machines to which we point as evidences and marks of our civilization, originated in the one thought, the saving of human labor. But the stomach is a veritable gehenna, and the appetite its grizzly gorgon that holds millions of women in a worse bondage than the negro suffered in the South before the war.

Such a bondage might be tolerated by the mothers of the race if, in return, mankind had made a few steps in his forward march. But when it is considered that this enslavement of woman has cost man half his natural period of longevity, and is responsible for 90 per cent of his ills, is it not time that he should make some effort to swing the pendulum of events in the other direction?

The bee, in some respects, is a very stupid animal. If a puncture is made in a cell that it is filling, it will go on all summer pouring honey in at the top while it runs out at the bottom. But when the queen bee is accidentally destroyed, the worker bees will take the egg that ordinarily would produce a neuter or non-sexual worker, and by putting it into a special cell and feeding the young larva on royal bee bread, it will grow to be twice the size of the worker, and develop into a queen bee, endowed with the wonderful power of sex.

The entire physiology of the bee is changed by a change in the system of feeding.

Man considers himself the wisest of animals; but he would not try to fill a barrel with an open bung hole at the bottom, unless he was in the condition into which he was trying to get the barrel. But man, although he has worked out a science of food chemistry that fills immense volumes, has not in the past been able to apply this knowledge so as to produce and maintain normal health, to say nothing of changing the very nature of his organism by the power of nutrition, as does the bee, guided only by blind instinct.

Science has probed more deeply into every other department of human affairs than it has into human health—the basic factor from which all other human activities spring. Every large city maintains an expensive health department, but its work is chiefly confined to sanitation. Many great colleges teach food chemistry, but have remained silent upon the important question of how it is to be applied or used so as to be of any practical benefit.

To know the chemical constituency of the human body is certainly interesting. To know the chemistry of food is likewise interesting. But what profiteth a man to know the chemistry of his body or the chemistry of his food if he does not know how to apply this knowledge for his own good—for the prevention and cure of disease? This knowledge is clearly within the realm of science, yet the Bureau of Chemistry, under our Federal Department of Agriculture, whose bulletins give the chemical analysis of all our food products, has nothing to say about how food should be selected, combined and proportioned under the varying conditions of age, temperature of environment and work, so as to give the best results in physical and mental health.

The reason of this failure is that food chemistry in the past has been studied and pursued as a "pure science," and not as an applied science. By pure science I mean a science the purpose of which is the mere finding out of things for the satisfaction of knowing, rather than for the purpose of using that knowledge. The philosophy upon which pure science justifies its existence is that when a man is looking for a definite thing he is very liable not to find anything;

but when he looks for truth for the sake of truth, he will find many things, some of which will be useful.

All branches of learning have their pure scientists. The knowledge of electricity was developed in our universities as a pure science long before Edison applied it. Professors in laboratories had played with wireless electricity many years before Marconi or De Forrest made it useful. Burbank is an applied scientist in plant breeding, but there are a half hundred professors in botany, whose names are unheard of outside of the particular college campus where they reside, who have more theoretical knowledge about plants than Burbank.

College professors are satisfied with the finding of truth. It takes a different kind of man to give it to the world in usable form. Pure scientists discover facts. Edison, Marconi and Burbank use facts. These men do things. The man of pure science is the miner of knowledge; he digs the crude metal which the man of applied science can work into a useful machine.

Why have we long had an applied science of electricity and of botany and of animal breeding and no applied science of human nutrition? The answer is obvious. The application of food chemistry or human nutrition is the work of building good bodies and keeping them in repair. That field of effort is occupied by the drug doctor, and so powerfully has he been intrenched in the public mind that it has taken many years for this branch of science to get recognition in a field where it finds its only application and use; but when once fully applied, it will be recognized as the most useful branch of human knowledge.

Why is Disease

Every century, since civilization dawned, has left upon the pages of history some great thing, something worthy of a place in literature and memory. Empires and dynasties have risen and fallen like bubbles on the water; bloody typhoons—called wars—have swept over the earth and exterminated races and changed the map of the world.

The mind of man was employed for thousands of years in trying to ascertain where he came from, for what purpose he was here, and where he was going. Stimulated and excited by invention and travel, only a few hundred years ago the faculties of gain and accumulation began their development. These have grown and evolved until they have reached such ugly and vulgar eminence that it is no longer respectable to be extremely rich.

It is only within the last few years that the intelligence of mankind has been directed towards finding out the really useful things in life.

So long as men looked into the heavens and said, "The Lord will provide," they never took much interest in performing that very important task themselves. So long as they depended upon ignorant kings and rulers for guidance, the brain was a useless lump of clay; but in this decade people are thinking.

The question mark is the sign of the times.

The universal password is "Why?" Why is disease so common and perfect health so rare? Why are the great majority of people afflicted? Why has the word "ease" been changed to "disease"? Why do we find so many specimens of perfect health and development in all other forms of life and so few among mankind—the king?

All forms of animal life on this globe, except man, live about eight times their periods of maturity. Man matures at twenty-four. Measured, therefore, by all other forms of life, he should live nearly 200 years. But he drops into his grave at an average age of forty—while he is yet in his youth.

There is a reason for this. And it has just occurred to the budding mind of the learned ones to ask, of what is man made? With what kind of material does he keep himself fed and repaired?

Disease is merely the outward expression or penalty for violated laws. Health is nature's reward for conformity to her laws. If man's present condition is imperfect and unnatural, to what must it be attributed?

The question at last is being solved. It could not long remain unanswered. It is too great, too important, too stupendous, too serious, for the great throbbing heart of the world to go on and give it no thought. The best talent in America—that throne and home of genius, whose light and literature have encircled the world—is beginning to turn toward this question. Men are really beginning to think something about the material out of which they construct themselves.

The Function of Food

The true function of food is to supply material for growth and for new tissue, to give to the body energy in the form of heat, motion, chemical and nervous action. Things which do not serve these purposes cannot be consistently classed as food. On the contrary, they are exactly the opposite, for when they are taken into the body, they must be excreted at the expense of energy. These facts should be observed in the selection of all materials used as food.

Obedience to nature's laws will keep life in the line of evolution to higher and higher degrees of perfection till it reaches that zenith to which nature is ever striving to bring all she creates.

But if these laws are violated, the process of evolution is interfered with, and the penalty is disease and death.

In the support and maintenance of life the first and most important thing is the substance upon which it feeds. Animals in their native state seem to put the proper appreciation upon foods. They instinctively reject that which is harmful—that which would interfere with nature's process of evolution—and accept as food that which is good for them. Man does not act with such wisdom. Civilization has created for him complex and artificial environments, in the chaos of which his instincts have been lost.

Man seems to have appropriated for food everything he could lay his hands on. His chief study and delight seems to have been the mixing and stirring together of all sorts of things, the combinations of which go to infinity. The most learned chemist in the world would not dare risk his reputation upon an attempt to analyze an ordinary Thanksgiving dinner.

The only true function of food is the growth and support of life. The needs of the human body are very limited. All the nutritive elements it requires can be found in the purest form in less than half a dozen different articles, which, in a natural and healthy being, should be selected by the demands of the system expressed by hunger.

The Stone the Builders Rejected

The digestive tract is a machine that makes blood out of food. Food is the raw material, the clay, and blood the building material, the tile—the body the finished structure. If you have poor building material, you will have a poor body. Natural (suncooked) food, in the right quantities and combinations, will make absolutely pure blood. Pure blood acts first on the brain, increasing thought activity; thought precedes all action. Pure blood builds up the body to its normal or natural condition, and fills it with strength, energy and vitality. It is the only thing that will make your skin fit your face. It will give you a bright, attractive and splendid personality—in short, it will give you ideal health. When you have perfect health you can brave anything; you will be in love with the world and people will love you, because the world is only a big mirror that reflects back the same image you present before it. Abundant health will make you cheerful and contented, and when you present a cheerful and contented front to the world, it will reflect the same thing back to you; then, and not till then, have you gained life's highest reward. Piling up money at the expense of your health is like a child piling up dust in the road only to be scattered to the winds by every vagrant breeze.

Nature never intended you to be thin, emaciated, pale, weak, nervous, irritable and sick. Health is your natural condition; disease has to be caught.

Errors in eating and drinking are the causes of nearly all congestions and accumulations of unnatural matter in the human body. Nature's process of eliminating these we call disease. Disease, therefore, is not an enemy but a friend to the human race. It is an effort on the part of nature to save us from self-destruction.

There never was, never will be, nor never can be a drug that will cure disease. It would be as much of a miracle to cure disease without removing causes as the turning of water into wine or raising the dead. Causes can only be removed by obeying the natural and infallible laws governing life.

Genius builds and furnishes our homes, constructs our ships and machinery, and clothes our bodies. Thought has transformed the modest daisy into the chrysanthemum, the wild rose into the American Beauty, the stage coach into the aëroplane, the courier into wireless telegraphy, and the tallow candle into the mercury vapor light, but ignorance still prepares and compounds our food. Ignorance is our steward and chef.

It seems incredible now that such men as Edison, Morse and Marconi, Schubert, Chopin and Wagner, Longfellow, Browning and Whittier, Huxley, Haeckle and Humboldt, Emerson, Ingersoll and Lincoln, men who have created miniature suns and stars, who have flashed civilization's ringing voice around the world; men who are twining around this globe a fabric woven from a woof and warp of wires and words, flashed over mountains and continents, over and under seas; men who, with rhythmic words and music's weird charm have planted in the human heart the roses of sympathy and love; men who have held aloft the shining torch of truth in the mælstrom of superstitious, dismal night; men who, with silver tongues and prophetic deeds, have placed our flag in the heavens and fixed the star of hope above the cradle of the poor man's child; men who have left literary legacies to the world and swept with their immortal pens every string on the harpsichord of human emotions—is it not strange, I say, that men like these have given no thought to the kind of material that would build the best blood, bone and brain!

MASTICATION

The stomach has no teeth. Teeth were the product of necessity. They were placed in the mouth by nature for the specific purpose of emulsifying food.

Food that is not thoroughly pulverized by mastication must be reduced to solution by the stomach and the other digestive organs. If it be such material as the various solvent juices will not dissolve, then it must be disposed of by disintegration, which starts with fermentation. This is the genesis of nearly all indigestion and intestinal disorders.

Fermentation changes food from a life-giving to a life-destroying substance. It generates poisons which are absorbed by the system and which prey upon the red corpuscles of the blood, lowering the vitality of every organ of the body.

Nature refuses to create and keep healthful any part of the anatomy which is not used. Allow the arm to rest at the side for a few months and nature will cease to feed it, and it will become feeble, emaciated and almost useless. Nature is a perfect economist. If the teeth are not used, she will refuse to keep them in repair; she will allow them to decay. She presumes that you do not need them because you have refused to put them to that use for which they were created. So long as people subsist upon soft, cooked, mushy foods, they cannot have good teeth.

While preparing this work I dined with some friends whose knowledge of the culinary art was very highly developed; from memory, I made an inventory of the quantity of food consumed by one of the most advanced disciples of French cookery; and according to my calculations, if the same quantity of material had been eaten in its elementary state and thoroughly masticated, it would have sustained the body under ordinary labor for a period of five days, and, with proper mastication, it would have taken about thirteen hours continuous chewing to have eaten the meal.

Thorough mastication will develop numerous flavors in natural foods that are a revelation in enjoyment to those who live upon them. The majority of people cheat and dull the keenest sense of taste and defeat the primary purposes of nature by yielding to their hurried environment. The most delicious flavors of foods are developed only by mastication, which gives the saliva time enough to act upon their chemical properties, and begin the process of changing and digesting them. For instance: the changing of starch into grape sugar is the first process of digestion; if done by mastication it develops a most delicious taste. If this most important function is not performed in the mouth by the act of mastication, the taste-buds are not only robbed of their rights, but extra labor is put upon the other digestive organs, and the process of digestion is much retarded and made more difficult.

Perfect mastication is the surest means of avoiding the habit of over-eating, which is so disastrous to the health and so common among civilized people. Every penny-weight of food taken into the stomach that cannot be used, is converted into poisons and becomes at once a leaden load upon the body. It so overburdens the excretory organs that they become torpid and congested, and a long train of common ills follow.

Food should be masticated until every atom is liquefied and is swallowed involuntarily. This would quadruple the pleasure of eating and eliminate nearly all forms of indigestion, constipation and over-eating.

In commencing the use of suncooked foods, the taste and appetite, so long fed upon fired and devitalized foods, must be reckoned with. If they accept the new diet, all is well; but should they rebel, give them some cooked food now and then. Then give them plenty of live, vital foods again, and the taste will soon accept the natural article. Then will one begin to live in a new world.

Until taste and hunger are sufficiently

well trained to demand such food as the system needs, we must employ science to aid them. We should avoid the continuous use of such things as contain similar nutritive elements, that is to say, we should not eat too much of any one thing. We should acquaint ourselves with the chemical constituents of the leading articles of diet, which will enable us to select intelligently our daily menu until abnormal appetite is changed to natural hunger.

No greater question can possibly command the thoughts of people than the study of nature's infallible laws of feeding. When the proper energy and vitality are given to the body by correct food, a certain amount of motion becomes imperative. We would not need to take lessons in physical culture. We would be forced to obey the demands of the body, thus sending to the lungs an extra amount of blood, which would cause deep breathing or extra oxidation of waste matter.

Therefore, if the great natural law of

feeding was obeyed, we would instinctively carry out the laws of motion and breathing, which would give us not only perpetual insurance against disease, but emblazon the way to perfect health.

Fletcherism

So important is mastication in the proper nutrition of the body that Horace Fletcher has made an " ism " of it. And a great and growing " ism " it is. When Fletcher's first book on the subject was published six years ago the doctors laughed—so did a good many other people. But Fletcher's words have run into many editions in many languages, and Horace Fletcher, a man under medium size and past the supposed prime of life, and who subsists upon about one-third the quantity of food the medical authorities prescribe, continues to break strength and endurance records; while universities, magazines and chautauqua managers invite this retired merchant to come and tell people how to chew their food—and why.

Animals, in their natural state, masticate their food leisurely and thoroughly. Grazing, seed-gathering and fruit-eating animals are all great chewers; in fact, they spend a large portion of their time eating, as their only purpose in life is to secure food and procreate their kind. With such animals there is no incentive to bolt food, and as such a process would result only in harm to the animal who practiced it, natural selection has eliminated the tendency. But when a pack of wolves captures and slays a buffalo eating becomes a matter of competition. The wolf who transfers the most buffalo meat to his interior in the least possible time has the best chance of living through the period of starvation that may ensue before the next buffalo is slain. Mastication to an animal with such feeding habits is a decided handicap; nature, therefore, puts the function of flesh digestion in the stomach and turns the wolf's teeth into mere tearing organs. The carnivorous beast had to eat in this manner in order to live, and in the scheme of adaptation nature has harmonized digestion with the method of eating. Man, roaming through the primeval forest, did not find great piles of mashed potatoes, festoons of bologna or plates heaped with corned beef and cabbage. As he began to be civilized, and these wolf-like methods of feeding were introduced, he learned to bolt his food in order to get his share, and to compete in the race for other things to satisfy his vanity. Were nature as speedy in her changes, as artificial habits are in their growth, man would long since have lost his teeth and salivary glands, and acquired a food paunch like that which the camel has developed to carry water in the desert. But evolution does not work so rapidly, and each generation of humans is born with teeth and salivary glands, and anthropoid tastes and appetites. Each individual, under the laws of civilized custom, is taught the neglect and abuse of these functions, which bring along a train of human suffering, and the Creator is accused of sending an affliction.

These same people are usually law-abiding citizens. Were they to violate a code made by their fellows, they would expect to suffer the penalty, but it seems never to have occurred to them that every molecule in this sphere and every star in space moves in obedience to divine ordinance, and that everything in this universe, man included, is created and developed according to laws that stand inexorable, infallible, unchangeable. If anything is divine, the laws that control man's development are divine, and their penalties are just and certain. Man has been fitted into them by the long process of evolution, which preserves those who obey, and eliminates those who fail to conform to the great cosmic scheme. Man is a result, not a cause. His health and disease are the direct results of his knowledge or ignorance of, his conformity to or disobedience of, the divine edicts of nature.

People, who should commune with each other to learn from the common experience of all the laws of nature, and the inevitable results that follow their obedience or violation, meet instead, about once a week, and appoint one of their number, who is a good attorney, to talk to the Creator. This mediator instructs the Creator in His duty, reminds Him of His promises, beseeches Him to change His mind, prays Him to reverse the laws of the universe—to cure Sister Sutton's rheumatism (which was caused by violating the divine laws of diet)—and usually winds up by telling Him to do as He pleases, and they will all be satisfied.

Instead of pleading man's cause before the courts of heaven, were the same energy and time devoted to studying his natural requirements under the varying conditions of his civilization and environment—searching for causes, digging through the sham veneer of dietetic artificialism down to truth, and teaching it to the masses—an amazing revolution in the health and morals of the nation would result.

Fortunately, the Creator works through natural laws, and the laws of inheritance are not affected by the perverted habits of a few generations of rebellious beings. Mr. Fletcher's observations upon children have proved emphatically that it is "natural" to masticate our food. We learn to bolt it. We often see painful examples of this educational process in the ordinary home when the child is not only given a continuous diet of artificially softened and moistened food, but is urged to hurry with his eating. The impatience shown and the ridicule thrust upon the child by other members of the family whose appetites and habits are already depraved, when the young creature is trying with all the instinct of his being to live aright, is one of the pathetic crimes of civilization.

The only mistake of Fletcherism, as taught by the originator, is that he instructs the people to Fletcherize the conventional bill of fare. This is good so far as it goes, especially for those who have taken up the idea with sufficient mental enthusiasm, but the ordinary mortal who for years has been

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subsisting upon biscuits that "melt in your mouth," and gravy with mashed potatoes, finds the gulping habit too strong to be readily overcome, and after making a few half-hearted efforts and seeing no change in his bodily welfare, he gives it up. Yet this same individual would chew apples or nuts to exceeding fineness.

Foods, in their natural condition, are in such form as to command, at least to induce, about the proper amount of chewing, providing one's mental state is at all normal. Starch foods especially need mouth digestion, while cellulose foods require to be thoroughly macerated so that the cell walls will be ruptured and permit the escape of the enclosed nutriment. Such foods in their natural state require thorough mastication before they can be swallowed. The process is instinctive. Sugar and proteids do not, in the economy of digestion, require much insalivation; hence a raw egg or a ripe peach may be taken with less mastication than grains or green vegetables.

It takes a most depraved appetite, indeed, to bolt nut meats or a leafy salad. On the other hand, it takes a most heroic mind to chew soup and masticate a corn-starch custard. It is too much like practicing boxing without an opponent or a punching bag.

Horace Fletcher at the age of fifty was a health-broken business man. The life insurance doctor refused to grant him a policy. Mr. Fletcher, now approaching the three-score mark in years, is a record-breaking young athlete and the possessor of the rosy mental and physical health of the prime of youth. Is it any wonder that he should feel that in mastication he has found the key to the problem of an efficient human machine? Mastication and Mr. Fletcher's willingness to be led by his natural appetite have caused him to adopt a diet consisting chiefly of natural foods, but the emphasis of his teachings are devoted almost wholly to mastication, with but slight reference to the selection and combination of foods. To chew our food is natural—if we have something to chew on.

The conventional cooked diet does not supply this. The uncooked or natural diet, in addition to its other virtues, does supply it and finishes and perfects the theory of Fletcherism.

Had Mr. Fletcher, instead of saying, " Chew your food, if it requires chewing, if not, chew it anyhow," changed his slogan and said, " Nature made food for teeth and teeth for food; eat natural food and chew it because you must," I am confident his most excellent work would have had a vastly greater influence.

We grind something in a mill and bolt it, roast it, grind it again, predigest it with diastase and pepsin, boil it with water, run it through a fine sieve, mix it with milk and egg and cook it again, dress it with melted butter and serve with whipped cream—is it not " rubbing it in " to ask us to pay for all this, and then go through a sham process of doing over again what isn't there to be done?

Decay of the Teeth

The destruction of the teeth bears a very close relation to the development of the various forms of malnutrition. The two prevalent causes for the loss of human teeth are, first, caries (commonly known as decay), and, second, pyorrhea alveolaris (commonly known as Riggs' disease).

Caries. The initial cause of caries is decomposing food. This produces an acid which dissolves out the minute inorganic salts of which the tooth is largely formed. This exposes the organic portion which lies beneath the inorganic part.

The exposed organic surface becomes decomposed, adding to the destructive acid which in turn dissolves out more of the inorganic salts. This double action may destroy the entire crown and even the roots.

Pyorrhea Alveolaris (by which the tooth is lost through demolition of its socket) commences through irritation of the gum tissue and peridental membrane. This membrane nourishes the socket and periphery of the root and attaches the root to its socket.

Calcareous deposits from the saliva and from the serum of the blood (exuded from the inner surface of inflamed gum tissue, added to which is more or less organic matter from the mouth) combine to form pyorrhea deposits, which press against the exposed margin of the peridental membrane, inflaming and gradually destroying it. Thereupon, that portion of the socket breaks down to the point of destruction of the nourishing membrane. As the socket disappears it leaves a space or pocket between the gum and the root. The gum becomes inflamed and lax, and the root becomes covered with a tenacious deposit, most difficult to remove, and sometimes almost inaccessible. The disease continues till none of the socket is left, when the loosened tooth can be picked out with the fingers.

Riggs' disease is frequently not recognized until a tooth has commenced to be loose, as there is little or no pain attending it during the early stages. Under all conditions this trouble can be prevented by more or less frequent instrumentation. It is, therefore, most important, under the present methods of living, that periodic visits be made to some dental practitioner, competent to successfully cope with such disorders.

When the saliva of the civilized man is compared with that of the savage, the latter, like that of animals in their natural state, is found to be in reaction decidedly alkaline; while our saliva and that of pet animals in confinement, and fed on prepared food, is weak alkaline, occasionally reaching an acid reaction, while the mucous secretion of the mouth is often thick and of acid tendency. It is a fact that alkaline saliva unites with normal mucous secretions so as to retard decomposition and neutralize acid. This difference has been found to be due to different conditions of saliva.

Summing up thus far, we find that the condition of the fluids of the mouth has much to do with preserving teeth from decay.

PREVENTION OF RIGGS' DISEASE. Chemical analysis of saliva shows it to contain alkaline salts in solution. Alkaline salts are insoluble in acid. Therefore, should the saliva by any means become acid in reaction, these salts would become insoluble and be precipitated or deposited. On rare occasions this occurs in a gland or duct, and then sometimes causes serious trouble.

A large percentage of cooked foods contain waste material, and in order to secure the required nourishment the digestive tract is overtaxed, producing unconscious and involuntary mental and physical effort which the individual does not realize. Added to this is a tendency toward decomposition in the alimentary canal, which, to a degree, contaminates the entire system and influences the character of the various secretions, including the saliva. It also tends to debase the vital standard of all the tissues, particularly those about the dental organ—the teeth—rendering the peridental membrane and gum less resisting to irritation. Many cooked foods, also, have an undue tendency to cling to the teeth.

The quality, quantity and kinds of food place an individual at a decided mental advantage or disadvantage. Meat, which is usually under the process of decomposition when eaten, tends to induce uric acid in the system. Animal food is no longer considered necessary for physical strength. Shreds of tissue from cooked meats often become wedged between the teeth, injure the gum, and produce gingivitis, which is a precursor to pyorrhea alveolaris.

We should partake of our food in a cheerful, meditative and tranquil mental condition; we will then masticate naturally. We should exercise the same rational care to protect our health that we employ to protect our business.

The only excuse nature offers to man for creating him is that she gives him liberty and the means of securing his happiness and contentment. Yet nearly everything he does with reference to his physical structure seems to be especially designed to defeat this purpose.

There is a great deal of pleasure to be gained from eating, but when our highly civilized man comes to perform this very important function, he shovels in the provender with one hand while he makes out a mortgage or figures interest with the other. The result is that he gets no happiness from the interest, but a great deal of unhappiness from the provender; and stands at the age of forty dejected and defeated. Half the amount of study bestowed upon himself and the inexorable laws of nature that he has given to the foibles of fashion or the fight for gold, would have given him health and abundant vitality up to and even beyond the century mark.

In old age, that time of life when selfish ambition and strife is ended, we stand before our fellows with accumulated knowledge and with no purpose to serve except the common good. This should be the happiest and most valuable period of life.

The secretion of the digestive juices is not determined, as was formerly believed, by the presence of food in the stomach, but by impulses sent from the brain and other nerve centers.

The presence of food in the digestive organs is one of the stimuli that cause these nerve centers to act, but not the only one. Scientists have proved that food introduced directly into the stomach without the senses of taste, sight or smell, in other words, without the mental associations that go with natural eating, stimulates the secretion of just about half the quantity of gastric juice necessary to its digestion. That this is the case in the secretion of saliva any person may prove by personal experiment. The natural inference is that the other digestive juices are likewise controlled, and we readily see in this fact the reason why wrong or disturbed mental conditions are so potent in producing digestive and other bodily disorders.

The digestive juices are not only controlled by mental stimuli as to quantity but also as to chemical composition. The mind unconsciously takes recognition of the nature of food through the senses of sight, smell and taste, and sends messages all along the line ordering the secretion of certain quantities of digestive juices containing certain proportions of pepsin and hydrochloric acid or amylopsin and intestinal alkali.

There is no more marvelous provision in nature. We think it wonderful that a bee by instinct can build a mathematically accurate cell. But the bee always builds that cell hexagonal. Could she, at her convenience and according to surroundings, construct a triangular, oval, round, square or pentagonal cell, she would be an engineer rivaling the ability of the instinctive chemist that resides in the alimentary nerve centers.

By this wonderful adaptation the man or animal living on natural food is abundantly protected against the ills of indigestion, but for civilized man the food manufacturer and the cook stove have spoiled all this. Man's instinct was evolved to tell peas from peaches and eggs from apricots, but, alas, for the digestive instinct when the owner sits at the Delmonico or Sherry board. Beside him stands a bowing, smirking waiter, who hands him a cardboard. " Ris-de-veau, Davoust-Jambon Porte, Maillot-Escargo, Bourguignonne " meets his eye. The digestive instinct is a stranger in a foreign land. It does not read the language. The man is puzzled—the waiter suggests, " Try some Lobster in Casserole Bourgeoise." " All right," replies the man, and the waiter goes to the manufacturing department.

The man's gaze wanders over the room; his eye catches a bunch of celery on his neighbor's table. The digestive instinct can understand that language and it manufactures juices for celery. The waiter arrives, the compound is served, its smell and taste are strange to the digestive instinct, but the man forces it down and orders Poires Marquise, Bombe Shah de Perse and Café Parfait. Then he drinks a Parfe d'amour, smokes a Manuel Garcia Came il Faut, and goes his way.

Presently the captain of finance receives inside information that something is wrong. The celery juice is wrestling with the rustic lobster, and the crustacean is getting the best of it. That evening he goes to his physician, who prescribes nux vomica and sodium bicarbonate. This is too much for the instinct of digestion, and she follows the way of the cave bear and the three-toed horse, leaving the field clear for the " higher " things of modern civilization.

Not only is the digestive instinct a skilled chemist, but a master mechanic as well. The reader has no doubt noticed the " lumps " pass down the throat of a horse or cow as the animal drank water or swallowed food. This wave-like motion is known as peristalsis, and is active throughout the whole length of the alimentary canal. Upon this motion all digestive processes are dependent, for the food in process of digestion must be moved along to bring it at the proper interval into the region, when it will be supplied with new digestive ferments and the digestive products be normally absorbed. If the peristaltic action is deficient or delayed, the waste products of digestion will remain too long in the alimentary canal causing constipation and decomposition.

On the other hand, if food passes through the body too rapidly, as in the case where, by the administration of purgatives, the peristaltic action is stimulated to an abnormal degree, food material may pass out of the body before digestion is anywhere near complete. This results in plain starvation, and accounts for the rapid loss of weight in the case of chronic dysentery and similar diseases.

Some Revelations of the X-Ray

Some interesting experiments have recently been made upon cats (this animal being immune to the harmful influence of the X-rays) that have thrown much light upon the relation of the mind to the digestive processes. The cat is allowed to become very hungry, and is then given food charged with bismuth subnitrate. This is an insoluble and harmless salt that has little effect upon digestion, but which is opaque to the X-ray. When the X-ray shadow of the "bismuth cat" is thrown upon the fluorescent screen, the motions of the alimentary canal are plainly visible.

After the cat has become reconciled to the experimental environment, it becomes possible to study the effects of the mental states upon the movements of digestion. Peristaltic action is found to be almost wholly dependent upon the mental attitude; when the cat is annoyed or frightened the movement becomes irregular, and if the condition is prolonged it ceases entirely. Anger, fear and unpleasant emotions interfere with digestion, while quiet, rest, sleep and mental tranquillity are invariably accompanied by normal and regular digestive movements.

The discovery of the adaptation of the digestive processes to the food, by means of mental impulses, throws more light upon the present prevalency of disease than any discovery of modern science. Knowing these facts, reason would at once tell us that we should partake of food only in its natural state, and in such combinations, and in such a manner that the senses can take full cognizance of what is offered as food, and dictate by appetite how much is to be eaten.

Mr. Fletcher says, "Taste your food." That is part of it—a big part. In addition, I would say, "See your food, smell your food, and think of your food as being for your body's best nourishment and good." In addition to this, eat only when you are hungry, when your mind is occupied with light and pleasant thoughts, and free from worry of every kind. If you are worried or overworked, do not eat, or if the period of this condition is too long, select foods that are readily soluble, and partake of very limited quantities.

The writer has a friend who is an engineer. The nature of his work is such that he is occasionally kept at severe mental action for as much as thirty-six hours at a time. During such times the company is in the habit of serving regular meals to the men every six hours. My friend had been accustomed to eat these meals, and after each period of over-time work had suffered a severe attack of indigestion. I recommended that he cease eating, or partake only of small quantities of certain readily soluble foods during such periods. He found under this system that he could work thirty-six hours without sleep, and feel none the worse for the experience. The food he had taken while under the mental strain of continuous work had undergone a process of fermentation and premature decay, and had poisoned instead of nourishing him.

So great is the mental influence upon nutrition that many who have had their attention called to this subject have cured themselves of various disorders by simply correcting the mental errors in their nutrition. The errors of wrong food selection and wrong mental processes during digestion are very closely related. Natural foods suggest a correct mental attitude, and give the instincts of digestion a chance to work.

The psychology of nutrition is a new subject of which we have much to learn. When we have learned, we shall accord both reason and instinct their proper spheres of action, and the inharmonies that now tend to destroy both body and mind can no longer be.

THE CHEMICAL SUBSTANCES OF FOODS

Carbohydrates

The word carbohydrate means carbon combined with water, i. e., the element carbon is combined with hydrogen and oxygen, which exist in the carbohydrate compound in the same proportion as they exist in water.

Carbohydrates are closely related chemically to alcohols, so far as their composition is concerned, but this does not imply that they have the same physiological effect in the animal body.

Carbohydrates are divided by the chemist into three classes, known as Monosaccharids, Disaccharids and Polysaccharids. The principal carbohydrates found in foods are given in the table below:

Monosaccharids.	Disaccharids.	Polysaccharids.
Pentoses,	Cane Sugar,	Starch,
Glucose or Grape Sugar,	Lactose,	Glycogin,
Levulose,	Maltose.	Gums,
Galactose.		Cellulose.

Pentoses have in the past been neglected by the food chemist. They exist in the coarse parts of plants, such as stalks and leaves; hence the carbohydrates of green plants contain a percentage of these pentoses. Pentoses are never separated from the plant as are other sugars; therefore, we may consider their physiological effect in the particular plan rather than study them as separate food materials.

Glucose, or "grape sugar," is the most important sugar known, from the standpoint of the physiological chemist. This sugar is normally found in considerable quantities in human blood, and is absolutely essential to the life process. The real use of glucose forms an amusing contrast with the popular conception of the term "glucose" as something injurious or poisonous.

Glucose is found in nature in all fruits and also in honey. It may be taken into the human body directly from such fruits, or it may be formed in the body by the digestion of other carbohydrates. It is the most wholesome of all sugars.

Levulose is the companion sugar of glucose, and exists in many fruits. Levulose is often called " fruit sugar." The composition of levulose is exactly the same as glucose; the difference between these sugars is due to the different ways in which the atoms are combined. The elements exist in the same proportion, but the atoms are arranged differently. Levulose, for all practical purposes, may be considered as equal to glucose in the human body. It is sweeter than glucose, resembling cane sugar in point of taste.

Galactose, which is of the same composition as the above, is another companion sugar to the first mentioned, and is formed by the digestion of lactose or milk sugar.

Just as there are three monosaccharid sugars with six carbon atoms each, there are three disaccharid sugars of interest to us, which have twelve carbon atoms each. The first of these is the ordinary commercial sugar made from cane or beets, the sugar from both sources being identical from a chemical standpoint. This sugar, when digested in the human alimentary canal, or by artificial means, combines with water and forms glucose and levulose.

The second is lactose, or milk sugar. Milk has about 5 per cent of this sugar, but would taste sweeter with as much cane sugar, for all sugars do not affect the sense of taste to the same degree. When lactose is digested, it, like cane sugar, combines with water, but instead of yielding glucose and levulose, yields glucose and galactose.

Maltose is the third member of the disaccharid group, and is of the same composition as the other two. Maltose derives its name from malt. It is formed from the starch of grains by the process of malting. Maltose can be further decomposed into monosaccharid sugars just as may cane sugars, but instead of forming two separate simple sugars, it is wholly converted into glucose. Maltose does not exist in man's natural bill of fare.

Starch. The proportion of the elements in starch is the same as in sugar, but the number of atoms that are combined is many times greater and is not accurately known. This is purely a theoretical consideration and of no practical interest, except that it shows that the polysaccharid is capable of being digested or broken up into many simple carbohydrate compounds.

Starch is the most abundant carbohydrate known. It is the chief constituent of all grains, and is found in large quantities in green fruits and tuberous plants. Common potatoes are composed chiefly of starch and water. Starch does not dissolve in water as do sugars.

Starch occurs in small grains or granules. These starch grains may be seen under a magnifying glass; in fact, the starch grains of potatoes can almost be distinguished with the naked eye. They are not atoms or molecules in the chemical sense, but are little masses in which starch has been deposited as it is formed in the growing plant. When boiled, these starch grains, which in the cold state are hard, solid particles, swell into a mushy or gelatinous mass, which forms starch paste. When starch is heated dry until it begins to brown it is changed into a compound related to the gum group, known as dextrine.

If starch is treated with digestive fluids, as saliva, or with certain acids, it goes through a complex process of digestion in which it is first turned into soluble starch, then into the various forms of dextrine or gums, and finally into maltose or the malt sugar which we have already studied.

As we have noted that maltose may be changed by digestion into glucose, we see how the starch in foods may be converted into the glucose of the blood. Just as glucose may be formed from starch, so maltose may be made by treating starch with malt. The brewing of beer depends upon chemical changes induced in starch by malt. Barley is ordinarily used for this purpose. The barley is sprouted in a warm, damp room, and a process of starch digestion begins, which is necessary in order that the young barley sprouts may grow. This changes the starch into maltose. The digestive principle developed in the barley malt may be utilized to malt other grain by mixing them with the sprouted barley.

If this process of malting is arrested at the proper time, and the sugar dissolved and extracted, a product is formed consisting chiefly of the sugar maltose. This is the basis of malt extract, malt honey, and many similar foods put on the market which are claimed by the manufacturers to have wonderful dietetic and curative values; but as there is no malt sugar in natural foods, and man's digestive apparatus has not been equipped to deal with it, the opposite conclusion would seem more rational, and in the light of the writer's experience is nearer the truth.

Glycogin is commonly called animal starch. It exists in the liver in small quantities. All carbohydrates are digested in the alimentary canal and absorbed in the blood in the form of simple sugars of the glucose group. When these sugars reach the liver they are again built up into a complex carbohydrate very similar to starch in composition. This glycogin or animal starch is stored in the liver until the body has need of it, when it is changed back into glucose.

The gums include a group of rather complex carbohydrates which are intermediate between starches and sugars. There are many varieties of gums derived from plants and which have various commercial uses in the market, such as gum arabic. The basis of ordinary chewing gum is not true gum, but is a petroleum product which is wholly indigestible.

Dextrine, of which we have already spoken, is formed from starch. Dextrine has no dietetic qualities that do not exist in starch, and, as with maltose, it comes into the digestive apparatus in a form not found in nature, and hence one for which no digestive adaptation exists.

Pectins are a group of gummy substances found in fruits, especially green fruits, and are in process of being formed into sugar. The pectins form the basis of fruit jellies. Green grapes, as every housewife knows, will make better jelly than ripe grapes. This is because the pectins in ripe grapes have been transformed into sugar. As fruits when eaten green are prone to cause digestive disorders, it would seem the better part of wisdom to allow nature to complete her digestive process and take all fruits in the ripened state.

Cellulose is, from the standpoint of human feeding, not a food product. Cellulose is practically indigestible by the juices of the human alimentary tract. An example of pure cellulose is cotton fiber. Wood is almost pure cellulose. The bran of wheat or corn is chiefly cellulose. Cellulose can be digested by strong acids into simple carbohydrates. Sugar can be thus manufactured from wood or rags, but the process is now too expensive to be applied commercially. Some of us may live to see the time when the chief food of mankind will be manufactured from scrap lumber and waste paper.

All plant products in their natural state contain some cellulose, though the percentage is very small in such articles as rice. Cellulose is valuable chiefly for its mechanical action in the digestive organs. Bacteria have the power of digesting cellulose. The bacterial action or fermentation in the human intestine may cause a slight amount of cellulose to be digested, but this is of no consequence from the nutritive standpoint, and is rather to be avoided than desired. Grazing animals have considerable power to digest cellulose. Goats, especially, have this power well developed. The goat who breakfasts off of the clothes-line is no more perverted in his appetite than the man who breakfasts on buttered toast.

Fats and Oils

The fats and oils in food products, whether of plant or animal origin, contain the elements—carbon, hydrogen and oxygen. These fats are formed by a combination of the fatty acids with the substance glycerin, which belongs to the alcohol group. Stearin, palmitin, olein, butyrin, are the more common food fats.

Natural fat from any source will usually contain several of these chemical compounds. The ordinary animal fats, such as tallow or lard, are formed chiefly of the two fats, stearin and olein. The different proportions of these fats will determine the melting point or hardness of the mixed product. Olein is a liquid at ordinary temperature, while stearin is solid. The reason that tallow is a firmer fat than lard or butter, is because it contains a larger per cent of stearin.

Olive oil, cotton-seed oil and other vegetable oils contain large per cents of olein, which accounts for their being liquid at ordinary temperature.

Butyrin is a fat found in small quantities in dairy butter, and does not exist in the cotton-seed oil and other fats from which oleomargarine is manufactured. This is the reason that artificial butter lacks the flavor of the dairy product, though this is remedied to some extent by churning the fats of the cotton-seed oil and tallow with fresh cream, which imparts a small quantity of the butyrin and similar compounds to the oleomargarine and gives the characteristic flavor of butter.

Besides the more common fats that we have mentioned, there are many fats that exist in certain vegetable oils in small proportions, and that give them properties which may render them unfit for food.

When fats are heated to a high temperature they decompose and form various products, some of which are irritating and poisonous to the human system. In the manufacture of packing-house and cotton-seed products the stearin is often separated from the olein. The granular appearance of pure leaf lard is due to crystals of stearin. In the packing-house stearin is separated from the tallow in large quantities. The stearin is used to make candles, etc., while the olein is used for food purposes, in this country, in the form of oleomargarine, or some such cooking product as cottolene, while in Europe it is used under its right name as a cooking product. It is as wholesome, if not more so, than lard.

Fats may become rancid; this is a natural decomposition of fat due to its uniting with the oxygen of the air. Nut kernels frequently become rancid from this cause. This can best be prevented by keeping them in air-tight packages.

Proteids

The food substances which contain nitrogen are commonly called proteids, or, if these compounds are considered together, the name of protein may be given the group. This protein is not one single compound, but includes all substances which contain the element nitrogen in such combinations as are available for assimilation in the human body.

Proteids are necessary to the existence of animal life. With the exception of fatty tissue, all the organs and tissues of the body are composed chiefly of proteid substances. These proteid substances in the human body can only be formed from proteid substances taken in the food, because no other food substances contain the element nitrogen and the body cannot make elements or change one element into another. Neither do the cells of the animal body have the power of effecting a combination of elementary nitrogen with the other elements. This power is possessed by bacteria that utilize the nitrogen of the air to form mineral salts or nitrates. Plants, in turn, have the power to unite the nitrogen derived from these nitrates with carbon, oxygen and hydrogen. In this way organic nitrogen or proteids are formed. The animal body may digest these plant proteids and transform them into other forms of proteids needed by the animal organism.

All proteids contain carbon, hydrogen, oxygen and nitrogen, most of them sulphur, and a few phosphorus. Iron, copper and bromide are also occasionally found in proteid compounds. The percentage by weight of the various elements which form the average proteid is as follows:

Carbon	52%
Hydrogen	7%
Oxygen	22%
Nitrogen	16%
Sulphur	2%
Phosphorus	1%

Proteid substances are properly divided into three groups as follows:

Simple Proteids.	Compound Proteids.	Albuminoids.
Albumins,	Respiratory Pigments,	Collagen,
Globulins,	Glucoproteids,	Gelatin,
Nucleoalbumins,	Nucleins,	Elastin,
Albuminates,	Nucleoproteids,	Reticulin,
Coagulated Proteids,	Lecithin Albumins.	Keratin,
Proteoses (Albumoses),		Skeletins.
Peptones.		

Besides these real proteids, there are a few substances known as amido compounds, which exist in small quantities in vegetables and a number of nitrogenous substances, which exist in meat and meat extracts, and which are not true proteids, as they have little or no nutritive value, but act as stimulants or irritants in the body.

Another class of nitrogenous substances which may be found in food products are ptomains. These are formed by the growth of bacteria and are in reality the nitrogenous waste products of bacterial life. Ptomains are apt to develop in meats and dairy products held in cold storage, and are sometimes the cause of serious poisoning.

Albumin is one of the commonest and simplest forms of proteid known; it is found in the white of egg, in milk and in blood. It is coagulated by heat and by certain chemicals, such as acids, alcohol and strong alkalies. Albumin is soluble in water and weak solutions of salt, but is not soluble in very strong salt solutions.

Globulins are much like albumin in properties, but are not soluble in water. They are, however, soluble in dilute salt solutions. Globulins exist in considerable quantities in the yolk of eggs and in the blood. The globulin in the body could not remain in solution if there was not always present a small quantity of salt in the blood. There are several types of globulins. Fibrinogin of the blood, which coagulates when the blood is exposed to the air, forming clots, is a globulin. Hemoglobulin, which is the chief component of red blood corpuscles, and which unites with the oxygen in the lungs and carries this oxygen to the various tissues of the body, is another form of globulin, and one which contains a considerable amount of iron.

Casein is the most important proteid substance in milk and is familiar to all as the curd or white substance of clabbered milk. A related form of vegetable casein is found in leguminous seeds such as beans and peas.

Proteoses and peptones are forms of proteids that are formed by the digestion of other proteids. They are not found in natural food, and the same remarks made regarding maltose and dextrine will apply to the use of these substances in the diet.

The compound proteids which we mention

in the table do not need any particular discussion, as they form a very small part of ordinary foods.

The albuminoids are proteids formed in various portions of the body, and are of a more complex nature than are albumin and globulins. They are also insoluble and difficult of digestion. Keratin is the chief proteid of the epidermis or outer skin. It is comparatively indigestible. Collagen is the proteid found in the connecting tissues of the body, ligaments, tendons, etc. Skeletin, elastin and reticulum are similar products which are found in the various tissues of animals. None of these products can be considered as suitable food materials for man, although the stomach has the power of digesting them to a limited extent.

Food Salts

The subject of salt in food has received considerable discussion and attention by scientific investigators, and many theories have been advanced by those interested in hygiene as to the effect of common salt used in food. The tissues and organs of the body contain certain salts, and without these salts life could not exist, but it does not follow, as some would interpret, that these salts need to be supplied separately from the forms of foods produced by nature. Food should not be of an artificial nature, such as would free it entirely from its mineral salts. A diet of sugar, pure oil and artificially prepared proteids would absolutely fail to nourish the body for any length of time, because of the lack of mineral salts. All natural food products, whether of vegetable or animal origin, contain a small but ever-present proportion of mineral salts. This is especially true of milk, eggs and the seeds and green portion of plants. The amount of salts in the human body is considerable, especially the calcium phosphates of the bones, but the amount of such salts that need be supplied daily in food is small because they are not consumed as rapidly as are the other elements of nutrition.

Several foods, especially rice and corn, are somewhat deficient in salts. At one of our experiment stations some pigs were fed exclusively on corn diet, and others on a diet of grain and green forage. At a certain age the pigs were killed and the bones were weighed and tested for strength. The bones of the pigs which had been on a corn diet, which is deficient in mineral salts, were about half as heavy and strong as the bones of the pigs fed in a more natural way.

Water

The human body contains about 60 per cent water. The water in the body might be roughly grouped into three divisions. First, water in small quantities enters into the actual chemical composition of the body. As we noticed, in the discussion of carbohydrates, water combines chemically with cane sugar when it is digested and transformed into glucose.

The second use of water in the body is to form a portion of the tissues and to act as a solvent in the bodily fluids. In this function the water is not changed chemically, but is only mixed with other substances; thus the blood is in reality water with glucose, peptone, etc., in solution and carrying along red blood corpuscles, fatty globules and other particles. A third use of water in the body is in the control of the temperature by means of perspiration, the evaporation of which has a cooling tendency.

Theories have been promulgated by hygienic teachers in the last few years, claiming that man should get his supply of water wholly from the juices of fruits and not drink ground waters, which are contaminated with mineral substances. While it may be true that water in certain localities, such as the alkali deserts and limestone hills, is unfit for drinking, yet the writer is of the opinion that the promulgator of the theory that man is not a drinking animal has never done a hard day's work in a Western harvest field. In the drying winds of the Western plains water evaporates from the surface of a man's body at the rate of 12 to 15 pounds a day. The theory of deriving one's water wholly from fruits and salads would not stand the test of such facts.

The best drinking water is rain water. Distilled and aërated waters, which are so abundantly manufactured by artificial processes, are mere imitations of nature's method of producing rain water. Science, however, has never proved that the small quantities of salts contained in normal ground water are of any injury to the human organism.

THE CHEMISTRY OF DIGESTION

The digestive juices of the human body are five in number, namely, saliva, gastric juice, bile, pancreatic juice and intestinal juice. These five juices are secreted from the blood by special cells or glands. Each of these juices contains one or more enzymes or digestive principles. These enzymes are highly organized chemical compounds which have the property of changing other chemical compounds without being destroyed or used up themselves except in minute quantities.

Malt, which is produced by the sprouting of barley, is a true digestive enzyme of the barley. Thus we see that plants, as well as animals, may have enzymes. The yeast cells that cause the fermentation of bread are minute plants which secrete an enzyme which causes the effect noted. It was formerly thought that the fermentation of yeast could not take place except in the presence of a living cell. This has now been disproved, as a German scientist has succeeded in grinding up yeast cells and filtering off the chemical compound or true enzyme which causes the fermentation of sugar.

It is now recognized by scientists that all processes of fermentation and digestion that are found in plant and animal life are due to definite chemical compounds known as enzymes. The action of digestion is then a truly chemical one, and could take place without the body as well as within, if we could manufacture the proper enzyme and produce the exact conditions of temperature, moisture, etc., that are found in the human alimentary canal.

The manufacture of predigested food depends upon various processes of fermentation or digestion that may be carried on by inorganic chemical agents, such as acids, or by ferments of bacteria or other forms of life. The malting of starch for the production of malt sugar, or fermented liquors, or the making of cheese by the action of the enzyme rennet, which has been extracted from the stomach of a calf, are examples of artificial digestion.

A great amount of discussion has been raised over the subject of predigested food. To answer the question intelligently, we must consider the chemical process involved in each case and the final product, both as to its mechanical and chemical condition. If a product is formed which is the natural food of man, the process is good; otherwise it is wrong.

With this diversion, to illustrate the breadth and importance of the action of enzymes, we will again consider the chemical action of the human digestive organs.

The saliva is the digestive juice of the mouth. It is secreted by three pairs of salivary glands. The secretions from these three glands are slightly different in composition, but for our purpose may be considered as one. The saliva is an alkaline fluid, and the digestive principle that it contains is a starch-digesting enzyme known as ptyalin.

The further functions of the saliva are to moisten food and facilitate swallowing.

Digestion in the Stomach

The importance of the stomach as an organ of digestion has been over estimated in modern times. In fact, from the discussions in the average text-book on physiology one would be led to believe that the stomach was the only organ of digestion, when, as a matter of fact, the chief purpose of the stomach is that of a receptacle for the storage and preparation of food for digestion later. Food passes through one process of digestion or preparation, but is not completed in the stomach; and all foods which are acted upon by the gastric juice can also be digested in the intestines. This has been proved by the fact that surgeons have successfully removed the stomach from both animals and men without seriously interfering with the nutrition of the body.

The stomach should be considered as a preliminary organ of digestion. The tables published in the physiologies giving the digestibility of various foods as requiring so many hours, refer to the length of time it takes for the food to pass out of the stomach. According to these tables boiled rice is given as one of the most digestible of foods. The reason why rice passes out of the stomach more quickly than other grains is because it contains practically nothing but starch; and as starch is not digested in the stomach, rice is passed on to the intestine much more rapidly than other foods which contain a larger per cent of protein, which goes through a longer process of stomach digestion.

In this connection it becomes necessary to refer to the interpretation of the experimental results obtained by investigators at the Battle Creek Sanitarium. In these experiments cereal products which had been put through various processes of predigestion were compared with uncooked whole wheat, the contents being artificially removed from the stomach by lavage after a given period of time. The results of this experiment showed a greater amount of starch digestion in the case of dextrinized or supercooked foods. These results were published as proof that starchy foods should be put through a process of predigestion by heat. To those who are not familiar with food chemistry, such results would appear very convincing, but to a practical food scientist, they only show how misinterpretation of scientific facts can be made to indicate just the opposite conclusions from the truth.

Starchy foods are not intended by nature to be digested in the stomach, but in the intestines, and the processes of partial digestion of these foods before entering the stomach only serve to interfere with nature's plan and deprive both the stomach and intestines of their natural functions. To charge that these theories might have emanated from such an institution through ignorance would be no more severe than to say they might have been promulgated to sell zwieback and crackers.

The gastric juice contains three principal enzymes or digestive principles. These are hydrochloric acid, pepsin and rennet. The hydrochloric acid and the pepsin are secreted by different cells, and could be considered as separate digestive juices, but as the action of one is dependent upon the other, we will consider these actions as one. Pepsin in the presence of hydrochloric acid acts upon proteids and changes them into proteoses and peptone. Comparatively little food is completely peptonized in gastric digestion. Proteoses are intermediate products between food proteids and peptone, being the principal product of the action of the gastric juice. Thus it is seen that this stomach action is only preparatory for the digestive processes of the intestines. The gastric juice does not act upon fat, but in the case of animal food, in which the membranes that enclose the fat cells are formed of proteid material, the gastric juice sets the fat globules free by dissolving these enclosing membranes. The chief action of hydrochloric acid in the stomach is to aid the action of the pepsin. Pepsin alone has no digestive powers. There are no other acids produced by the secretive glands of the stomach wall. If other acids are found in the contents of the stomach, it is because they have been taken in the food or are produced by abnormal fermentation.

The hydrochloric acid of the stomach is formed from the sodium chloride or common salt of the blood. The secreting cells of the stomach glands are thought to have the power to form hydrochloric acid by uniting the chlorine of salt with the hydrogen of water. This is a very unusual chemical process, and has not yet been successfully produced in a laboratory.

One of the chief functions of hydrochloric acids in the stomach is that of an antiseptic or germicidal fluid. Not all bacteria are killed by this fluid, however, for some germs can live in an acid medium while others may live best in an alkaline solution. The alternation of digestive juices from alkali to acid may be considered as a provision of nature to destroy bacteria and enzymes of plant and animal origin that are taken into the digestive tract with food. This adds another reason to those already mentioned why foods should be thoroughly masticated. By such provision nature attempts to provide for the digestion of food only by such enzymes and ferments as will produce a finished product wholly suited to the particular requirement of the body. When we attempt by artificial processes to digest our food with other enzymes than those of our own digestive organs, or take into the stomach large quantities of food without proper mastication, which allows foreign or abnormal fermentation to take place, we may expect, as a natural result, that the nutritive material supplied to our tissues will not be perfectly adapted to the needs of human cell growth, and consequent derangement of the bodily functions takes place.

The rennet of the gastric juice is principally concerned with the digestion of milk; other than this, it has no particular function.

The problem of why the stomach does not digest itself has puzzled scientists for many years. The investigations of the twentieth century have at last solved this fascinating question. The walls of the human stomach are composed of proteid material, and should be dissolved by the gastric juice according to all known chemical laws. The explanation formerly given was that the stomach did not digest itself because it was alive. This was begging the question.

There has lately been discovered an enzyme that is secreted by the cells in the stomach wall, which is known as antipepsin. This antipepsin destroys the action of the pepsin and prevents the action of the pepsin upon the stomach wall itself. Were antipepsin secreted in sufficiently large quantities to mix with the food in the stomach cavity, no digestion could take place. The presence of this antipepsin in the stomach walls has been proved in the following manner: The arteries leading to a portion of the stomach wall in a dog were severed, so that this portion received no blood supply and could not form the usual amount of antipepsin. The secretion of pepsin went on in the remainder of the dog's stomach and digested the portion of the stomach wall which was receiving no blood supply, and hence secreting no antipepsin.

Intestinal Digestion

Bile. The bile is a juice secreted by the liver. It enters the small intestines a few inches below the stomach. One function of the bile is to facilitate the digestion of fat, for when the bile is partly excluded from the digestive tract, the fats are not so completely absorbed. Bile is not an important digestive fluid. In fact, bile is chiefly a waste product, which is secreted into the alimentary canal, and thus passes from the body.

PANCREATIC JUICE. The secretion of the pancreas contains important enzymes; one acts upon starch, one upon proteids, and one is a fat-splitting enzyme. Pancreatic juice also has the power of coagulating milk, and is believed to contain some rennet. The pancreas is a secretive gland located entirely outside the intestinal walls, and produces a juice, which is poured into the small intestines at the same point at which the bile enters. Pancreatic juice is strongly alkaline, and as soon as the food coming from the stomach comes in contact with the pancreatic juice and bile, the acid is neutralized, and the material becomes strongly alkaline.

The starch-digesting enzyme is called amylopsin. It appears to be very similar to ptyalin in its power to digest carbohydrates. This amylopsin completes the digestion of starch that was begun by the saliva. It acts upon starch with great activity. One part of amylopsin can change 40,000 times its bulk of starch to glucose. This can act only in alkaline solution, and if any abnormal fermentation takes place in the digestive tract, producing a large quantity of acids, the digestion of starch is stopped. It is interesting to note that this enzyme is entirely absent from the pancreatic juice of infants. This explains why infants cannot digest starch.

The second enzyme to be considered in the pancreatic juice is trypsin. This is a substance distinct from pepsin, but its action is the same. The chief distinction is that trypsin acts in an alkaline solution, while pepsin acts in an acid solution. Trypsin is much more energetic in its digestive power than the pepsin of gastric juice. It completes the digestion of proteids that is begun in the stomach and converts all proteids into soluble forms. A number of forms of proteid that are not acted upon at all by the gastric juice are readily digested by the trypsin of the pancreatic juice.

The fat-digesting enzyme of the pancreatic juice is steapsin. This is the principal fat-digesting enzyme of the body, fat not being affected by the juices of the stomach. This substance has power to split fats, that is, to convert them into the fatty acids and glycerine of which they were originally composed. This fatty acid then combines with alkalies of the bile and pancreatic juice to form soap. Soap is soluble and passes through the walls of the small intestines in this form. Having passed through the walls of the intestines, this soap is again changed into fat. The reason that nature provided such a complex process for the absorption of fat is because fat is insoluble. If the intestinal walls were constructed so that fat globules could be taken directly through them, they would also be open for the entrance of germs and other foreign particles.

Frying foods in grease causes a thin film of melted fat to spread over the surface of the starch of proteid particles, with the result that these particles cannot be properly acted upon by the saliva and gastric juice, and as a result do not receive the preliminary changes necessary to normal digestion. Fat, taken in its natural form, does not interfere with other digestive processes.

Intestinal Juices. In addition to the digestive juices that are poured into the small intestines from the pancreas and the liver, there is a juice which is secreted from the walls of the intestinal cells. This is called intestinal juice or succus entericus. It is a light-yellow fluid with a strong alkaline reaction due to the presence of sodium carbonate.

One action of intestinal juice is to change cane sugar and maltose into glucose, which is then absorbed directly into the blood.

The Secretion of Digestive Juices. Within the last few years many remarkable discoveries have been made in regard to the secretion of the various digestive juices. Until some ten or fifteen years ago it was believed that the secretion of digestive juices depended simply upon the presence of food in the alimentary canal. Recent discoveries in this branch of physiology are to be accredited to a Russian scientist by the name of Pallow, and his followers and associates. The facts now known regarding this part of nature's work are essentially as follows:

The secretion of the various substances which make up the digestive fluids of the body depend upon two sorts of stimuli. First, direct nerve stimulus from the central nervous system. Second, the chemical stimulus upon the walls of the digestive organs. Depending upon either or both of these sources of stimulation, the digestive juices of the body are regulated in quantity, and what is much more worthy of note, in their actual chemical compositions.

It will be readily seen how far reaching in its effect upon our dietetic treatment and practices is this knowledge of the influence of various factors upon the composition of the digestive fluid. An excellent illustration of the practical importance of Pallow's discoveries concerns the comparative digestibility of various foods. The former method of estimating the digestibility of food was to analyze the foods and also the intestinal residue, and subtract the undigested remnant of each particular class of food element from the amount originally present in the food. By such means it was possible to show that certain foods were, say 80 or 90 per cent digestible, as the case might be. No estimate was made by this method of the amount of material that must be secreted by the body in order to digest the particular foods.

According to the old investigation milk and meat are about equally digestible. It is now known that the digestion of milk requires only a small fraction of the energy and nitrogen that is necessary in order to digest meat or proteid from vegetable sources. Thus it will be seen that where it is desirable to get a large amount of available nitrogen into the system with the least possible expenditure of energy, milk is a food par excellence. This is a very logical idea, and one which we can understand, because milk is created for the sole purpose of serving as food for animal life.

The amount of acidity in gastric juice required to digest meat is far in excess of that required for a meal of vegetable substance. The amount of acidity is greatest with milk, second with meat, and least with bread. The strength of the digestive influence of pepsin was greatest with bread, second with meat, and least with milk; from this we learn that starchy foods are unsuitable for the use of those who suffer from supersecretion of hydrochloric acid, for the excess of acid prevents their digestion by neutralizing the alkali of the intestines.

Saliva secreted for nitrogenous food does not contain as much ptyalin as that secreted when starchy foods are consumed. For this reason the thorough insalivation of starchy foods is much more important than that of meat, milk, eggs, etc. Dr. Harvey W. Wiley has recently advised that meat be swallowed in chunks, as is done by carnivorous animals. This advice, however, is not altogether sound, for the reason that man is not a carnivorous animal, and his gastric juice does not act as rapidly upon flesh foods as does that of meat-eating animals. If meat be taken into the human stomach either in large amounts or in large pieces, decomposition may set in before digestion has proceeded far enough to prevent the action of micro-organisms.

The mental influence upon the secretion of digestive fluids may originate from the thoughts of the man or may be brought about reflexively by the sight or smell of food. All are familiar with the experience of having one's mouth water at the sight of a particularly appetizing dish. Many of us have undergone the same experience by thinking of some particular food of which we are fond, even though there is nothing in sight. Scientific investigation has shown that the secretion of saliva is only an example of what takes place in the other digestive organs. Experiments of the ingenious Russian scientist prove that the act of tasting and swallowing food is the chief factor in determining the secretion of the juices from the stomach walls. By skilled surgical operations the esophagi of dogs were severed and made to open externally so that the food swallowed by the dog did not pass into the stomach. The secretion of gastric juice was then determined in the case of different foods which were taken into the dog's mouth and swallowed, but which did not reach the stomach. Not only did this act of pretended feeding start a flow of gastric juice, but the gastric juice secreted in the case of different foods was adapted to the particular food, according to the general principle which we have already discussed.

These facts emphasize several important considerations regarding our diet. First, we should eat slowly and get the whole taste out of food by thorough mastication. Second, we should not disguise our foods by high seasoning. Third, foods that do not require the same digestive principles should not be taken together at the same meal.

Fermentation is the term generally applied to changes that take place in such food substances as carbohydrates, due to the growth of bacteria, while the term putrefaction is applied in a similar way to the changes taking place in nitrogenous or proteid materials.

Abnormal Processes in Digestion

There are changes which take place in the human alimentary canal, that are not beneficial or necessary to normal digestion. The cause of the most important abnormal changes in the contents of the stomach and intestines is the presence of living micro-organisms called bacteria.

Because of the invariable presence of greater or less quantities of bacteria within the intestines of all ordinary animals, some scientists have insisted that their presence was in some way necessarily related to the life of the animal and was probably beneficial.

New-born animals, however, are free from bacteria, hence these germs must make their way into the alimentary canal with food.

Ingenious scientists have taken new-born guinea pigs and kept them in sterile or germ-proof compartments, giving them filtered air to breathe, and absolutely sterile foods. These pigs lived and thrived through the experiment as their brothers would outside the bacterial-proof dwelling, and this is considered as good evidence that bacteria accumulate in the digestive organs of all animals, not for a purpose connected with animal physiology, but in order to digest and assimilate foods. Conditions are established which are so near those required for bacterial growth that the bacteria take advantage of the conditions just as weeds, if given a chance, thrive in a cultivated field.

We have already referred to the antiseptic or germ-destroying properties of the gastric juice and other secretions of the digestive organs. This would suggest that the growth of bacteria is undesirable growing in the human intestines, and hence we cannot say with certainty that all this growth is harmful, as the resulting waste products of each particular species of bacteria would need to be considered separately before we could say whether or not it acted as a poison. It is safe to make the general statement, however, that bacteria are abnormal or foreign to the human digestive canal, and that their presence is detrimental to human welfare.

Micro-organisms give off as waste products of their growth various substances, dependent upon the species of bacteria and the material in which they are growing. Thus the waste products of the yeast plant are carbon dioxide and alcohol.

In the alimentary canal there exists an abundance of carbohydrates and proteid material which form excellent food material for numerous species of bacteria. The substances produced by the growth of these various kinds of bacteria are numerous. They include the gases, carbon dioxide, hydrogen sulphide, hydrogen, marsh gas or methane and ammonia. Butyric, lactic and other acids are also produced as a product of bacterial fermentation in the intestines, together with alcohol. Perhaps the most detrimental of all are the substances produced by the bacterial putrefaction of proteids of which indol and skatol are the two most important.

Under ordinary conditions the bacteria themselves do not penetrate the intestinal walls, and their evil influence would be confined to mechanical disturbance of gas in the digestive organs and to the destruction of a portion of the nutritive material of food, were it not for the fact that these harmful and poisonous products we have mentioned are soluble, and hence pass through the intestinal walls with the digested food material into the blood, and are thus distributed throughout the entire body.

It has been observed in the presence of intestinal congestion, where the food remains in the intestines over nature's time limit, that the amount of these harmful nitrogenous decomposition products that are excreted by the kidneys is considerably increased, proving that these products have circulated throughout the body.

Arterial sclerosis, or the hardening of the walls of the arteries, which is one of the principal causes or the manifestations of old age, is caused by the continued presence in the blood of small quantities of poisonous material which gradually destroys the protoplasm of the arterial walls and causes it to be replaced by a degenerate form of tissue. It is known that alcohol and the poison of syphilis causes sclerosis, or hardening of the arteries. In the absence of these poisons, the presence of some similar acting toxic substance would naturally be suspected; otherwise the hardening of the arteries would not take place.

The poisons produced in the intestines by bacterial decomposition are absorbed into the blood, and undoubtedly act in a similar way to the other poisons above mentioned, and this factor, as a cause of old age and premature death, is much greater than other sources, because it is practically universal. Numerous other disorders or diseases, too numerous to consider here, can be traced to this same general cause.

In the light of all modern experiments it is evident that anything which lessens the amount of bacterial growth in the intestines is desirable and beneficial, while changes that increase the amount of such growth are to be guarded against as seriously detrimental to health.

The thorough mastication of food has been shown to decidedly lessen the bacteria of the intestines. Overeating is perhaps the greatest factor of all in bringing about a condition which favors excessive intestinal fermentation.

A person living on the conventional diet not only takes large quantities of food, thus filling the digestive organs with an excessive bulk, which weakens the relative strength of the digestive juices and injures their antiseptic properties, but he also eats hastily, swallowing the food in lumps, which cannot be penetrated by the digestive juice, and which ferment before they can be digested.

The effect upon the bacterial growth of the intestines of cooked food has already been referred to. Cooking, which is recommended to destroy germ life, acts ultimately in exactly the opposite manner. Cooked food is usually moist and warm; hence in excellent condition for bacterial growth. No cooked food, after sterilization by heat, must again be allowed to come to an ordinary temperature at which it becomes again contaminated with bacteria, as, indeed, it would in the digestive organs themselves. The result is that the cooked masses which form such excellent culture for bacteria, decompose at a much more rapid rate than would similar foods uncooked. Cooking generally leads to overeating and less mastication, both of which, as before pointed out, favor bacterial growth. Thus it is seen that the efforts commonly recommended for the destruction of bacteria in foods greatly increase the amount of decomposition and fermentation that actually takes place in the alimentary canal.

The putrefaction of proteids in the intestines is checked by a large percentage of carbohydrates and by organic acids. The preserving qualities of sugar depend upon the fact that putrefying bacteria cannot live where sugar is abundant. The beneficial effect of fruits in lessening the amount of bacterial decomposition in the intestines is due to the presence of relatively large amounts of sugar and of organic acids. Milk is known to have a prohibitive influence upon putrefaction in the alimentary canal, this being due to the presence of milk sugar, and especially lactic acid. This explains why clabbered milk, which contains a considerable proportion of sugar changed into lactic acid by the action of souring bacteria, is especially beneficial in preventing intestinal putrefaction. Prof. Metchnikoff, of the Pasteur Institute of Paris, became so enthusiastic with this discovery that he has proclaimed sour milk to be a remedy for old age. While Metchnikoff's enthusiasm has perhaps led him too far, there can be no doubt but that his theory is good and worthy of consideration.

We should not, however, seek for any one specific remedy against intestinal decomposition, but should perfect the entire diet, thus limiting the opportunity for bacterial growth.

Mechanics of Digestion

Chemistry is not the only factor that is to be taken into the consideration of the digestive function. The mechanical condition of food, when it is taken into the digestive organs, very greatly influences the chemical process that takes place.

Small particles of material will dissolve, of course, much more rapidly than will large ones. The greater the dissolving surface, the more rapidly will solution take place. If the substance that is being dissolved is a firm particle the digestion or solution will take place only on the exterior surface and the interior of the particle, however small, will remain practically unchanged. This is what occurs when food materials, such as grains or nuts, are taken in an uncooked state, as mastication does not dissolve them but only divides them into small, distinct particles.

If, however, the grain be subjected to prolonged heating with water, a partial solution takes place. The entire mass becomes mushy and permeated with water. When such a mass is brought in contact with dissolving or digesting fluids, it mixes too rapidly with the fluid, just as molasses would mix with water, subjecting the whole mass to the immediate action of the digestive fluids. In normal digestion, the enzymes are continuously secreted for a period of several hours. They begin work on the outside of the minute but distinct food particles, dissolving them little at a time. This dissolved portion is absorbed as rapidly as formed, and active and complete digestion is constantly taking place.

When the food material has been changed into a mushy mass as above referred to, the whole bulk is immediately subjected to the action of the digestive fluids. The result is that the digestive principles at first secreted cannot complete the digestion of the entire mass, but the entire bulk is partly digested, and various abnormal fermentations and decompositions then set in.

The predigestion fad has been one of the greatest fallacies that has ever been forced upon the public mind. That the sugars of the juices of some fruits that are already in the form of glucose can be immediately absorbed without any digestive process does not prove that mushy cooking, malting and other forms of so-called predigestion are beneficial. The so-called "predigested breakfast foods" are not changed into the final product of digestion, but are in an intermediate stage between starch and glucose. They are composed of semi-soluble starch, gummy dextrine and maltose. These substances only interfere with and disturb the normal process of digestion.

Ninety-nine physiologies and dietetic books out of every one hundred make the statement point blank that raw starch is indigestible. This fallacy has been established by the experiment of putting samples of raw and cooked starch into two test tubes and treating them with some digestive enzyme. The cooked starch being soluble is all attacked by the digestive enzyme at one time, and started on its way through the numerous changes in the complex chemical process of changing starch to glucose. In the sample of raw starch the digestive enzyme attacks the particles from the outside, and slowly digests or eats off the exterior of the starch grains. After a given length of time, our chemist adds iodine to the two test tubes. Iodine gives a blue color with starch. In the test tube with the cooked starch, all of which has undergone a certain amount of digestion, no blue color is discerned, for no pure starch is left. In the other tube, in which a portion of the starch has been more completely digested, but in which some of the particles remain wholly unchanged, a blue reaction is, of course, obtained, and the chemist proclaims that uncooked starch is indigestible.

Mr. Milton Hastings, while at the Kansas Experiment Station, made a comparison of two diets containing several varieties of grains. The diets were alike in every respect, with the exception that in one instance all the grains were boiled for two hours, while in the other case they were taken in an uncooked state. In the case of the uncooked grains, no starch whatever passed through the body in an undigested form. In the case of the cooked grains, the material remaining undigested was much in excess of that in the uncooked diet, although no actual starch was present.

There is only one interpretation to such results, and that is, that while in the case of cooked grains the digestive processes may start with more rapidity than in the case of uncooked grains, they are not thoroughly completed, and various decomposition products occur, as well as undigested proteid, which would not happen in the case of the foods taken in their natural state.

Moreover, if uncooked starch was taken

in excess of the digestive capacity and passed through the body wholly unchanged, no harm would result. The starch grain in its unchanged state is a fine, white, glistening granule, wholly insoluble, and its presence in the digestive tract would have no effect whatever upon the bodily functions, for without solution no material can have any possible effect upon the physiological processes except by irritating the mucous surfaces of the digestive organs; in the latter respect, starch granules are harmless.

With the exception of foods that are already soluble in water, and which are rapidly digested and absorbed, the condition in which foods should enter the digestive tract is in finely divided, yet distinct, particles, and not in solutions or gummy masses.

If the mastication of uncooked food is not thoroughly performed, it may result in their being passed through the body without all being dissolved, but it is much better for food to be swallowed in this condition than to be taken in a form that would turn to poison in the intestines.

METABOLISM

Metabolism is the term applied to all processes that take place within the body from the time food is absorbed from the digestive tract until it is passed out of the body through some of the excretory organs.

We may study metabolism best by considering the two chief classes of physiological processes with which foods are concerned. First, the building of actual bodily tissue. Second, the generation of heat and energy.

The chemist could analyze an adult man and a new-born infant and know that the infant, in order to reach manhood, would need to add to its body so many pounds of carbon, sulphur or iron. But the problem of nutrition is much more complex; not only must we consider the formation of new tissue, but we must allow for the rebuilding of the old, and for all those processes of vital activity that involve the destruction of food material or bodily tissues. Nor can this allowance be proportioned from the analysis of the body because the various elements composing the body do not change with equal rapidity. Thus a man in a harvest field might pass through his blood in one day 10 or 15 pounds of oxygen, in the form of water and carbon dioxide, which would amount to 10 per cent of the oxygen contained in his body, but if he daily took calcium or fluorine to the extent of 10 per cent of that contained in the body, death from poisoning would speedily ensue.

We can best comprehend the use of foods for building the body by considering separately the changes each class undergoes from the time it is absorbed from the alimentary canal until it is excreted from the lungs or kidneys, or deposited in the body as bone or muscles.

The second function, or rather we may say a group of functions, to be considered in the study of metabolism is the generation of energy and bodily heat; for heat is only one form or expression of energy.

The production of heat and energy in the body occurs almost entirely through the oxidation of food material. The three principal classes of food material, proteids, carbohydrates and fat, can all be oxidized to produce heat.

Energy may be mechanical, chemical, electrical or thermal (heat). The conservation of energy, which is one of the fundamental laws of science, shows that no energy can be lost, but can only be changed into other forms. This being true, and it being possible to change all energy into heat, we use heat as a measure of energy.

The unit of heat, and consequently of energy, that is used by scientists is a calory, which is the amount of heat required to raise one thousand grams of water one degree of temperature on the centigrade thermometer scale. The energy of food is measured in calories or vienos, one vieno being equal to one hundred calories.

These terms are convenient for measuring the energy in food, but in order that this energy may be liberated in the body it is necessary that the food be absorbed and oxidized within the body in a normal manner.

Because of the law of the conservation of energy, which states that no energy in the universe can be lost, it is possible to study with great accuracy the energy taken in and given off by the human body.

The method by which energy is measured in accurate scientific experiments is by means of a device called the respiratory calorimeter. This device consists of a small room, the walls of which are impervious to the transmission of both heat and air. In this room a man or animal may be kept for a period of several days. The air breathed, food eaten, bodily heat given off, waste products excreted, and mechanical work done, are all measured with the greatest scientific accuracy. Many interesting results have been obtained in the investigations conducted with this wonderful scientific device. Calorimeter experiments have confirmed the results of the oxidation of various foods in the laboratory, and have given us data from which to compute the stored energy in various food substances. We have thus ascertained that the amount of energy yielded to the body by 1 gram of proteid is 4.1 calories; from 1 gram of carbohydrates 4.1 calories, being equivalent to that of proteid. One gram of fat oxidized in the body yields 9.3 calories, which is more than twice that yielded by proteids or carbohydrates.

Metabolism of Carbohydrates

The products of the digestion of carbohydrates are absorbed from the alimentary canal in the form of glucose and smaller amounts of levulose, acetic, butyric and lactic acids. These substances pass into the blood vessels of the intestines, which unite to form the portal vein which supplies blood to the liver.

The chief function of the liver is to act as a reservoir for the sugar of the body. The blood, in order to properly nourish the body and supply energy to the muscle cells, must contain about .15 of 1 per cent of glucose or blood sugar. If, after a full meal of carbohydrates, the entire amount of digested glucose passed into the circulation, this percentage would be increased many times. Here the function of the liver comes into play, for all blood from the intestines must pass through the liver before going over the body. The liver " senses " the increased content of sugar and the liver cells extract and store in the form of glycogen or animal starch a sufficient amount of glucose to reduce the percentage in the blood to the proper proportion.

After digestion has been completed and the blood begins to run low in glucose, the liver cells again " sense " the difficulty and the glycogen is reconverted into glucose and again passes into the blood. This action of the liver in keeping the body fuel at constant or even pressure is one of the most important and wonderful processes in physiological chemistry.

The chief use of glucose and other forms of digested carbohydrates is the formation of heat and energy. Glucose is oxidized principally in the muscles, producing carbon dioxide, water and some lactic acid. The lactic acid which is simply a partly decomposed form of glucose is further oxidized, forming the same final products. Glucose in the blood has still another function, as it is used to build up or form fat. Fat is a form of stored-food material which is not as readily available for use as is glycogen and glucose.

We might use a homely figure of comparing the energy-producing substances of the human body with the movement of merchandise in ordinary commerce. We could say that the glucose of the blood was as merchandise in the hands of the people ready to be consumed; that glycogen of the liver would represent goods in the hands of the retailer; while fat, which is stored in large quantities, would be represented by merchandise in warehouses.

Many interesting experiments have been conducted to prove that fat in the animal body can be produced from the carbohydrates of food. For illustration, a pig for a given period was given food containing only half a pound of fat, and yet gained during the period 9 pounds of fat. Such facts prove beyond all possibility of doubt that carbohydrates are converted into fat in the animal body.

Diabetes is a disease in which the control of the sugar in the blood becomes deranged and the sugar is excreted by the kidneys. It is caused by long-continued eating of starch and other glucose-forming foods in excess of the needs of the body. The reason every one who eats an excessive amount of starchy foods does not become afflicted with diabetes is because the body mechanism does not always break down in the same place.

When the amount of carbohydrates consumed is just the amount necessary to keep up the fires of bodily warmth and muscular energy (and this will be regulated by the appetite when one subsists entirely on natural suncooked foods), all will go well. But if an excess of such food be taken—and it almost invariably is by those living on a cooked diet—one of three things must happen. (1) The intestines will refuse to absorb the excess, and it will pass through the digestive tract a decomposing mass. (2) The excessive glucose may be deposited as bodily fat. This, however, is only an active factor, while the body is actually gaining weight, for the obese body whose weight is constant utilizes no more food than the normal body. (3) An excess of sugar absorbed from the intestines and not converted into fat, forces the sugar content of the blood to an abnormal percentage, and the kidneys, whose normal function it is to excrete nitrogenous waste products and retain the sugar, "spring a leak," which allows the sugar to pass out with the urine. In severe cases not only the excess but the normal sugar is strained out of the blood by the "leaky" kidneys, and the patient literally starves to death, though he may eat and digest an abundance of food. The remedy, if taken in the early stages, is to reduce the amount of sugar in the blood to normal through natural diet, or replace it by fat as far as possible.

Of these three ways in which the body disposes of an abnormal amount of carbohydrate food, the last is fortunately the most rare and the first most common. Were the reverse true, mankind would speedily be exterminated if he persisted in his present methods of living.

Metabolism of Fat

Fat, as absorbed from the digestive tract, is in the form of fatty acids and glycerine, but immediately recombines in passing through the intestinal walls into its original form. This fat then enters the lacteals which unite to form the thoracic duct. This duct or tube empties its contents into one of the large veins near the heart, whence it is distributed throughout the body. The fat of the blood is not regulated to a definite amount like the content of sugar. After a meal at which much fat has been taken, the blood for a time is whitish in appearance, due to the numerous minute globules of fat. Fat of the body may be deposited directly from food fat. This can be proved by feeding an animal that has been starved until its own bodily fat has been greatly reduced upon some particular form of fat. The fat immediately deposited will then have the peculiar characteristics of fat taken with the food. Thus a dog that has been given a heavy diet of tallow will deposit fat which will contain a large quantity of stearin and palmitin, and consequently have a higher melting point than normal dog fat.

The distinction between tallow, lard, olive oil, human fat, etc., is chiefly due to the various portions of stearin, olein, etc., which compose the mixed fat. The reason human fat is not identical with the food fat is because the body has selective power in depositing these fats. Thus, if the sole source of fat which a man takes in his food is tallow, the fat-depositing cells in the human body would refuse a portion of the stearin and deposit a larger percentage of olein, thus giving a softer or more liquid fat than supplied in the food.

When the consumption of glucose in the muscles becomes greater than the supply available in the blood and the glycogen of the liver, bodily fat must be consumed. This explains why exercise reduces obesity. The proper method of preventing or curing obesity is a double process: First, the diet should be so selected and combined as to lessen the amount of fat that can be deposited from the blood; and, second, means should be employed to use or consume the fat that has accumulated.

The whole story of the use of fat in the body is quite simple. Fat is least changed by digestion of all food materials. It has no particular function in the life processes, save that of storing energy. More bodily energy can be derived from a pound of fat than any other source. Carbohydrates and fat perform very similar functions within the body, and can, in a large measure, replace each other as a source of heat and muscular power.

Metabolism of Proteids

The chief materials of which the human body, in normal health, are constructed being proteid substances, it is evident that only foods containing nitrogen can be utilized to construct the tissues. For this reason the metabolism of proteid or nitrogenous foods is of very great importance. When we realize the fact that muscle, blood, brain, nerves, cartilage, tendons, the various internal bodily organs and the tougher material of the skeleton are only various forms of proteid material, and must contain their proper proportions of available or organic nitrogen, we can readily understand why nitrogenous foods form a distinct class that must be considered by themselves. Only the mineral deposits of the bones and teeth and the globules of fat that are deposited as a source of stored energy can be constructed without nitrogen.

The first use of proteids in the body is the actual adding to or increasing of bodily tissues. When a flabby-muscled young man from the city goes to work on a farm and gains 20 pounds, the cells of his muscles have actually increased in size and number. This requires proteids which can only be obtained from the nitrogenous material in food. The growth during early life is due to an actual increase of the size of all bodily organs, and is merely an accumulation of proteid matter.

The second use of proteids, one which in mature life is of more importance than those already referred to, consists of the formation of the various nitrogenous products which are produced in connection with the different processes of the body, and which are destroyed by the functions of life. For illustration, pepsin of the gastric juice is a nitrogenous substance. This can only be formed from proteids. All digestive enzymes and various other substances formed in muscles, nerves and various organs throughout the entire body, are of a nitrogenous nature, and in their formation and use a certain amount of proteid material is destroyed. When the digestive enzymes and similar products are formed from proteid, they consume considerably larger quantities of actual proteid material than from their own weight, for these peculiar compounds can only be constructed from certain portions of the ordinary food proteids.

The third form in which proteids may be consumed in the body is in the actual replacement of worn-out cells: the skin, hair and mucous or lining membranes of the bodily cavities are constantly being cast off on the external surface, new cells being formed underneath. Cells within the interior of the body when they become injured or have passed their usefulness are removed by the phagocytes or white blood corpuscles and must be replaced by other cells.

In the case of bacterial infections, as

tumors, boils or contagious diseases, the bacteria feed upon the proteids of the blood. The white blood corpuscles are then destroyed in the effort to remove the intruders, and all these substances must be replaced by proteids from food. A rapid loss of weight in severe fevers is due to this kind of loss, and also the increased oxidation due to the higher temperature.

The gain or loss of bodily proteids is indicated by the gain or loss of the nitrogen. The income of nitrogen can be ascertained by analyzing the food. The outgo of nitrogen is computed by analyzing the excretory products of the body. If the body at the beginning or the end of an experimental period is carefully watched, and the income and outgo of nitrogen determined as has been stated, we can compute the amount of gain in the body that is nitrogenous tissue. The other gain or loss of bodily weight must be fat. These calculations cannot be made exact owing to the amount of food and water that is residual in the digestive organs at the time the various weighings are made.

We have learned, however, that in the digestive tract products of food are all converted into a soluble form of proteid known as peptone. The purpose of converting these products into a soluble form is that they may pass through the walls of the alimentary canal.

This is all that was known about proteid metabolism until the soluble peptone stage was reached, at which point all track was lost of the chemical processes until the nitrogen was again secreted by the kidneys in the form of urea.

No one explained how the radically different proteids, such as egg albumin, milk casein and wheat glutin could appear in the body as blood globulin, brain lecithin, or the myosin of the muscles.

We cannot fully explain here the history of all investigations that have shown the true state of affairs regarding proteid metabolism, but must be content to recite what actually happens to the nitrogenous material of food. Proteids contain carbon, hydrogen, oxygen and nitrogen, and sometimes small quantities of sulphur, phosphorus or iron. These proteids are now known to be chemically changed by the digestive enzymes of the intestines into simpler compounds containing these same elements.

These simple nitrogenous substances pass into the liver, and just as the liver regulates the supply of sugar, so it regulates the supply of nitrogenous compounds in the blood. A certain amount of proteid-forming material is passed through the liver and goes on to perform the various functions for which proteid is utilized in the body. All nitrogenous material in excess of the amount required by the body is challenged by the liver, and the nitrogen, together with a portion of the carbon, hydrogen and oxygen, is split off, forming urea, which is excreted by the kidneys. The remainder of the proteid substance having been robbed of its nitrogen is now essentially the same as carbohydrates, and goes to form glucose or blood sugar, which may in turn form bodily fats.

This explanation throws light upon several interesting points. It has been stated that proteid is the most essential food material of the body, because it alone contained the nitrogenous compounds from which the bodily tissues and the chemical enzymes, which control all living processes, could be constructed. But we now see that as important as is a supply of proteid materials, any excess above the bodily needs is immediately turned into glucose and urea; the first of which, while useful to the body, could be taken in a simpler and less expensive form, and the latter of which is waste product harmful to life, and must be immediately excreted from the kidneys.

The nitrogen that is actually used in the body has a different history from that of the excessive proteid taken as food. The food proteid is simply split by the chemical addition of water, much as starch is changed into glucose. The proteid that is really used by the body is oxidized and is excreted by the kidneys chiefly in the form of creatinin and uric acid, and the proportions of these compounds compared with the urea in the urine show whether a man's diet contains an excess of proteid or is lacking in that group of food substances.

THE VIENO SYSTEM OF FOOD MEASUREMENT

Five years ago, when I published the first edition of "Uncooked Foods," I gave the tables of food analysis taken from Bulletin 28 of the Chemistry Bureau of the U. S. Department of Agriculture. These tables were useful as reference for the chemist, but I had never found them to be of any particular value in practical dietetics. They were published at the time as being the best thing available.

Two years ago, assisted by Mr. Milton Hastings, the physiological chemist in Christian's School of Applied Food Chemistry, I designed a new system of food measurement, which I have called the "Vieno System," and which places the essential facts of food analysis in a practical form. This system has been taught for two years to the students of my School of Applied

Food Chemistry, and this test in actual work has been proven the most practical system of food measurement yet devised. It is here given for the first time to the general public. It is much simpler than the older food tables, and yet is complete and accurate enough for the purpose for which it is intended—that is, the calculation of the energy and available nitrogen in individual dietaries.

The vieno tables tell the amount of energy that may be derived from food in the chemical laboratory, but nothing of the amount of energy that the body must expend in the process of assimilation. This cannot be given in a table, because it varies with the individual and the condition of his digestive organs.

Neither does the energy or nitrogen factor constitute all that is known about the chemical properties of food. But they represent two of the most important facts, and the two which are first to be considered in determining how much of a particular food we should eat.

To the vieno table, as first planned, I have added a column, giving the constipating or laxative effects of food. This action, however, depends, to a great extent, upon the amount taken, the way in which the food has been prepared, and the other foods with which it is combined. As the laxative factor cannot be numerically represented, I have grouped foods into the following classes: (C) constipative, (L) laxative, (N) neutral. This classification applies only when foods are taken in their natural state, and in normal quantities, and combined with no other foods that would materially change their effect. The table assumes that meats will be cooked; other foods are assumed to be uncooked.

In the case of acid fruits, I have appended a fourth column, giving the comparative acidity. The amount of energy and nitrogen contained in such foods is small, and their use in the diet is determined chiefly by the acid content.

Explanation of the Vieno System

Things are commonly measured by volume or by weight. That volume would not be an accurate form of measurement of food values is evident to all. A bushel of lettuce leaves would clearly contain less food value than a bushel of wheat.

Weight would seem to be a more accurate way to compare foods, but all foods contain water, which may vary from 5 to 95 per cent. A pound of turnips, which is nine-tenths water, would not be comparable with sugar, which has scarcely any water at all.

Even if it were not for this water content, weight would not be a fair method of comparison, because some foods are of more value per pound than others, owing to their difference in chemical composition. Thus a pound of butter gives 2¼ times as much heat to the body as the same weight in sugar.

As before mentioned, the two chief food factors which we desire to measure are energy-producing and tissue-building power.

All true foods, when assimilated in the body, produce some energy. In fact, only such substances as produce energy, when combined with the oxygen taken in through the lungs, can be strictly classed as food.

We have taken this energy-producing power of food as the best basis for measurement and comparison. Nitrogen would have been taken as a unit and energy figured by a table, but it is simpler to use energy as a unit and figure the nitrogen in various foods by giving in a table the amount of nitrogen per unit of energy. Multiplication of the units of energy by the nitrogen factor is necessary because the ratio of nitrogen to energy is different in each food.

Energy is the power to do work. The form of energy with which we are most familiar is mechanical energy, as raising a stone or propelling a bicycle. Heat is another form of energy. Heat and work can be converted into each other. The steam engine converts heat into work, while a "hot box" turns work back into heat.

Experiments show that a definite amount of heat always yields a definite amount of work, so that the amount of heat formed by a food material when combined with oxygen is taken as a measure of its energy. This is ordinarily expressed in calories, which, as stated in the last chapter, is the amount of heat required to raise 1000 grams of water 1° centigrade.

The definition of the term calory need not concern the reader greatly for we will have no use for it other than a mere explanatory term. Instead we will use the vieno: a unit which is equal to 100 calories. This unit is selected because it gives such quantities of food as are easily measured and remembered. The word "vieno" is derived from the words "vital" and "energy," and is pronounced vi-en′o.

Nitrogen is the chemical element that is most concerned with the function of life. All animal tissue contains nitrogen, and it forms about one-sixth part by weight of the nitrogenous or proteid substances. Muscle is composed of proteid and water. If we were to take 100 pounds of lean meat or muscle and dehydrate it completely, we would have about 18 pounds of dry material left. If we should analyze this dry substance or proteid, we would find that about one-sixth or 3 pounds would be the element nitrogen. Thus we say that muscle contains 18 per cent of protein or 3 per cent of nitrogen. In ordinary practice protein is mixed with fats and salts and cannot be measured by simply drying out the water. So the chemist finds the amount of nitrogen present and multiplies by 6.25, which gives about the per cent of proteid. This method is not accurate because the per cent of nitrogen in various proteids is not the same. In this system we discard the use of the terms protein or proteids and refer to the amount of nitrogen directly.

All compounds of the element nitrogen are not available as food. For illustration, the nitrogen of the air or of ammonia gas or gunpowder cannot be utilized in the animal body. The nitrogen in foods only refers to available nitrogen. Compounds containing other forms of nitrogen are not foods, and are frequently poisons.

In the following table I have attempted to give the amount of each particular food that one vieno equals, in as simple manner as possible.

In the first column I have told in the plainest language possible what one vieno of food equals; as one vieno equals two-thirds of an ounce, or one vieno of protoid nuts equals one rounded tablespoonful. This method is, of course, only approximate, as in some foods it is impossible to find a simple term to express the amount of one vieno. This is especially true of cooked foods, because of the varied amounts of water absorbed or lost in the cooking process. No food table which would attempt to give the positive value of cooked food would be worth anything from a scientific standpoint. In such cases the only way for the student to become familiar with a vieno is to weigh one pound of the uncooked or natural material and ascertain how much it makes after it is cooked.

The definition given in the first column, in the case of milk, butter, eggs and cheese, is fairly accurate. In the case of cereals and bread the definition is also approximately correct. With fresh vegetables we have not attempted to define the vieno by volume, as vegetables are loose and bulky, and it is only practical to measure them by weight.

In fresh fruits we have defined one vieno as " one large orange, or six plums," etc. In this case we have made allowance for the non-edible portion; all weights given in the table consider only the edible portion.

The defining of one vieno of nuts in spoonfuls is sufficiently correct for practical use. With pecans we have given the actual number of nuts of average size that equal one vieno. This is done only as an illustration, and not continued throughout the table. This first column of our table is for rough work, and is designed to aid the reader in approximating the amount of one vieno.

The third column of the table, which gives the number of vienos in one pound, is the column which should be used in more accurate work. A pound of food here referred to invariably means one pound of the edible portion only. The way to compute the amount of food in one vieno is to take one pound of the food to be used and divide it equally into as many portions as the number in this column. For illustration, if one pound of wheat is given as equal to 16 vienos, one should take a pound of wheat and divide it into 16 portions; each of these portions will represent one vieno. As soon as a pound of food has been divided in this manner, and the amount of one vieno of such food fixed in the mind, it is easy enough to estimate the number of vienos and it will not be necessary to repeat the weighings in the future.

The fourth column of our table gives the nitrogen factor. This column is to be used for computing the amount of nitrogen in the diet. The way to do this is to take the total number of vienos of each food eaten and multiply this number by the nitrogen factor. The product will be the actual amount of nitrogen consumed (expressed in decigrams). As a decigram is one-tenth of a gram, it is only necessary to divide by ten to change the nitrogen, when given in decigrams, to grams. For illustration, 30 vienos of almonds with a nitrogen factor of 5 would give $30 \times 5 = 150$; this means 150 decigrams or 15 grams of nitrogen.

We express the nitrogen in decigrams because it does away with the use of decimals. If in reading other works one finds the amount of nitrogen given in grams he only needs to add a cipher to reduce it to our system.*

* As for comparing the Vieno System with the old-fashioned food tables, giving the percentage of protein, carbohydrates and fat, and the energy in calories, the computation involved is too complex for a popular work. The reader may secure a further explanation of this relation from the Vieno Booklet of Christian's School of Applied Food Chemistry.

Name of Food.	One Vieno Equals:	Number of vienos in one pound.	Nitrogen factor.	Laxative effect.
MEAT.				
Bacon (smoked medium fat)	An average slice	30	2	N
Dried smoked beef	Portion size of egg	8	26	C
Lamb chops	Portion half-size large egg	15	9	N
Leg of mutton (medium fat)	Portion size of very large egg	11	12	N
Pork chops (medium fat)	Slice ½ inch thick and 3 inches square equals 3 vienos	16	8	N
Porterhouse steak	Slice ½ inch thick and 2 inches square	13	9	N
Ribs of beef (medium fat)	Portion half-size large egg	15	9	N
Round beefsteak (medium fat)	Slice ½ inch thick and 1½ inches square	9	16	N
Smoked ham (medium fat)	Slice ½ inch thick and 3 inches square equals 3 vienos	19	5	C
FISH.				
Fresh catfish	1½ ounces	11	9	N
Fresh mackerel	2½ ounces	6	20	N
Lobster	¼ pound	4	30	N
Oysters	Nearly ½ pound	2	19	L

Name of Food.	One Vieno Equals:	Number of vienos in one pound.	Nitrogen factor.	Laxative effect.
Fish—Cont'd.				
Salmon (canned)	Portion size hen's egg	9	11	N
Trout	¼ pound	4	31	N
POULTRY AND EGGS.				
Chicken (broiler)	3 ounces	5	31	N
Chicken (mature)	1½ ounces	10	14	N
Eggs (albumen)	Whites of six eggs	2	36	N
Eggs (whole)	1 large egg	7	14	N
Eggs (yolk)	Yolk of very large egg	17	7	C
Turkey	1¼ ounces	14	11	N
DAIRY PRODUCTS.				
Butter	Not quite 1 cubic inch	36	0	N
Buttermilk	1 full glass	2	13	L
Condensed milk (sweetened)	3 tablespoonfuls	15	4	C
Cottage cheese	3 ounces	5	30	C
Cream (containing 20% of fat)	5 tablespoonfuls or 1/10 pint	10	2	C

Name of Food.	One Vieno Equals:	Number of vienos in one pound.	Nitrogen factor.	Laxative effect.
Dairy Products—Cont'd.				
Full cream cheese	Portion size of walnut	20	10	C
Skimmed milk	1 full glass	2	16	C
Whole milk	⅔ glass or ⅙ quart	3	8	C
CEREAL FOODS.				
Cake	Similar to 1 vieno of bread	1	3	C
Cane sugar (common granulated)	3 teaspoonfuls (heaping) or 1 heaping tablespoonful	19	0	N
Christian's combination cereal	1 sauce dish	16	5	L
Christian's laxative bread	3 cakes	16	5	L
Christian's laxative cereal flakes	1 sauce dish	16	6	L
Christian's unfired bread	3 cakes	18	6	L
Cornmeal	1 ounce	16	4	N
Corn starch	Slightly less than 1 ounce	17	0	C
Crackers	4 Uneeda biscuits	19	4	C
Force	1 heaping sauce dish	6	5	N
Graham bread	Slice ¾ inch thick from average loaf	12	6	N

Name of Food.	One Vieno Equals:	Number of vienos in one pound.	Nitrogen factor.	Laxative effect.
Cereal Foods—Cont'd.				
Graham flour or whole wheat flour	1 ounce	16	6	L
Grape nuts	1 small sauce dish	17	5	C
Hominy	1 ounce	16	4	N
Honey	1 ounce	16	0	L
Macaroni	1 ounce	17	6	C
Maple sugar	Lump size large walnut	15	0	N
Maple syrup	4 tablespoonfuls	13	6	N
Mince pie	⅛ of pie	13	3	N
New Orleans molasses	1½ ounces	13	0	L
Oatmeal or rolled oats	Slightly less than ounce	18	6	N
Pearled barley	1 ounce	16	4	N
Rice	1 ounce	16	4	C
Rye flour	1 ounce	16	3	C
Shredded wheat	1 whole biscuit	16	6	L
Toasted corn flakes	1 heaping sauce dish	16	4	C
White bread	Slice ¾ inch thick from average loaf	12	6	C
White flour (winter wheat)	1 ounce	16	5	C
Whole wheat	1 ounce	16	6	L

Name of Food.	One Vieno Equals:	Number of vienos in one pound.	Nitrogen factor.	Laxative effect.
NUTS.				
Almonds (kernels)	1 heaping tablespoonful	30	5	N
Black walnuts (kernels)	1 heaping tablespoonful	31	6	N
Brazil nuts (kernels)	1 heaping tablespoonful	32	4	N
California walnuts (soft shell, kernels)	1 heaping tablespoonful	33	4	N
Chestnuts (kernels, fresh)	1 heaping tablespoonful	11	4	C
Cocoanuts (fresh)	About ½ ounce	27	2	N
Cocoanuts (prepared)	2 rounding tablespoonfuls	31	2	C
Filberts (kernels)	1 rounding tablespoonful	33	3	N
Pistachios (kernels)	1 heaping tablespoonful	29	5	N
Hickory nuts (kernels)	1 rounding tablespoonful	33	3	N
Peanuts (kernels)	1 heaping tablespoonful	26	7	N
Pecans (kernels)	1 rounding tablespoonful or 8 average nuts	34	2	N
Protoid nuts (Italian pine nuts, kernels)	1 rounding tablespoonful or 2 heaping teaspoonfuls	28	8	L

NAME OF FOOD.	ONE VIENO EQUALS:	Acid factor.	Number of vienos in one pound.	Nitrogen factor.	Laxative effect.
FRUIT.					
Apples	1 apple 2½ inches diameter	11	3	1	L
Apricots	6 of moderate size	18	3	3	L
Bananas	1 large banana	—	5	2	L
Blackberries	2 moderate size sauce dishes	12	3	3	L
Canteloupe	1 canteloupe 5 inches in diameter	—	2	3	N
Cherries	1½ moderate size sauce dishes	13	4	2	L
Cranberries	Not quite 1 pint	37	2	1	L
Currants (dried)	3 tablespoonfuls	—	13	1	N
Dates	5 average dates	—	16	1	N
Figs	1 very large fig	—	15	2	L
Grapes	1½ moderate size sauce dishes	8	4	2	L
Lemons	3 moderate sized lemons	78	2	3	L
Olive oil	1 tablespoon, very full	—	42	0	N
Olives (ripe)	8 olives	—	12	1	N

Name of Food.	One Vieno Equals:	Acid factor.	Number of vienos in one pound.	Nitrogen factor.	Laxative effect.
Fruit—Cont'd.					
Oranges	1 large or 2 small oranges	20	2	2	L
Pears	1 large pear	5	3	2	L
Plums	6 small plums	14	4	2	L
Prunes	3 large prunes	—	14	1	L
Raisins	2 heaping tablespoonfuls	—	16	1	L
Raspberries	2 moderate size sauce dishes	16	3	4	L
Strawberries	3 sauce dishes	18	2	4	L
Watermelon	15-pound melon equals 10 vienos	—	1	2	N
VEGETABLES.					
Beets	½ pound		2	5	N
Cabbage	¾ pound		1	8	L
Carrots	½ pound		2	5	L
Celery	1 pound		1	9	L
Dried peas	About 1 ounce		17	11	N

Name of Food.	One Vieno Equals:	Number of vienos in one pound.	Nitrogen factor.	Laxative effect.
Vegetables—Cont'd.				
Green corn	1 large ear	5	6	L
Green peas	¼ pound	4	11	L
Lima beans (dried)	1 ounce	16	8	C
Lettuce	1 pound	1	10	L
Navy beans (dried)	1 ounce	16	11	C
Onions	½ pound	2	5	L
Parsnips	6 ounces	2	5	L
Potatoes	¼ pound	4	4	C
Spinach	Almost 1 pound	1	15	L
Squash	½ pound	2	5	L
String beans	½ pound	2	8	N
Sweet potatoes	3 ounces	6	2	N
Tomatoes	Almost 1 pound	1	6	L
Turnips	½ pound	2	5	N

OLD AND NEW DIETARY STANDARDS

The term " dietary standard," as it has been applied in the past, means the amount of various classes of nutrients that should be taken by the human body under the varying conditions of age, work, etc.

Many investigations have been made during the last twenty-five years in this country, Europe and Japan regarding the amount of foods consumed by various groups of people. The facts gathered, which include more or less accurate records of the foods eaten by many thousands of individuals under widely different circumstances and conditions of life, is invaluable scientific data, but the interpretation that has been placed upon these observations, forms one of the most conspicuous blunders made by the scientific world. Whether this criticism should fall wholly upon the men of science, who made the investigations, or more upon the people who misinterpreted their meaning, is an open question; but the fact remains that from the general teachings in physiologies and popular bulletins published by the government there has been widely spread many very incorrect ideas respecting the amount and character of nutrients required to maintain a high standard of life and health.

The following table gives, in the Vieno System, the results of a number of the investigations as made. These figures represent the actual daily average amount of food eaten by the people under observation when they were following their customary diet:

	Vienos.	Decigrams Nitrogen.
California Football Team	66	375
New England Rowing Club	40	255
Wealthy class in American cities	30	250
U. S. Army rations	37	200
Farmers, Eastern U. S	34	160
Skilled laborers, U. S. cities	40	220
Alabama negroes	34	145
Japanese peasants	20	100

From such records the government standards have been roughly approximated. The standards published by the United States Government, computed by Prof. Atwater, and commonly known as the Atwater Standards, are as follows:

	Vienos.	Decigrams Nitrogen.
Man at hard muscular work	55	280
Man at hard work	41½	240
Man at moderate work	34	200
Man at light muscular work	30½	180
Man of sedentary habits	27	160

The Atwater Standards for women are computed as four-fifths of the amount of food required for a man under similar conditions.

Of course it has been recognized throughout that no correct standard could be prescribed for individuals without knowing the details of their environment and personal habits, yet these dietary standards have been put forth to guide the public in the selection of their food. Although the great majority of people eat what is set before them and ask no questions about nitrogen and energy, the influence of a prescription so universally published as the Government Dietary Standards seriously sways and affects the habits of the people. Obviously the correctness of Government standards is of vital importance to the health and welfare of the nation.

A dietary standard to be of value should tell the amount and proportion of food materials required to keep the human body in its highest working capacity. The error committed by the men who planned the foregoing standards, is that they have assumed that the amount of food a man does eat is a criterion of the amount he should eat.

Man is a creature of habits, and civilized man is a creature of a good many bad habits. The argument that the average amount of food eaten is the amount that should be eaten falls under suspicion at once when we consider the fact that by a similar line of reasoning we could prove that the use of tobacco is necessary because the majority of men use it, or that deformed feet are necessary for good social standing because a few million Chinese women consider this to be the eminently correct thing.

The idea has been spread far and wide that the diet of the American working man, which is the richest in proteid of any race in the world, is responsible for the great economic thrift of the American people. As a matter of fact rich diets are associated with prosperity, but the prosperity is the cause of the diet, not the diet the cause of the prosperity. Meat and rich foods pervert the taste and gain a hold upon the bodies of men, as alcohol and narcotics do. When a man or nation becomes wealthy, gluttony is the usual result, but there is no proof that a heavy consumption of food is the cause of a nation's greatness. On the contrary, history shows many illustrations of the rise and growth of a people in power and prosperity, the consequent adoption of excessive and luxurious habits of eating and drinking, followed by physical deterioration and the decline of the race. Diet was the mercury in the national thermometer that marked the first mental decline of the Roman empire. The power to live from the work of others, which is miscalled wealth, gives leisure and luxury, and the demands of sensuality are apt to assume control while mentality declines at a corresponding ratio.

The criterion that we should depend upon to determine dietary standards is not the amount of food eaten, but the amount of food that is found to give the greatest vitality and capacity to do things. It is reasonable to assume that this amount would be the least quantity of food that would maintain activity without using up the food material stored in the body. All food taken in excess of the amount actually required is a poisonous embargo laid upon the vitality of the body.

To do a given amount of work or to add a pound of tissue to the body requires a definite quantity of energy-yielding or tissue-building material; but if more food is eaten than is needed for these purposes, the excess must be thrown off at a tremendous expense of vital force. If it is not digested, it ferments in the alimentary canal, giving rise to poisonous products, which enter the blood and cause all manner of ills. If it is absorbed by the blood, it must be decomposed into simple products before being secreted, for the complex substances of food cannot be directly excreted from the body. All this means that food taken in excess of the actual requirements is not only useless, but very detrimental, consuming energy, poisoning and interfering with the normal action of the body, and overtaxing the organs of excretion.

The assumption that the amount of food that will give the best result is the least quantity that will maintain normal bodily functions is now known to be correct. It has been positively proven by recent scientific experiments that we would be greatly benefited in health if the above dietary standards were cut in half. The obstinate manner in which the old school of scientists have tried to avoid the acceptance of the modern investigations is almost amusing. They seem to be much afraid that the world will starve to death, and have searched in vain throughout the field of science for facts to sustain the old standards of diet.

True Food Requirements

The amount of energy required by the body depends very greatly upon the amount of work done, and hence cannot be prescribed when this is unknown. However, there is a certain amount of energy consumed by the beating of the heart and in the maintenance of bodily heat which can be fairly well estimated. The daily quantity of energy-yielding food required for the maintenance of the life functions is about one vieno for every 10 pounds of bodily weight. For a man at steady muscular work, such as a carpenter or farmer, this quantity should be about doubled. The amount best suited to a man of sedentary habits, but who takes regular exercise for an hour or two each day, is about half way between these two quantities. Thus a man weighing 140 pounds would require 1½ vienos for each 10 pounds or 21 vienos of food per day. These weights apply only to people in normal flesh, who neither desire to gain or lose weight.

The fact that either fats or carbohydrates can be used as a source of muscular energy can be taken advantage of in prescribing dietaries for persons whose digestive organs are so deranged that they cannot partake of a normal amount of either of these nutriments. This does not mean, however, that the proportion of fat and carbohydrates in the food can be entirely disregarded. The digestive processes involved are radically different, and a suitable ratio of carbohydrates and fats should be maintained if we expect to keep all functions of the digestive and assimilative organs in their best working order.

With a view to guiding in a general way those who wish a standard of diet for ordinary use, and who consult tables in which fats and carbohydrates are listed separately, I might state that the fat should form about one-fourth the total source of energy of the food or one-eighth the weight of water-free substance.

Consideration of the amount of proteid food required by the body is of special interest. An idea that was held by scientists until forty years ago, and which is still a matter of popular belief, is that nitrogenous foods are the source of muscular energy. This is a natural assumption. Lean meat is muscle. If a man eats muscle he would surely grow muscle and be a strong man. The apparent logic of this is so evident that its belief among people, who are not acquainted with physiological chemistry, is almost universal. As a matter of fact, the man who eats the muscle of an ox for the purpose of adding strength to his own biceps goes as wide of the mark as the college boy who takes calf's brains for breakfast the day before examination.

The fact that nitrogenous foods are not a source of muscular energy has been repeatedly proved by experiments on man and animals. The glucose or grape sugar in the blood, taken into the muscle cells, and there uniting with oxygen brought from the lungs, is the true source of muscular energy. When the body is fed upon proteids and lacks sufficient quantities of other food, a portion of this can be converted into glucose or blood sugar, which maintains bodily heat and energy. This (together with fat) is the source of energy of carnivorous animals, but they have excretory organs especially adapted to handle the useless products that are left when proteid food is used to produce glucose for muscular energy.

Prof. Chittenden, of Yale, has proved that dogs are capable of living for an indefinite period, maintaining health and increasing bodily weight upon a diet with only a small proportion of proteid. Thus we see that even carnivorous animals require for the maintenance of the bodily functions a comparatively small amount of nitrogenous material, and can get their strength- and heat-forming elements from carbohydrates and fats.

During active life a given quantity of nitrogen is required to maintain health. Under certain conditions the amount of nitrogen required for the maintenance of health would be increased; for illustration, a rapidly growing youth would consume nitrogen to actually increase the tissues of his body. An emaciated person, who wishes to increase weight; a person recovering from a severe case of illness, or one who is just beginning to take up strenuous work and whose weight shows a daily increase due to actual growth of muscles, all these would require nitrogenous food in addition to that required for the normal vital processes.

The amount of nitrogen actually consumed in the physiological processes has been determined by various methods, and for the adult is from 40 to 60 decigrams per day. This amount, however, makes no allowance for the waste necessary in the refusal by the digestive or other organs of parts of the proteid not suited to actual bodily uses.

From the results of numerous experiments the quantity of food nitrogen, which is found to maintain the best bodily condition, is about three-fourths of a decigram per pound of bodily weight. Less than one-half a decigram per pound bodily weight would cause nitrogen starvation, while more than one decigram per pound, except in the case of a person rapidly gaining flesh, would fill the blood with those nitrogenous decomposition products that are known to be the cause of fatigue, muscular soreness and that feeling of listlessness experienced by the consumer of an excessive proteid diet.

As explained in the chapter on flesh foods, the proteid of flesh is worse in this respect than milk, eggs or vegetable proteids, because flesh is laden with the unexcreted nitrogenous decomposition products of the animal.

The reason that the flesh-eating athlete is more healthy than the sedentary flesh eater is because his much more rapid circulation passes the blood more frequently through the excretory organs, removing a larger proportion of the poison.

Those abstaining from meat proteids need much less training to keep in physical trim than the steak-fed athlete. Compared with the number of contestants, an overwhelming proportion of the endurance tests in athletics are won by non-meat-eating athletes. The best record for the arm-holding endurance test made in this country by a meat eater is 22 minutes; the non-meat-eater's record is 176 minutes.

Nature's Food Scales

But must I weigh all my food and count every apple and ice-cream soda I eat during the day? I would answer by saying that if you have been eating as blindly as the average American nothing could more forcefully impress upon your mind the importance and interest in the subject of food than to provide a note book and compute for a few days the energy and nitrogen contents of your diet. This, with the Vieno System, will be easy enough, if you dine in your own home. With the aid of the popular approximations of the " one-vieno-equals " column you can even get a line on how near you are meeting the real needs of you body, though you live at boarding house or hotel.

It is interesting, right and helpful that we should study, know and profit by the findings of science, but nature gave man a means of determining the food requirements of his body a hundred thousand years before the invention of the Vieno System or the multiplication table.

There are several thousand taste-buds called " papillæ " on the top and root of the tongue. When the mouth receives food that is approved by the taste-buds each motion of the jaw in mastication pumps out saliva which is thoroughly mixed with the food, which brings out new and still more delicious tastes. The mouth is the laboratory in which everything that goes into the stomach should be tested and prepared. The taste-buds are the police of the stomach. If they have not been perverted and abused, they will stand ever on guard and protest when either the quantity or quality of the body's building material goes wrong.

They will perform this service for us perfectly if we train and treat them decently; but if we abuse and pervert these delicate organs by heaping upon them and forcing them to accept stimulating, irritating and unnatural things, they cease to perform their functions, and sullenly accept almost anything and any quantity with which we choose to load them.

Luigi Cornaro was a Venetian nobleman and philosopher. He became a physical wreck at forty. He ceased philosophizing about ethics and such things and decided to ascertain why.

He very soon solved the problem. It was over-eating. He began by restricting himself to 12 ounces of solid food per day. As he advanced in age he still further reduced his daily ration until he partook of only one egg a day, in addition to a very little wine and water.

After adhering to this custom for many years and enjoying perfect health, he one day partook of 2 ounces of solid food, an experiment which nearly cost him his life. Some of his best works were written between the ages of eighty-six and ninety-five. He lived to be 103 years old, though the best doctors of his day had told him at forty that he could never reach the age of fifty.

In subsisting wholly upon uncooked food, the natural tendency is for all the organs that are employed in converting food into energy to become normal, and make no demands except those required by nature. Natural foods require more mastication, which is nature's greatest guard against over-eating; but until the system adopts the new régime and the taste-buds are given opportunity to adjust themselves to the change, it is best to partake of about half the quantity one would eat were the foods cooked, and masticate them twice or three times as long.

FLESH FOODS

Many thousands of people attain fine physical development and seem to maintain good health when subsisting upon a mixed diet, including meat. It is true that meat will sustain life, and it is equally true that human life can be sustained without it.

The question of whether man should eat the flesh of animals seems to be especially fascinating for those who give much attention to the subject of human nutrition. There are many viewpoints from which the question of vegetarianism may be discussed. Religious teachings have been very conspicuous in the history of flesh eating. Some sects require man to refrain from all animal products, while others condemn only the flesh of certain animals. The discussion of these various teachings is of no importance to the scientific student; hence I will not consider them here.

Flesh eating has been widely discussed during the past few years—chiefly from the animal's standpoint, that is, the cruelty and destruction of life involved in the slaughter of innocent creatures who are in many ways physiologically related to us. That practices and customs that train humanity in cruelty toward animal life are to be discouraged cannot well be disputed; but this phase of the subject of vegetarianism is also one somewhat without the realm of food chemistry, and upon which ample stress has been laid by other writers.

I wish to discuss vegetarianism here from the standpoint of scientific human nutrition. One of the first and most important phases of the question is man's natural adaptation to such a diet. By natural adaptation I mean the fitting of the physiological organism to the food primitive man was able to procure. The digestive and metabolic process of man, has, in his comparatively brief period of civilization, doubtless undergone some changes, but it was in the long ages of evolution that the digestive organs of man received their chief characteristics. For this reason it is of especial importance for us to know the diet of primitive men at a time before his increasing resourcefulness enabled him to gather his bill of fare from the four corners of the earth.

The food of the man-like or anthropoid apes, of very primitive savage tribes, and that of our own ancestors, as indicated from remains found as fossils and in caves, all throw light upon the subject. The consensus of these various studies indicates that the original or natural diet of man was one drawn chiefly from the vegetable kingdom, but not entirely so. Fruits, nuts, green vegetables, edible foliage, tubers and roots, were all included in man's primitive bill of fare. The foods of animal origin were varied, and consisted of such articles as birds' eggs, shell fish, and, though it may not please some of our twentieth-century readers to be reminded of it, primitive man undoubtedly devoured many insects and other low forms of animal life. Our modern custom of eating lobsters, clams and frogs' legs might well be considered an inheritance of this habit.

Primitive man ate all of the foregoing articles uncooked.

From the above facts it will be clear to the mind of the unbiased reader that man does not need to ingest large quantities of beefsteak in order to survive. Neither do the facts of man's primitive diet prove that he is by nature an absolute vegetarian as is the cow, and wholly unsuited to digest any material of animal origin. The anatomy of man's teeth and digestive organs, when compared with that of other animals, bears out the conclusion that he is by nature chiefly a vegetarian, but not absolutely so, and that his digestive organs can assimilate a diet that is somewhat more bulky than that of carnivorous animals, but, on the other hand, less bulky than the diet of animals which subsist wholly on succulent plants as do the herbivorous species.

A diet composed exclusively of flesh contains fat and nitrogenous compounds only. These two classes of foods can maintain life. For that matter proteid alone will maintain life, for proteid is capable of forming both blood sugar and bodily fat. The fact that the proteid or fat of meat can be made to fill, in the physiological economy, the place naturally filled by the carbohydrate materials of vegetable food, does not prove that such a diet is without its harmful influences. The living body has many wonderful provisions whereby life is maintained under favorable influences. Just as a blind person develops a sense of touch which in a way acts as a substitute for sight, so the ability of the body to convert proteids or fats into sugar may be utilized in case of emergency; but the using of this emergency or substitute function cannot develop as perfectly an adjusted bodily machine as will a naturally balanced diet. The fact that some people exist on an excessive meat diet no more proves that it is without its handicapping and evil influences than does the almost universal use of alcohol indicate that man is benefited by indulging in intoxicants.

Fat and proteids are the elements supplied by flesh foods, and in considering the use of meat we may well ask, " Is meat the best source from which we may secure these elements?"

The proportion of fat required by man is not large, and where this proportion is greatly increased it results in the unbalancing of both digestion and metabolism.

The proteid substance of meat includes all of the edible portion of a carcass, except the fat. The proteid of meat is more completely and more rapidly digested than is the proteid of vegetables. Notwithstanding this fact, there are serious objections to the use of meat as a source of nitrogen in our food. One objection is that flesh food contains the unexcreted waste matter of the slaughtered animal. When the process of metabolism is suddenly arrested by death, the effete and decomposing cells and partly oxidized waste products, which are normally in the blood and muscle tissue, are left in the flesh. Moreover, while excretion and circulation are stopped immediately upon the death of the animal, the muscle cells live for some hours—at least until the animal warmth has left the flesh. These cells living after the death of the animal continue to produce animal poisons, and as there is no circulation to carry them off they accumulate in much larger percentage than in the normal live muscle cell. When an animal dies in a warm environment, the actual death of the muscle cells is due to this very accumulation of waste product, which would normally be carried away by the circulation and thrown off through the lungs and kidneys.

Plants can thrive upon the carbon dioxide or other excrement of the animal. One form of life may thus utilize what is excreted by another form of life, but the living thing that cannot get away from the excreted matter of its own activity is poisoned thereby. When bacteria growing in a solution of sugar have excreted alcohol until it forms a certain percentage of the contents of the liquid, their activity is stopped. They die from the poisons they have produced. This is the reason why liquids containing a high percentage of alcohol must be distilled and cannot be brewed. The same principle applies to the cells of the human body. The flesh of animals whose physiological processes are almost identical with our own, containing as it does waste products that have not yet been excreted, must, when taken into the human body, add extra burdens to our excretory organs, which are usually overburdened in their effort to remove the effete matter of our own cells. Carnivorous animals are especially provided with an excretory system capable of taking care of such matter; but it is unreasonable to expect the excretory organs of man, which are not adapted to such a purpose, to throw off, in addition to its own waste matter, similar decomposing products of other animals.

Meat in the sense the word is used here includes beef, mutton, pork and an occasional allowance of wild game. From the standpoint of its chemical consideration, meat may well be divided into flesh or lean meat and animal fats; the former of which we will consider first.

Lean meat is composed of the muscle of the animal. Stated roughly, lean meat is three-fourths water and one-fourth protein. The protein is composed first of connective tissue, which is a tough, fibrous substance that forms tendons and holds the muscle cells in place. Chemically, connective tissue is formed of albuminoids, which are somewhat difficult to digest, and do not perform any important service in the nutrition of the body, as they cannot take the place of true proteid in tissue formation.

The percentage of connective tissue depends upon the cut of the meat. As every housewife knows, the cheaper cuts of meat contain a larger amount of this material. The gelatine of commerce is a manufactured product derived from the connective tissue of animals.

A second portion of the protein is in the form of globulin, myosin and other true proteids, which form the actual muscle substance. These proteids form perhaps three-quarters of the entire proteid of meat, and are the most valuable food substance it contains. A very small portion of meat proteids is formed by the free albumins of the blood, which are mechanically retained in the muscle cells, the purpose of which is the nourishment of the animal, and, therefore, are not unwholesome as food. The fourth class of nitrogenous substances found in flesh foods is called meat extractives. Though they exist only in quantities of from 1 to 2 per cent of the weight of the flesh, they are the most interesting from the standpoint of our discussion, because they are not present in any but flesh foods, and are products of cell life, hence not wholesome as food. They are composed of urea, uric acid, creatinin, etc., and are similar or identical to the waste products of human-cell metabolism. The amount of these substances contained in flesh depends upon the condition of the animal at the time of slaughter; being greater in animals in which the normal functions have been seriously disturbed by fatigue or fright.

Meat extractives, which are physiological poisons, are the principal substances in meat extracts and beef tea. Their stimulating effect upon the body, like that of alcohol, is due to these poisonous properties. The use of beef tea for nourishing the sick is about as wise as the use of alcohol to keep one from freezing. Beef tea is but little more nourishing than urine, which it very closely resembles in chemical composition.

The chemical composition of the various kinds of meat need not be elaborated upon in this work. The variation is not great except that due to the per cent of fat.

The distinction between beef and mutton from the nutritive standpoint is of no consequence. Scientific facts do not show that one of these articles is particularly better or worse than the other. The use of pork has been generally condemned the world over. The reason for this is probably explained by the prejudice of tradition and religion, rather than by any scientific facts.

The chief distinction between pork and other meats is that the former contains a much larger percentage of fat. Pork is usually prepared by frying, while pork fat is largely used in the preparation of other foods—a process of preparation that is exceedingly harmful, and which no doubt has reflected much upon pork as an article of food. The prejudice against swine because of the filthy habits of the animal is more a matter of sentiment than of science. The hog is not an unclean animal if given a chance. Corn and alfalfa fed pork is, so far as science knows, fully as wholesome as beef or mutton, if prepared in similar fashion.

Animal Fats

The use of animal fats outside of those consumed as fat meat is confined chiefly to their use as shortening in bread and pastry, and for the purpose of cooking other foods by the process of frying. These uses of fats are not to be commended regardless of the nature of the fat. As the fats from animal carcasses in any form are not palatable, there can be very little use for them in an approved dietary. The chief distinction between animal and vegetable fats is in the proportion of olein compared with stearin and palmitin. The proportion of the two latter elements is much greater in the fats of pork and beef than in those of the human body. This is especially true of tallow. For this reason vegetable fats, which are of a more liquid nature, are more desirable, where we wish to add fatty tissue to the body, than those of animal origin.

Cold Storage of Meat

Only a very small amount of the meat produced in America is consumed near the place of slaughter. Refrigerator cars have been constructed for the purpose of preserving meats until they can reach their destination, and large cold-storage plants erected to hold it, awaiting market advances for the benefit of packers and tradesmen. Meat in cold storage slowly undergoes decomposition, and, as is well known, storage meat will decay much more rapidly after its removal than will fresh meats. The process of ripening meat in rooms of varying temperature depends upon this decomposition. The natural enzymes of the meat, and the bacteria contained, digest a portion of the proteids, forming nitrogenous decomposition products, similar to the meat extractives above referred to. Ripened or storage meats contain a larger per cent of this group of compounds than does fresh meat.

The high flavor of ripened meats depends upon the odor produced by this decomposition process. There are certain species of bacteria that produce more poisonous waste products than others, and this occasionally causes the development of ptomains in cold-storage meat.

The use of cold-storage or ripened-animal products is to be condemned. Nevertheless, if people insist upon using flesh food, and economic conditions make it profitable to produce meats far from the place of consumption, the use of cold-storage meats seems inevitable.

Contagious Diseases and Animal Food

Much has been said regarding the contraction of contagious diseases from eating the flesh of diseased animals. This risk has been much magnified in the public mind. Flesh is seldom taken in an uncooked form, and disease germs are destroyed in most flesh foods by cooking. The cooking process, however, must be thorough. The heat must be sufficient to coagulate the proteids. The interior of a slice of rare beefsteak has not reached this temperature.

The most dangerous form of disease contamination from fresh flesh food is that of trichinosis. Trichina are worm-like creatures, the first stage of whose growth is in the flesh of swine. When taken into the human digestive organs they are revived and bore their way through the walls of the digestive organs to complete their growth in the human muscle tissue. Trichinosis is one of the most fatal of diseases.

Tape-worms have a similar origin. There are several species, some being derived from pork and some from beef. The tape-worm cyst or larva is embedded in the muscle of the diseased animal, and when not killed by heat will hatch out and live in the human intestine.

Tuberculosis is the most prevalent disease among animals, especially cattle. The flesh of the diseased animal is contaminated with the tubercle bacillus, and there is now but little doubt of the transmission of the disease from the bovine to the human by means of this infected meat. In spite of the fact that a surprisingly large proportion of all cattle are infected with tuberculosis, only a comparatively small number are thrown out by the government inspectors as being tuberculous. That a great amount of such infected meat is sold to innocent consumers is certain. On the other hand, a natural diet and life in the open air will cure tuberculosis, whereas living in close, dark rooms and eating meat and drinking alcohol are among the chief predisposing causes in the development of this disease.

Fish

Under this heading we will consider both true fish and other water creatures, such as shellfish, frogs, lobsters, etc.

The flesh of most fish is quite free from fat, and consists almost entirely of water and proteids. Fish is less concentrated than the flesh of warm-blooded animals, averaging about 18 to 20 per cent of proteids. The percentage of ash in fish is also somewhat greater than in other flesh foods. The prevailing idea that fish is good food for the brain was founded upon the fact that analysis of some fish show a considerable percentage of phosphorus, which substance is also found in the brain. There is no reason to believe, however, that the use of fish affects in any manner the brain tissue. Any well-balanced diet contains ample phosphorus to nourish the brain.

The argument against the use of meat because of the presence of nitrogenous decomposition products holds true with fish, though in a modified degree. The decomposition products of cold-blooded animals are not identical with those of mammals, and hence their presence in the human body does not add to the percentage of human waste products in the same manner as other meats do.

Because of the fact that oysters and clams are frequently eaten uncooked, they are often commended as a valuable source of proteid. The serious objection to the use of these things, especially uncooked, is that they are grown in the sea, often around our harbor entrances which are usually flooded with sewage, and hence they are liable to be contaminated with typhoid or other disease germs. The amount of actual food value in shellfish is quite small. They contain only about 10 per cent of proteids, and as the remainder is water they are scarcely worth considering as a source of nutriment.

Poultry

In the use of domestic and wild fowl as food the same general conditions obtain as in the case of the flesh of animals. There are a few special points, however, concerning poultry that are worth considering.

The production of chickens and other domestic poultry is one of the most widespread American industries, and is capable of being carried on in communities too thickly settled for the economic production of beef and other meats.

Another point to be observed in the use of poultry as food is, that because of the ease with which every farmer and villager can keep a flock of chickens, it is possible for him to have fresh meat of his own production; otherwise, if he used flesh foods, he would be compelled to depend upon the various meat products of unknown age and origin which the general markets afford.

Another reason why the use of poultry from the hygienic standpoint is less objectionable than the flesh of the mammal is that the amount actually consumed is usually much smaller than other forms of meat. According to the old idea of economy and diet, this would be a serious argument against the use of poultry products, but as has been clearly pointed out, the most serious criticism that can be urged against the modern bill of fare is the use of large quantities of meat. The chief reasons that keep meat upon the bill of fare are matters of custom and taste, and not of hygiene. From this viewpoint we see why that form of meat food which is pleasing to the taste, without adding any great quantity of actual flesh food to the diet, is a step in the right direction.

The methods of feeding poultry or other animals by shutting them up in small quarters and feeding upon soft mush foods is condemned by many upon the ground that it is unnatural and harmful to the health of the fowls, and, therefore, the meat could not be wholesome. The facts are, this process, if not carried too far, will produce a quality of meat less harmful than the meat of thin, ill-fed animals. For the reason that the greatest objection to the use of animal foods is the presence of the unexcreted waste products, and these are present in small quantities when little muscular exercise is taken. For similar reasons, the flesh of young animals is preferable to old ones. The white meat is in all cases preferable to dark, as its properties are more like eggs and milk—are stored animal food substances rather than flesh with its metabolic poison. Of all meats eaten, liver and kidneys are the most abundantly filled with decomposition poison products. The same general statements regarding domestic poultry apply to the use of wild game. The amount of actual food value contributed to the world by the slaughter of game is comparatively small. A similar amount of vegetable food could be produced at one-tenth of cost of time and expense without slaughtering the wild creatures of our forests. The present popularity of hunting as a sport, and the regard of all wild animals as rare and dainty articles of diet, is but the expression of the vainer and less worthy sentiments of man's nature. It is a step backward toward savagery instead of forward toward a higher civilization.

The custom of flesh eating would entirely disappear from the catalogue of civilized habits in less than twelve months were it not for the fact that flesh foods are made edible by the process of cooking. People might eat shellfish, dried and smoked meat a short while, but it would not long endure. This would also solve several other great questions with which misguided individuals, societies, churches, political parties and State legislatures are vainly struggling, for the habit of flesh eating is largely responsible for the universal desire among civilized people for some form of stimulant. This craving supports and perpetuates the habit of taking distilled and ardent liquors, tobacco, tea and coffee, and the numerous drugs which, all together, have done the human race more harm, dethroned more intelligence, sapped from the human economy more vitality, ruined more homes, made more widows and orphans, and changed more natural virtue into artificial vice, caused more sorrow and tears, more failures and fears, than all other agencies of destruction put together.

That the habit of flesh eating is responsible for the almost universal desire for stimulants and narcotics has ceased to be questioned by those who have been placed in position to make experiments, from which all real knowledge is obtained. These conclusions were first forced upon the writer by noticing the gradual disappearance of the appetite for coffee and tobacco in his own case when he began to experiment upon himself with natural foods. With this hint to work with, no opportunity was lost among the thousands of patients he has treated to observe the effects, and get at the truth, along these lines. If one or two people had completely lost their appetites for all forms of stimulants, after going upon a natural food régime, it might have revealed only an idiosyncrasy. When a half dozen or a dozen undergo the same treatment with the same results it suggests that it might be true. But when hundreds give the same evidence, with no apparent deviation from this general rule, it forms one of those cases where a new truth is revealed from the chaos of our alleged civilization. Such has been the experience of the writer in the responsibility of cooking and meat eating for the perpetuation of alcoholism and kindred evils.

NON-FLESH FOODS OF ANIMAL ORIGIN

Eggs and milk occupy an unique place among foods; they are animal, yet they are not flesh foods. The purpose which milk and eggs serve in nature throws much light, even to the unscientific mind, upon their nutritive value.

Living creatures do not exist for the benefit of other forms of life, but for themselves only. The lumber in our homes owes its existence to the plant's struggle for sunlight, which made it necessary for the trees to possess a strong storm-withstanding stem to hold aloft its leaves above the shade of other foliage. The leaves and stems of grass are essential to the life of the plant, and were not created as food for cattle.

The majority of human foods of plant origin represent the nutrient material supplied by the parent plant for the early life of the seedling. All grain, nuts, fruits and tubers are merely modified forms of food material adapted to the rapid nourishment of the young plant. For this reason the starch and oil of seeds, the sugar of fruits and the lesser quantities of nitrogen contained in all seeds are in a more available form for cell nourishment than would be the mature portions of the plant.

Milk and eggs in the animal world occupy a position identical to that of seeds and fruits in the plant kingdom; that is, they are created for the first nourishment of the offspring. In the process of evolution a fundamental distinction between birds and mammals is in the manner in which the young are nourished. The egg of the bird supplies sufficient nourishment to develop the young to a point where they can exist upon the ordinary food of the adult, while in the mammal this nourishment is supplied by milk.

Eggs

The hen's egg must contain all food material necessary to form all portions of the body of the young chick, and to supply it for a time with heat and energy. An average egg weigh 2 ounces; of this weight about 10 per cent is shell, 30 per cent yolk, and the remainder white. The white of the egg is composed of albumen and water. The yolk consists of globulin, egg fat and lecithin; this latter substance contains a considerable proportion of phosphorus, and is one of the essential constituents of brain and nerves. The egg, as a whole, without shell contains 13 per cent of protein, 10 per cent of fat, and 1 per cent of ash, and about 77 per cent of water.

The growth of the animal body compared with the amount of energy expended is more rapid, the younger the animal. For this reason the percentage of nitrogen in milk and eggs is much too great to form a balanced adult diet, and should be supplemented by articles containing larger proportions of heat-producing materials, preferably carbohydrates.

The proteid material of eggs is in a form especially adapted to the construction of new cells. For this reason it is one of the best foods known for use in cases of emaciation, where new tissue is to be added rapidly to the body.

Under the personal observation of the writer, patients have been known to gain at the rate of a pound a day on a diet composed almost entirely of eggs and milk, with just enough of other articles to meet their chemical requirements. In case of malnutrition and emaciation of the body, there is no food known superior to eggs for rebuilding and revitalizing the body and overcoming previous errors of diet.

Fresh eggs contain no " extractives " or other harmful substances. Stale eggs are open to the same criticism as ripened or stored meat, but, fortunately, owing to the sulphur contained, eggs always become repulsive to the sense of smell before decomposition has proceeded far enough to render them unwholesome.

Spoiled eggs are frequently deodorized by criminal dealers and sold to bakers and used in bakery products. Many cases of poisoning have been traced to this cause.

Eggs, considered as a food product, are much superior to flesh foods. The white of the egg is almost pure albumen, and is readily digestible and assimilable; therefore, it can often be digested by those who are suffering from disorders of the digestive and assimilative organs when no other form of nourishment can be taken.

Eggs are especially the food for growing children and those who are between the ages of twenty and thirty years. The best way they can be used or prepared, is to whip to a very fine froth, taken alone or with a very limited quantity of fruit juices, cream and sugar. Eggs will combine readily with nearly every other article of food.

The quantity of eggs that can be used in a normal diet depends upon the amount of nitrogen desired. An egg contains about 14 decigrams of nitrogen. Thus it is seen that from eight to ten eggs will supply an ample amount of nitrogen for the daily needs of the body were none taken from any other source.

The consumption of five eggs per day, when we rely wholly upon this article for animal proteids, is sufficient for one taking a normal amount of exercise, while from two to three per day are sufficient for one pursuing sedentary occupations.

Milk

Milk and the various forms of manufactured products made therefrom constitute one of the most important groups of food in the modern bill of fare. Milk and eggs have been excluded by some vegetarians, but outside of the sentimental feeling against foods of animal origin, there are no good reasons for these interdictions. Dairy products are free from the particular objections urged against the use of flesh foods and form a source of easily assimilable nutriment that excels, at least for certain purposes, any foods from the vegetable kingdom.

It is true that the use of milk by man cannot strictly be called a natural food, as it is clearly evident that before man became civilized enough to keep domestic animals dairy products were unknown.

The constituent elements of cow's milk vary greatly. Dairy cows, by long and careful domestication, scientific breeding and feeding, have been brought to a high state of specialization. Some classes of cattle have been bred for large quantities of milk, Holstein cows having been known to produce 100 pounds of milk per day, which, of course, is many times the quantity required for the nourishment of a calf. The Jersey breed has been selected for the quantity of butter fat contained in the milk. This often runs to abnormal percentages, being in some cases as high as 8 to 10 per cent, whereas the normal or average butter contents would not be more than 3½ or 4 per cent.

The average composition of mixed milk from many cows which forms the commercial product, runs about as follows: Water, 87 per cent; lactose or milk sugar, 4.5 per cent; butter fat, 3.5 per cent; ash, .7 per cent; proteids, 3.3 per cent, of which about 2.5 per cent is casein and .8 per cent albumin.

Commercially, the value of milk has been measured almost entirely by its content of butter fat. This idea is not altogether correct, for the chief value of milk as a food lies in its nitrogenous elements. Fat can be secured equally well from many other sources. Milk proteids are especially valuable, and cannot easily be supplanted in the diet.

Milk, like eggs, forms an unbalanced article of diet for adults, though the distinction is not so great, as milk contains some carbohydrates. Milk is intended for the nourishment of the young animal at a later stage of development than is the egg, and hence contains a slightly larger proportion of the energy-making substance. A calf romping in the pasture would require more energy-producing materials than a chick in the shell. The milk of various animals varies much in composition, depending upon the natural requirements of the young of their respective species.

Milk is as nearly a perfect food as any article now known, but, as I have before pointed out, the diet for an adult should contain more carbohydrates in proportion than is found in milk. The large amount of casein in cow's milk tends to cause coagulation in lumps that are difficult of digestion in the human stomach. This tendency can be counteracted in several ways. If milk is allowed to sour or clabber, the casein coagulates, and it can then be taken into the stomach without danger of being formed into curds by the gastric juice. Sipping and thoroughly insalivating the milk instead of drinking it, as one would water, also reduces the curdling in the stomach and insures better digestion and less liability to the formation of gas.

Milk harmonizes in the stomach with all non-acid fruits, cereals, nuts and all vegetables containing starch. Milk should not be combined with acid fruits, especially the highly acid kinds, such as lemons, limes, grape-fruit, pineapples, etc. Neither should it be taken at the same meal with meat, except in very limited quantities, nor should it be used with green salads.

When the stomach has been over-burdened with a quantity of inharmonious combinations of food until the mucous membrane has become irritated and probably ulcerated, there is no food so acceptable as milk. For the common disorder of hyperchlorhydria, which is a term used to describe a condition of chronic sour stomach, milk is one of the best counteractive foods known.

When adults have long violated the dietetic laws of over-feeding—consuming large quantities of food and drink that have been devitalized by fire and fermentation—milk is, in many cases, the one food that will restore a normal condition. Especially is this true in advancing age, when the body has little use for energy producing foods.

When milk is taken for the purpose of counteracting a congested condition of the bowels or an irritated condition of the mucous membranes of the stomach, it should be combined with the fewest possible things.

Adulteration of Milk

The practice of adulterating milk with water has very largely ceased, owing to the surveillance of city authorities and the passing of laws that fix legal standards requiring milk to contain a certain percentage of fats and total solids.

The chief form of criminal tampering with milk has been the use of preservatives to prevent souring. Formaldehyde has been used very extensively as a milk preservative. This substance is a poison, destructive to all cell life, and has been the cause of great prejudice against the use of milk as food for children whose delicate organisms are very susceptible to poisons.

The pasteurization of milk is a process of heating for the purpose of destroying possible disease germs and the lactic acid bacteria. In pasteurization the milk is heated to about 170° F.; it is not boiled for the reason that boiled milk is distasteful, and would readily be detected by the public. It is evident that the practice of pasteurization, which would cause coagulation of the protoplasm sufficient to kill the bacteria, would also coagulate the albumin, rendering it difficult of both digestion and assimilation.

Cooking milk is recommended by certain alleged dietetic authorities on the ground that it kills bacteria. They probably forget, maybe do not know, that all the five digestive fluids are strongly germicidal. The bacteria that may exist in milk, of which so much fear is entertained, could not live an instant after coming in contact with the gastric juice, which is strongly acidulous, to say nothing of contact with the saliva, bile and pancreatic and intestinal juices.

Milk, however, should be taken with some intelligence. A valuable lesson in its proper use can be learned from the calf or nursing infant, which draws and swallows it in small quantities, and which keeps up a continuous motion of the jaws, as if in chewing, thus pumping into the mouth enough saliva to aid nature in the first process of digestion, and at the same time increases the flow of digestive juices in the stomach and intestines.

The too free use of boiled or sterilized milk will produce scurvy in children, and when scurvy exists both sterilized and raw milk must be discontinued. It is, therefore, much better to commence at once the use of milk in its natural condition than to risk the development of scurvy, and then be compelled to eliminate from the diet such a valuable food.

Sterilized milk lacks freshness. It tastes dead, and to a very great extent is dead. The coagulation of the proteid molecules that takes place in boiling sets free the inorganic portion of the molecules, thus rendering them, as to iron and flourine, unabsorbable, and as to the phosphates, unassimilable. The use of sterilized milk becomes especially serious when it is remembered that children require both phosphatic and ferric proteids in a living form, which are contained only in the natural or uncooked milk.

The proteids of cow's milk are not wholly suited to the human infant, being too high in casein and too low in albumin. Neither is there enough milk sugar in cow's milk for the human infant. By the humanizing of milk for infants is meant its alteration to decrease the casein and increase the milk sugar. This is accomplished by taking the top half of a bottle of milk and adding an equal volume of water and 3 to 5 per cent of milk sugar. The exact proportions and concentration should depend upon the age, weight and general condition of the child.

Cheese, Butter and Oleomargarine

Cheese consists of the coagulated casein of milk, together with the fat globules that may be mechanically retained. Cheese is made by coagulating the milk with rennet, which has been extracted from the stomach of a calf, the sugar of milk being passed off in the whey and lost.

Smear-case, or cottage cheese, is formed by allowing the milk to sour or coagulate by gradual warming. This form of cheese is usually made from skimmed milk. and hence contains practically no fat.

The cheeses of commerce are ripened in various ways. The process of ripening cheese is due to the action of enzymes present in the milk or formed by bacterial growth. Ripened cheese is considered to be more easily digested than the unripened product. About the best that can be said of this process is that the ripening of cheese is perhaps the least objectionable of all processes of decomposition taking place in food proteids. The only benefit that can be claimed is one of flavor, and in matters of flavor the appetite for limburger and other such cheeses is at least a cultivated or perverted taste that furnishes no evidence of merit or nutrition.

In the manufacture of cheese, the milk sugar and a part of the albumin and fat are wasted, and, as there is no advantage in taking milk in this changed form, there seems to be little excuse for the use of cheese in a diet when fresh milk can be obtained.

The fat, when removed from the other contents of milk, constitutes butter. Butter is very wholesome when not subjected to high degrees of heat, with other cooked foods. The custom of salting butter is wrong, and inexcusable from a hygienic standpoint. It had its origin, no doubt, in the fact that it became commercially necessary in order to preserve it during the time consumed in shipping, transporting and marketing. During the last few years fresh or sweet butter has come into general use in all large cities and well-appointed hotels and cafés. In Paris, where the culinary art is studied and kept at a higher standard than in any other city in the world, it is considered an offense to serve salted butter. It is taken for granted that the article is aged and would have spoiled had it not been preserved with salt.

Oleomargarine is a general term that includes all manufactured preparations of fats which imitate dairy butter. At the present time there is an internal revenue tax of ten cents per pound upon the manufacture of oleomargarine that is artificially colored yellow to resemble butter. There is no good reason why oleomargarine should not be sold on the market when put out under its own name. The object of the governmental regulations is to prevent its being sold as butter.

Oleomargarine is manufactured by combining beef fat with cotton-seed oil until a product is formed which has a melting point similar to that of butter. Lard is also used in some oleomargarine products. This combination of fats is then churned with cream or milk, and sometimes dairy butter is added to the artificial product in the process of working. The object of this latter operation is to give the flavor or odor of dairy butter.

There is much popular prejudice against the use of oleomargarine, but it is practically as digestible and quite as wholesome as dairy butter.

FOODS DERIVED FROM PLANTS

Cereals

The literary fabric of the ancient world has been woven from warp of fiction and a woof of fact. When we turn to it we find the beautiful, the poetic, the absurd and the true so mixed together that scholars of every nation regard their separation as worthy of their most profound thought.

It was from this confusion that the word "cereal" came. Ceres was a goddess worshipped by the ancient Romans. She occupies a most conspicuous place in the beautiful myths that adorn the classic literature of those ancient peoples. She was considered the head of the agricultural department. Her special duty was to sit on fleecy clouds and pour from the hollow of her mythical hand floods of sunshine and showers of rain over the grain fields of the Cæsars. Therefore, all grains grouped together were called cereals.

Cereals were first used as food by man only when in a green or soft state, that is, from the time the grains began to form in a milky condition until they ripened and became so hard as to hazard the integrity of the teeth. Later they were soaked in water to soften them, and then in warm water, which saved time and facilitated the work of preparation. This custom evolved into the use of hot water, then hotter water, until boiling or the present method of cooking was the result.

In order to facilitate and lighten the labor in the preparation of cereals, they were pounded, crushed and broken, which custom very naturally evolved into the modern roller mill. The present methods of grinding and cooking cereals render mastication unnecessary, so far as pulverizing them is concerned. Therefore, they pass the taste-buds under false pretences and the salivary glands do not have to perform their duties, hence they do not pour into the mouth the amount of saliva necesary to perform the first step in digestion.

Soft, mushy foods are also responsible for the woeful decay of teeth, which is such a conspicuous mark of civilized man. Nature will not keep alive or produce, generation after generation, any part of the anatomy that is not used. Her system of economy is perfect.

When cereals are taken in their natural state, or not too completely pulverized, so that the teeth may be employed in their final and complete grinding, they constitute a valuable food for a normal, healthy person. This would also be better for the teeth, and make cereal substances much easier to digest and more thoroughly convertible into energy. Under the present dietetic régime, in which cereals are regarded as the staff of life, it is safe to say that more than 50 per cent of all stomach disorders are caused by mushy or unmasticated cereal starch.

The variety of grain used depends upon

the climate and habits of the people. The predominant use of rice by the Asiatics, wheat by the Europeans, and maize by the American Indian, is so well known as to need no comment.

WHEAT is often stated to be a complete food. This, however, is not strictly true. Wheat contains only a very small percentage of fat; and while fat can be made in the body from carbohydrates, it is more natural and entails less work upon the digestive organs and liver if the diet is balanced so as to contain all the nutritive substances the body needs in the right or natural proportions.

All of the digestible carbohydrates of wheat are in the form of starch. A diet composed of wheat alone would contain 70 per cent of this food, which, while perfectly wholesome, is digested with difficulty. The proteids of wheat exist in larger quantities and in greater variety than that of most any other grain, but the wheat proteids are more difficult of digestion than the proteids of milk, eggs or nuts.

Wheat varies greatly in composition, according to the variety and locality in which it is produced. This fact is not known by the average writer upon dietetics, who spends a great deal of time eulogizing wheat as the wonderful staff of life, because his food table tells him that wheat contains 13 per cent of proteid, while corn only contains 10 per cent. As a matter of fact, much of the Pacific Coast wheat, largely used in the manufacture of cereal foods, contains less protein than corn. On the other hand, the macaroni wheats, produced in South Dakota, contain as high as 18 per cent of protein.

Rye, as a whole, may be considered in a class with wheat. Botanically, the plants are similar, and so far as known the effects upon the body are not very different. Rye contains a larger per cent of cellulose and somewhat less gluten, and for this reason it is more laxative than wheat.

Barley is very similar to wheat and rye. It is, perhaps, somewhat less laxative than either, because it contains less cellulose. It cannot be used alone as a bread-making grain because the nitrogenous or glutinous substances are not tenacious enough to hold the loaf when it raises. For this reason it has been greatly neglected as a food product. Barley deserves a decidedly more important place in our dietaries than it has hitherto been accorded. The most palatable form in which to eat barley is as an uncooked flake.

OATS. The composition of oats varies somewhat from the above-mentioned grains. Oats contain a larger proportion of both fat and proteids, and form a desirable food if eaten in the proper manner. The objection to oats as an article of diet is the manner in which they are commonly used as food. Rolled oats and oatmeal are prepared for the table by cooking hastily, which forms a doughy mass consisting of gelatinized starch entangled with the peculiar gummy proteid of the oat grain. This mass is a most prolific source of disturbed digestion, for mechanical as well as chemical reasons.

Rolled oats, wheat and barley are delicious when served uncooked with cream, grated nuts and, if something sweet is desired, dates, figs or raisins.

Corn is the cheapest material capable of nourishing the human body that is produced in the temperate zone. It is less digestible and more deficient in mineral salts than the grains thus far mentioned. It is not an unwholesome food material, but there is nothing to be gained except cheapness in substituting it for other grain products. The mature corn grain is very dry and hard, and somewhat unpalatable. Corn in the future will probably play an increasing part in the problem of feeding the world as a cheap raw material from which to manufacture glucose.

Rice is lower in proteids than any of the food grains, and is also low in fat. The starch of rice is quite easily digested, more so, perhaps, than any other form of grain starch. Rice is almost entirely devoid of mineral constituents, and for this reason it is productive of serious nutritive derangements. Proteids and salts from other sources are largely cut off. Before science pointed out this difficulty the rice diet was productive of serious physical disorders in the ranks of the Japanese navy.

The use of grains in the diet may be considered from three factors: First, as a source of energy; second, as a source of nitrogen; third, as a means of regulating intestinal peristalsis. All grains contain from 70 to 80 per cent of starch, and, therefore, the question of energy is one rather of assimilating the energy contained than of the amount present in the original material. The use of grains in the diet deserves the most careful consideration, and the study should not be confined so much to the particular grains as to the quantity and the energy which can safely be derived from these sources. The conventional American diet is composed of such an abnormal amount of grain starch, and is prepared in such an unscientific manner, that it has become one of the most prolific sources of stomach and intestinal disorders with which I have had to deal. In a great number of cases it becomes necessary to prohibit cereal starch entirely, except in specially prepared forms, and then in very limited quantities.

Grain, as a source of proteids, has received undue consideration in hygienic writings. The actual differences in the percentages of proteids or nitrogen in the various kinds of grains, or in flours or breakfast foods, is hardly worth consideration. Grain is not the natural source of proteid for the human body, and grain proteids are not so easily digested as those of eggs, milk and nuts. The nitrogen content of grains is not nearly so important an item to consider in deciding the kind of grain food as the question of fermentation and intestinal congestion or constipation.

The primary objection to cooked grain is that it induces over-consumption of cereal starch, which is the chief cause of intestinal congestion, and the long train of ills that follow this condition. The greatest virtue of taking grains in their natural state is that it first limits the consumption, and, second, it relieves and often cures intestinal congestion and many sympathetic disorders.

Nuts

Nuts, one of the best articles of food known to science, the thing which helped to lift primitive man from a gibbering anthropoid to the Greek Apollo, are by many people, the most misunderstood and maligned articles in all the dietetic catalogue. The nut is commonly used now, and for many decades has been used, as a confection, or to finish off the alleged good dinner; and while in all probability it was the only decent article of diet eaten during the feast, yet, owing to its geographical position in the "potpourri," it was charged up with a lot of mischief for which it was in no wise responsible.

There are many intelligent people who sincerely believe the nut to be an indigestible and harmful article of food, and we quite agree with them when it is eaten as course thirteen at a prize dinner. But when given an opportunity, and eaten as a decent nut should be, it is one of the most delicious, harmless, healthful and hygienic articles that ever graced the table.

It is encouraging, however, to know that the nut is rapidly gaining in appreciation and popularity. The great food reform movement that is now sweeping over nearly all the civilized world has caused thousands of people to abandon the use of flesh foods, and the natural substitute therefor is nuts. In any large market can be found to-day from fifteen to eighteen different kinds of nuts, all of which possess very superior life-giving properties. Nuts are especially to be recommended as an article of food, owing to the fact that they have not been contaminated by the cook stove.

Nuts should be thoroughly masticated. They should be reduced by the teeth to perfect emulsion before entering the stomach, and not more than two ounces eaten at a meal. Two vienos of pure fat is enough to supply the demands of a normal body for twenty-four hours. By consulting our table on nuts, a correct idea can be gained as to the quantity of each variety that should be consumed per day. Almonds, peanuts and Brazil nuts should be blanched before eating, that is, the inner covering should be removed by soaking in tepid water.

Botanically speaking, nuts are the seeds of trees and shrubs which store the greater proportion of the food material for the seedling in the form of vegetable oil. There are few miscellaneous articles of food that are known by the name of nuts which do not primarily belong in this group. In the following discussion, we will take up the various nuts in order of their general worth as food products.

Pine Nuts include several species of nut from as many different kinds of pine trees, and many different countries. The Italian pine seed or nut, which is sometimes known as the pignolia, or in its refined form as the protoid nut—a name given to it by the author owing to the large per cent of proteids it contains—possesses the highest per cent of proteid material of any article of food known. Its chemical properties are as follows: 34 per cent proteid, 47 per cent oil, 9 per cent carbohydrate, 4 per cent ash, and 6 per cent water. The protoid nut, while containing pound for pound the most nitrogen of any known food, has a lower nitrogen factor than the foods in which the fat is replaced by water, as in eggs and skim milk. This same point should be noted in consulting the analysis of all nuts which contain a large amount of fat that supplies energy in the most condensed form. Hence the nitrogen factor, which is the relation between nitrogen and energy, is often lower in nuts than in grain. Another advantage of protoid nuts over all other species is in their softness, which renders them more easily masticated, and hence more readily soluble and digestible. The protoid nut is grown on the crown lands of Italy, in a very narrowed area of country, along the north coast of the Mediterranean Sea.

The forms of pine nuts found in the southwestern United States are not so rich in protein as the protoid nuts, but in other respects are excellent food. The American pine nuts are not marketed extensively, as the crops are irregular and expensive to gather.

The Pecan, which is one species of hickory-nut, contains 13 per cent of protein and 70 per cent of fat. It is a very delicious and desirable food, though somewhat inferior to pine nuts and almonds in digestibility and as a source of nitrogen.

The pecan nut, which has been considered in the South for many decades as a wild, prodigal growth of no great importance, is now being cultivated, harvested and husbanded as one of the most profitable, as well as one of the most important, articles of food grown in that balmy clime.

The Agricultural Department of our national government has published bulletins on the subject of budding and growing the pecan, and pecan orchards are being planted in various localities in the South, and several States have adopted measures to encourage the industry. During the next few years this movement will undoubtedly receive the attention it has so long merited. It looks as though within the next few years we might see the boundless plains of Texas converted into pecan orchards instead of cattle ranches, and great pecan-shelling mills take the place of slaughter houses.

THE ALMOND is a most desirable food. It contains 17 per cent of nitrogen and 54 per cent of fat. The flavor is very agreeable and the nuts, in digestibility, rank next to protoid nuts. They can be substituted for each other in dietaries.

SOFT-SHELLED OR WHITE WALNUTS are commonly known as "English walnuts," though they are chiefly grown in France and California. These nuts contain 24 per cent protein and 63 per cent fat, and form one of the staple nut foods of both Europe and

America. Hickory-nuts, Brazil nuts and butternuts are of similar food value to walnuts.

Filberts or Hazel Nuts are quite different from the previous variety of nuts, and are less digestible. They should be masticated exceedingly fine, and should not be taken by those whose digestion is particularly weak. Filberts contain 15 per cent of protein and 65 per cent of fat.

Chestnuts are distinct from the other nuts because of the fact that their chief food value consists of starch rather than oil. This makes them of less value as a food. The small quantity commonly used, however, does not overburden the system with starch as would a full meal of potatoes or bread. I, therefore, consider them a proper adjunct to the diet.

Cocoanut is a product of the palm tree and, while quite distinct from our nuts of the temperate climate, is a very valuable and abundant food which deserves a more universal use. Cocoanut is about one-half fat and contains 6 per cent of protein and 28 per cent of carbohydrates. Cocoanut should be well masticated, as the substance is exceedingly fibrous.

It is amazing to think of the kind of food that alleged civilized people subsist upon, when nature spreads before them its vast fields and stores of fruits and nuts that have waved to and fro in the pure air and sunshine, that have drawn their substance from old Mother Earth and filtered it through a hundred feet of pure white wood—life-giving substance that has responded to the warm embraces of summer and spring—substance that has fed the swelling bud, burst it into bloom, and filled it with fragrance and honey, sweet as Araby's fabled rose—foods born from the fecund womb of Mother Earth, fed on the fragrance and wrapped in the many-hued swaddling clothes of odorous blossoms, rocked by every pure and passing breeze in the life-giving cradle of summer and spring, nursed to maturity at the breast of maternal nature, and cooked by the fires of the eternal sun.

Leaves, Roots and Tubers

Experience has led me to the conclusion that leaves of vegetables containing chlorophyll, such as lettuce, cabbage, spinach, parsley, etc., are very necessary and valuable articles of food. Such vegetables can be taken in an uncooked or salad form and are very rich in the organic salts so essential to the maintenance of health.

In the selection of foods, one of the safest rules to be governed by is that all articles that can be used as they are handed to us by Mother Nature, without offending the sense of taste and smell, are good food, and, on the contrary, all articles that have to be ground, mixed, fixed, cooked, greased, mushed and mussed up, are not only unnecessary, but could be eliminated from the diet to advantage.

The essential value of the vegetable group of food materials is not one of the great food value per pound. Succulent vegetables contain anywhere from 75 to 95 per cent of water. It is rather the great variety of substances which are incorporated in fresh vegetables that gives them their chief value as food. The ordinary leaf of lettuce contains cellulose and proteids, active chlorophyll, pentoses, sugars and starches, representing carbohydrates in various processes of transformation, small quantities of fat and a relatively large per cent of mineral salt, besides numerous flavoring materials.

Vegetables, as they grow in our gardens, may be conveniently grouped according to that portion of the growing plant which we consume. These groups are the leaf or salad vegetables, the roots and tubers, the fruit-like vegetables, and a fourth class might be made of the immature grains and legumes. The salad vegetables are very essential in a well-rounded bill of fare, and the neglect of their use is perhaps one of the greatest errors in dietetics. My preference of these salads is according to the following list: Spinach, lettuce, romaine, water cress, parsley, cabbage, turnip tops, beet tops, radish tops, dandelion and kale.

The Irish or white potato is the only true tuber that is used extensively as human food. It is formed chiefly of starch and water. It is not palatable when taken in the uncooked form. Cooked potatoes are generally insufficiently masticated and combined with other food products with which starch does not harmonize. For this reason I deem the use of potatoes undesirable.

The sweet potato is a root and differs chiefly from the Irish potato in containing more sugar and less starch. The sweet potato is more wholesome than the Irish variety, and I consider it one of the best of cooked foods.

The root vegetables, given in the order of my preference, are: Carrots, turnips, beets and parsnips. Carrots are exceedingly palatable in an uncooked state, especially with nuts, and I highly recommend them when one is living entirely upon an uncooked bill of fare.

Tomatoes may be considered upon the border line between vegetables and fruits, and

I have found them exceedingly useful in cases of intestinal congestion and torpidity of the liver. Watermelons are wholesome, and can be used in the diet in a manner somewhat similar to the juices of berries and oranges. Ripe muskmelons and canteloupes are readily acceptable to the stomach, and can be eaten as freely as bananas.

I have invariably found that the use of uncooked vegetable substances has an exceedingly beneficial effect upon the digestive action and the general toning up of the system. This is not because of any large amount of nutritive units, but because of the presence of a variety of appetizing, mildly stimulating and vitalizing substances which are not to be found in the conventional bread and meat diet of artificialized man. These elements are craved by the normal appetite, and must be supplied if we are to have the highest degree of health and physical vitality.

Legumes

Legumes are the product of a certain group of plants characterized by the production of seeds in pods. Beans and peas are the most familiar representatives of this group. Peanuts, though from the name erroneously classed as nuts, are legumes, and very much resemble the other members of this group in chemical composition.

Legumes are rich in nitrogen, and some varieties have a large percentage of oil, though decidedly inferior to true nuts in this respect. Legumes are not equal to nuts in food value. In their natural state they are hard, somewhat indigestible and unpalatable. These qualities are due to the fact that the nitrogenous properties of legumes are radically different from those of nuts, and belong to a class not so desirable as food substances. For this reason legumes in the uncooked state have a flavor which is universally objectionable, and when taken in liberal quantities they cause many digestive disturbances. Many vegetarians, upon discarding a meat diet, have substituted legumes as the chief source of nitrogen. By this change they have made little improvement, and in the case of weak digestion may actually suffer from the inability to derive suitable nitrogenous nourishment from this source. Fresh peas and garden beans are desirable products when eaten for variety, as are most other garden products, but they should not be made the chief source of nitrogen in the diet.

There are two legumes that are used very widely as foods and which, because of the oil contained, are better balanced and more nutritious than common beans and peas. The first of these is the peanut; the second is the soy bean, which is used largely in Japan and China. These products are similar in composition and contain about 30 per cent each of protein and fat.

Fruits

Fruits occupy a most conspicuous place in the needs of the human body, and in subsisting upon elementary foods, they constitute one of nature's most important articles of diet.

It would astonish the average omnivorous Englishman or American to know what magnificent specimens of manhood are built almost entirely from fruits in some of the South Sea Islands. According to the most authentic history of man, fruits undoubtedly composed the principal part of his primitive diet. Primitive man was active, nimble and agile. Fruits left no deposits in his veins and arteries to age and stiffen them. Fruits made for him pure blood, and breathing the open air kept it pure. His surplus energy demanded activity which kept the pure blood surging through his veins. Long life, superior power and endurance were the results.

It is a hopeful sign for the future health and longevity of our race that the demand for and consumption of fruit is rapidly increasing.

The banana will supply the body with all the elements of nourishment that is obtained from cereals. Many cases of chronic stomach disorder have been permanently cured under the direction of the author by eliminating wholly all cooked cereals and breads of every description and substituting therefor the simple diet of very ripe bananas. The banana is at its best when the skin is covered with small black spots, or when it assumes a pied appearance. Where the consumption of bananas is large enough, they should be purchased by the bunch, and where it is not, they should always be purchased by the hand, not detaching them from the stem until they are needed for use. They should also be kept in the sunshine as much as possible.

It is believed by many people that bananas do not agree with them. Close observation will show in almost every instance that this condition is the result of other things with which the fruit is mixed in the stomach, and the seeming difficulty can be overcome by making an entire meal occasionally on fruits, or fruits and nuts alone.

The succulent class, such as apples, oranges, grapes, peaches, plums, pineapples, and all the juicy berries, possess great corrective properties, in addition to their value as food. They seem to be designed by nature to overcome the evil tendencies of many other foods, while giving to the body their own nutrition.

Each distinct genera of fruit has a specific effect or office to perform in the human body. Oranges are the best "liver pills" ever invented, while apples are the best known remedy for that "dark brown" taste so often experienced next morning after the ten-course dinner.

The juices of strawberries, blackberries, raspberries and dewberries are delicious and healthful. When it is pressed out and the refuse discarded, there is no better food in the fruit family. But the large amount of seeds these berries contain, which are very hard and entirely insoluble, produces in many people irritation of the mucous membrane of the intestinal tract, which manifests itself in many harmful ways.

Grape-fruit contains many very pronounced and valuable nutritive and healing properties. It is a natural antidote for biliousness when taken without sugar.

Like nuts, the most desirable feature about fruits is that they are not an article commonly considered necessary to be cooked. The cook has undertaken in many ways to improve them by the application of his art, but has been unsuccessful, as is evidenced by the fact that nearly all fruits are used in their natural or elementary state, even by those who advocate cooking even their drinking water.

In subsisting upon uncooked foods we must necessarily depend very largely upon fruits and nuts, but we should exercise judgment, patience and toleration. We must remember that we often suffered for our wrong eating, and accommodating nature may have partially adjusted our bodies to these incorrect habits. Therefore, when correct methods of eating are employed, the wrong must be undone and overcome by the same law of evolution, and the stomach sometimes rebels against a change even toward the right. However, the body will adjust itself much quicker to the right than to the wrong, and when the adjustment is once made and the natural dietetic law obeyed perfect health, strength, endurance and vitality are the inevitable results.

The chemical composition of fruits consists of about 80 or 85 per cent water, 5 to 15 per cent of sugar, 1 to 5 per cent of organic or fruit acids, and small quantities of protein, cellulose and numerous salts, a portion of which may be combined with the fruit acids. Some unripe fruits contain starch and various other carbohydrate substances, some of which are distasteful and unwholesome. On the other hand when fruits become over-ripe and decay has set in, the sugar is changed into carbon dioxide, alcohol and acetic acid, and the fruit rapidly deteriorates in wholesomeness and palatability. These changes, together with the loss of water, account for the sponginess and tastelessness of cold-storage and other long-kept fruits. Fruit is best when it has been allowed to ripen naturally on the trees, but modern commercial conditions demand that it be picked slightly immature and allowed to ripen on the way to or while being held for market.

Fruit acids are composed of carbon, hydrogen and oxygen, and are burned in the body the same as sugars or fats. The actual energy-producing contents of fruit is not large, and depends almost entirely upon the sugar contained. The dietetic value of fruits consists chiefly in combinations of salts, sugars, organic acids and various flavoring or aromatic substances. These same salts, acids, etc., in their commercial form, and administered separately, would be of no value and might produce harmful results, but in combinations of ripe fruits they occupy very important places in the diet.

Dates, figs and raisins constitute a group of the best foods known to the dietary. They contain about 75 per cent sugar, which is chiefly glucose or grape sugar, the principal source of power for the human system.

Fruits should never be cooked. The folly of cookery and artificial methods of preparation is more apparent in fruit than in any other article of food.

The process of taking the water from fruits to prepare them from season to season is of great importance. It has added one of the greatest luxuries known to the uncooked bill of fare. Evaporated, dried or dehydrated fruits, when soaked in pure water, may be restored to almost their original condition. Aside from the fresh or natural condition, this is perhaps the most palatable and wholesome form in which they can be taken. The methods of canning fruits, as practiced by the farmer's wife, are to be given next consideration.

The ordinary commercial preparations of canned fruits, jams, marmalades, jellies, etc., are generally of a very inferior and doubtful character, and commercial competition has reduced the standard until it is almost impossible to ascertain the quality of these articles. The Pure Food Law has accomplished much to establish honesty in the preserving and labeling of foods, but these products are still far from ideal, and should not be considered where fresh or evaporated fruits are obtainable.

Sugars

Sugar in its various forms is an universal food product. Sugars are the principal substances contained in fruits, but we shall here confine our discussion to the various sugars and syrups as they appear in commerce.

Beet Sugar. Contrary to common belief, the greatest proportion of the world's supply of sugar comes from the sugar beet. Sugar, which had been previously manufactured entirely from the maple sap and sugar cane, was discovered about 100 years ago to be present in beets. A very interesting historical fact is that the sugar beet industry owes its origin to the efforts of Napoleon to supply France with home-produced sugar because of the tariff or embargo laid upon foreign commerce. At the present time all of Central Europe is a heavy sugar-producing region. The method of production and the amount of sugar contained in beets has been greatly improved, so that the present industry is quite able to compete with the production of cane sugar of the tropical regions. Crude sugar from sugar beets is unpalatable, and must be refined before it is fit for use. The refined or crystallized form of beet sugar is chemically identical with cane sugar.

Sugar cane, though not as important as formerly, is still grown very extensively in Louisiana, Cuba, Mexico and other semi-tropical countries. The chief distinction between cane sugar and beet sugar is that the crude cane sugar, before it is refined, is very palatable and a wholesome product. The brown sugar of commerce is uncrystallized or unrefined cane sugar, and is fully as wholesome, and to most tastes more palatable than the granulated product. It is to be regretted that fashion has decreed that we should all use granulated sugar.

Refined sugar, whether produced from beets or cane, is sometimes slightly contaminated with sulphurous acid which is used for bleaching purposes. Indigo is also used for the same purpose, and while ordinarily not present in large quantities, is at least useless, and if present in any considerable amount is very objectionable. Powdered sugar is identical with granulated sugar, with the exception that it is ground.

Maple sugar, which is made by concentrating (boiling down) the sap of the soft maple, is a product decidedly superior in natural flavor to any sugar of the foregoing sources. Maple sugar contains a small proportion of glucose and levulose, but its chief distinction from other sugars is a matter of flavor. The hickory tree contains flavors somewhat similar to the maple. A cheap substitute for maple sugar has been manufactured by flavoring common sugar with the extract of hickory bark.

The other forms of dry sugar, which are obtainable in the market, are milk sugar and crystallized glucose. The chief use of milk sugar as an article of diet is in humanizing cow's milk for infant feeding. The dry glucose, or, as it is sometimes called, grape sugar, is not commonly seen in the market for the reason that it is difficult to crystallize, and hence it is much cheaper to market glucose in the form of syrups.

Glucose

Commercial glucose is made from starch. Its wholesomeness depends wholly upon the care exercised in its manufacture. Pure glucose is a good food. The manufacture of glucose is an excellent illustration of the substitution of science for nature in food manufacture. When we eat grapes we know that we are partaking of one of the most important substances required in the processes of life. Science has taught man to manufacture exactly the same substance that is found in the grape from the much cheaper product, corn. Were it not for the use of cheap materials and careless workmanship by unscrupulous manufacturers, this article would come into general favor as a food commodity.

The best form in which sugar can be taken is in natural sweet fruits, honey, maple sugar and unrefined cane sugar. Maple, sorghum, cane and glucose syrups are perfectly wholesome when free from foreign materials.

The total amount of sugar that can be taken in the diet may run to very considerable amounts, but it should not be combined with starch products, especially cooked starch. The general condemnation of sugar, as an article of diet, is due to the fact that it is usually eaten with porridges, puddings, etc. This mixture is very apt to ferment in the stomach or digestive tract.

Sugar can be taken with nuts forming an excellent combination. Sugar can also be taken with milk and eggs, helping to balance those articles and make them more suitable to human and especially to adult human requirements. The amount of sugar that can be taken each day depends somewhat upon the individual, but in the case of a strong, healthy adult, taking much exercise and having no particular desire to increase weight, sugar, chiefly in fruits, should furnish from one-fourth to one-half the total energy of the body. Experiment has proved that glucose can be taken in larger quantities than cane sugar; the latter product, however, should never exceed one-fourth pound daily.

Confections. Under the general term of confections are included all products manufactured for the purpose of appealing chiefly to the sense of taste, rather than to serve any special food requirements. The chief products that enter into confections are the various forms of sugars, nut kernels, flavoring extracts and coloring materials. Many of the substances used in the manufacture of confections are the most wholesome of food material, and yet the eating of confections as a general practice is to be condemned for several reasons; first, the substances that candy manufacturers use are unknown to the consumer, and hence the temptation to use cheap or adulterated material or to flavor and color the article is apt to govern the merit or quality; second, candies are usually eaten without regard to appetite or the need of food; third, the combination of materials used in manufacturing confections is designed wholly for the purpose of appealing to an artificial sense of taste rather than natural hunger.

Honey occupies a most unique place in the realm of food products, as it is practically the only food substance which man utilizes from the insect world. Honey is sometimes compared with milk and eggs as a nutrient. These former substances differ in being complete foods for the nourishment of young and growing animals, and hence must contain all food material necessary to construct the animal body. Honey, which is a carbohydrate, is gathered and used as a food for the adult bee. Pollen or bee-bread, which is a nitrogenous substance, is the food of the larva or young bee. This illustrates a very interesting fact in physiological chemistry. The insect differs radically from higher animals in that its life is divided into three complete stages. When the adult insect with its wings emerges from the cocoon or pupa, its growth is complete. Some insects never take any food in the adult stage. But the adult bee takes food, which is practically pure corbohydrates, and which would not maintain the life of a growing animal.

Honey is composed chiefly of glucose and levulose, with perhaps 10 per cent of cane sugar, depending upon the flowers from which it is gathered. Honey is one of the most wholesome forms of sugar known, and its delightful flavor makes it a very desirable food product. A " land flowing with milk and honey " was the scriptural poet's idea of an ideal country. These are the only two things used by man which serve no purpose in nature except food. No better combination of foods was ever suggested by either poet or scientist.

Vegetable Oils

Vegetable oils form entirely too small a portion of the modern bill of fare. Fats are the best source of heat and energy of any class of food substances. Vegetable oils contain a large per cent of olein, which is considered the most palatable and the most valuable fat known. Vegetable oils are more valuable than animal oils as human food, because they are more adapted to the fat metabolism processes of the body and less liable to contain harmful substances. For those who cannot thoroughly masticate nuts—because of defective teeth—vegetable oils afford one of the most necessary articles of diet. Nuts, unless mastication is perfect, do not contribute to the body all the fats they contain, while oils overcome completely this difficulty.

The olive is an unique plant ranking as far as the nature of the food material goes between fruits and nuts. Ripe olives contain 40 to 60 per cent of oil; the best quality of olive oil is extracted by cold pressure, the cheaper grades being pressed out at higher temperatures.

The superiority of olive oil is due to the fact that it is composed almost wholly of olein, containing very little fatty acids and other impurities, and has a mild, sweet and agreeable flavor.

Green olives have become a standard on the American table as pickles, but I do not recommend their liberal use. Ripe olives may occupy a conspicuous place on the sun-cooked bill of fare.

Cotton-seed oil is a by-product of the cotton fiber industry. For this reason it is the cheapest of vegetable oils. Cotton-seed itself is not an edible product, for the cotton-seed proteid contains an alkaloid substance which is unwholesome, and in large quantities poisonous.

The methods of cotton-seed oil manufacture are more complex than those of olive oil. The oil must be heated and bleached with certain chemical agents, and if intended for salad or table use, a portion of the stearin must be removed to render it more liquid.

Peanut oil is an excellent food substance, which is almost entirely neglected in this country. This oil contains the best portion of the nut. Other vegetable oils, that are valuable as foods, and the use of which is to be commended, are sesame and sunflower oil. These products are not produced extensively in this country.

Cocoa butter is pressed from the beans from which cocoa and chocolate are made. The butter has a flavor similar to these products.

Cocoanut butter is not extensively used in America as a food product, for the reason that it becomes rancid too rapidly. The product is popular in Germany, and with the introduction of better methods of preservation we expect to see it more extensively used in this country as a food product, as the sources from which it is derived are almost unlimited.

Palm oil comes from a different species of the palm plant than that which produces the cocoanut. Palm oil is a very inexpensive product, and one which is chiefly used in the production of soap and candles, although it is perfectly wholesome as a food. Such products have not been extensively utilized in this country as food, because people have, in the past, been content with the fat of the hog, commonly termed lard.

It does not follow that all vegetable oils are edible or wholesome. Many vegetable oils contain, in addition to olein, stearin and palmitin, and other fats quite undesirable for food. Castor oil, for illustration, contains ricinolein, which is a poison, and to which its purgative action is due, nature abhorring a poison. Croton oil is very poisonous and the most powerful purgative known to science.

Linseed oil contains large quantities of linolein, which is the substance that oxidizes, forming the stiff rubbery coat on the surface when exposed to the air. This makes linseed oil valuable as a painting oil, but objectionable as a food.

DRUGS

By the selective processes of millions of years of evolution, chemical substances and chemical changes, which work together in harmony, have become associated to form the series of chemical transformations we call life. True food furnishes the foundation or constructive material on which these life processes depend. All other conditions that affect the human body are merely methods of disturbing these natural chemical changes.

To illustrate, we will take the chemical changes that may take place in the hemoglobin of the blood. Hemoglobin is a proteid containing iron. It is a complex chemical compound, and combines with other substances very readily. In the lungs it combines with oxygen. In the muscles it parts with the oxygen, which in turn combines with the glucose to produce heat and energy.

This process is one of the thousands of life forming changes, selected by evolution from the millions of chemical possibilities in the universe. If carbon monoxide, which is present in illuminating gas, be breathed into the lungs it also combines with the hemoglobin, but produces a permanent compound which prevents the normal combination with oxygen and thus causes death.

It is to this latter class of chemical changes, entirely foreign to the normal processes of life, that the effect of drugs belongs. The stimulants, medicines, narcotics and drugs used by humanity owe their use to superficial reasoning, false guidance or misinterpretation of nature's language as expressed in symptoms.

The principal argument against the use of patent medicines has been that they are evil because the user took opium, cocaine or whiskey without a doctor's prescription. Why taking a poison without a doctor's prescription should be dangerous, and its sale a heinous crime, whereas the sale and use of the same drug over a doctor's prescription should be tolerated, even highly commended, is something difficult to comprehend. It is not in line with human evolution to find a way to legally administer poisons, but rather to point out the folly of interfering with nature's work by dosing the human body with poisons of any kind.

In order to give the reader who is not versed in chemistry a clear conception of the nature and effects of drugs, I shall discuss briefly a few of the more important ones. For this purpose it will be helpful to group them into the following classes: (a) Alkaloids or narcotics, (b) alcohols and related compounds, and (c) poisonous mineral salts and acids.

Alkaloids affect primarily the nervous system and may cause freedom from pain or that state of unnatural exhilaration of which the dreams of the opium fiend are a typical symptom. Alkaloids are all of vegetable origin, and are composed of carbon, hydrogen, oxygen and nitrogen.

The second or alcohol group of drugs includes the ethers, chloroform and coal-tar products. This group is also wholly of plant origin, alcohol being distilled from plant products and coal-tar being formed from petrified plants. These drugs always contain the three elements, carbon, hydrogen and oxygen; some contain an additional element which gives them their peculiar property, as the chlorine of chloroform. Coal-tar is the most wonderful source of drugs known. The distillation of this substance produces coloring matters, preservatives, poisons and "pain killers," *ad infinitum.*

The mineral acids and salts of certain metals, especially mercury, lead and copper, are powerful physiologic poisons. Patent medicines are frequently labeled "Pure Vegetable Compounds." This label has descended from the old days when the most potent drugs were taken from this mineral group. At the present time the label is amusing, for, while the mineral poisons in this group are still widely used in medicine, alkaloids and the acetanilide group of chemicals, purely organic or vegetable compounds are a source of far more human misery than all mineral drugs put together.

Narcotics

Opium is the sap of the seed capsule of a certain Asiatic species of poppy. It contains a large number of chemical compounds which belong to a group known as alkaloids. All substances of the alkaloid group in the animal body are disturbing factors. The most active alkaloid in opium or morphine and the general effects and uses of the crude opium, and the refined morphine, may be considered together.

The effect of opium or morphine upon the body is that of producing unconsciousness by benumbing the nerves. Opium addicts are pathetic examples of the progressive stages by which the body and mind may become enslaved to the influence of a narcotic.

Opium is eaten or smoked by the Chinese and other Asiatic races to a fearful extent.

This habit is the worst form of drug slavery known. In this country the morphine habit is the more common form. Morphine is taken internally or injected beneath the skin with a hypodermic syringe. Nearly all of the morphine slaves in this country begin the use of this drug under their physicians' prescriptions.

The use of opium as prescribed by medical men is chiefly for the relief of insomnia or pain. The use of opium in cases of great agony produced by injury, etc., is an act where we can reasonably say that the end justifies the means. Unfortunately, this is only one of the uses to which opium is put by the medical profession. Prescriptions containing opium or morphine are frequently given to relieve pain or to produce sleep, when the primary trouble is chronic and should be cured by removing the causes and not temporarily alleviated by stupefying the nerves. The lengthy death lists due to the use of opium or any other narcotic include both those killed, sooner or later by the drug, and those who die from the disease, which is in this manner merely concealed but not cured.

The dangers of the use of opium are so well known and the habit so universally condemned that tricks are resorted to by manufacturers of medicines to deceive the people into believing that they are using some "harmless" substance, while it is the influence of the opium that gives the medicine its deceptive effect. Patent medicines, which claim to kill pain or soothe coughs and produce sleep, usually contain opium. Millions of babies in this country have been given opium in the form of Mrs. Winslow's Soothing Syrup, and the opium fiends produced and the graveyards filled by this fiendish compound can be imagined, but will never be accurately known.

Cocaine is an alkaloid, the use and influence of which are almost as noteworthy as those of opium. Cocaine is derived from the leaves of the cocoa plant, which grows in the Andes of Peru.

The effects of cocaine differ somewhat from those of opium. It produces absolute freedom from pain, and is used more particularly to produce insensibility in local parts of the body, as in the case of extracting teeth, etc. The cocaine slaves, which are alarmingly on the increase in this country, commonly depend upon the hypodermic injection of the drug. The habit is usually acquired, as in the case of morphine, by the prescription of a physician. The patient learning from experience of the freedom from pain and the sense of exhilaration that can be produced by the drug, and believing it harmless because his doctor has prescribed it, continues the habit on his own responsibility after he has been dismissed by his physician. The cocaine fiend, like the opium slave, develops an insatiable desire for the drug, and is in extreme physical torture when deprived of it. The development of untruthfulness and trickery in victims when they desire their allowance of the forbidden drug is one of the marked traits of the narcotic slave.

There are a number of medicines in common use which depend for their action upon the cocaine they contain. A large number of catarrhal powders in the market are diluted forms of cocaine, and are used extensively both by those who do not realize the nature of the drug they are using, and by those who know that they are cocaine slaves, but prefer to disguise the fact in this manner.

NUX VOMICA is derived from the seeds of a plant that grows in India. Strychnine is the alkaloid which exists therein. Strychnine is quite different in its effects from the above-mentioned alkaloids, and instead of benumbing the nerves, causing sleep or a pleasing sensation, the effect of strychnine produces nerve stimulus, which causes convulsions of the muscles. Death from strychnine is caused by the muscles of the chest becoming so rigid that breathing ceases.

The medical use of strychnine is more for a stimulant than a narcotic. It is given only in desperate cases, where there is some hope that the convulsive effect of strychnine may cause the patient to revive.

QUININE is derived from Peruvian or Cinchona bark. This bark contains a number of alkaloids, as does the juice of the poppy plant. These alkaloids, in turn, may react with acids, forming salts. Sulphate of quinine is the most common form. Bromide of quinine is also extensively used. Quinine has one distinct and remarkable property that is worthy of note. I have repeatedly made the statement in my writings that drugs strong enough to kill disease germs will also kill the patient. This particular drug, in one particular case, is an exception to this rule. Quinine will kill the germs of malaria, which, however, are not bacteria (microscopic plants), but a minute form of animal life. Aside from this one particular use, quinine is a typical alkaloid, and its disturbing effect upon the nervous system is well known. Its extremely bitter taste is, perhaps, the reason we do not have quinine fiends. The extensive use of quinine is probably due to the fact that people observing its effects in malaria, infer that it will cure other fevers, which is not the case.

TOBACCO belongs strictly to the narcotic class. With the possible exception of opium, tobacco is by far the most detrimental narcotic used by man. The active principle of tobacco is nicotine, which is an alkaloid. Nicotine is one of the most deadly poisons known. In distilled form, nicotine even in minute quantities, produces death almost instantaneously. The nicotine contained in a pound of tobacco is sufficient to kill several hundred men if administered in the form of pure nicotine, but in smoking and chewing tobacco only a small amount of this poison is actually absorbed into the body. The sickness caused by the first cigar is evidence of the poisonous effects of the nicotine upon a body not accustomed to its use. The quantity of nicotine that can be taken by the habitual tobacco user would be sufficient to kill a person in which the nicotine habit had not been formed.

Tobacco as a narcotic is not so drastic in its hold upon the body as are opium and cocaine. For this reason the use of tobacco is not so generally condemned. Popular opinion, however, is now rapidly recognizing the fact that all these substances belong in the same general class, and are deteriorating factors in human development. The rapid spread of the cigarette habit among young boys has done much to arouse popular agitation against the tobacco evil.

From the standpoint of health, nothing can be said in favor of the use of tobacco in any form. Pulmonary and stomach disorders with tobacco users are common examples of its destructive tendencies. Tobacco is particularly detrimental to the optic nerves and sexual vitality.

The use of tobacco gradually deadens the sensitiveness and control of the nervous system. The tobacco heart is an extreme effect upon the nervous system of this narcotic. The craving for tobacco is frequently associated with the craving for intoxicating liquors and highly seasoned food. These three factors go hand in hand in perverting the true sense of taste and arousing abnormal cravings which destroy natural appetite.

Neither tobacco nor nicotine are now used extensively by medical practitioners. Tobacco was formerly used as a purgative, while nicotine was given in cases of strychnine poisoning, the idea being that one poison would neutralize another. This theory, however, is becoming obsolete.

Coffee belongs to the group of narcotic substances. The alkaloid which gives coffee its characteristic properties is caffeine. Coffee also contains 3 or 4 per cent of tannic acid. Other substances in coffee, to which the pleasant odors and tastes are due, are various forms of fats and carbohydrates, but these in the real coffee berry exist in small quantities, and their beneficial effects are more than counteracted by the harmful effect of caffeine. The physiologic effect of caffeine is that of a nervous stimulant, increasing the general nervous and mental activity. It is given as an antidote for opium poisoning because it produces an opposite effect in regard to sleep. Coffee, when used habitually, causes many nervous disorders. Many forms of indigestion, dyspepsia, and especially hypersecretion of hydrochloric acid, are caused by the coffee habit, the tannic acid being the chief provoking factor. The effect of coffee upon the nervous system is that of continued stimulation or excitation. When used regularly, coffee overworks and wears out the nervous system, thus causing a deterioration of both body and mind. If caffeine was taken in a highly concentrated form, it would result in a narcotic habit quite as enslaving as the use of opium or cocaine.

TEA is very similar in its chemical composition to coffee, containing even a greater percentage of the alkaloid caffeine, and also a larger per cent of tannic acid. Tannic acid is present in green tea in greater quantities than in the black variety. In addition to the evil effects caused by the caffeine which it contains, tea is more destructive of the normal activities of the stomach because of this tannic acid. The reader may get some idea of what the stomach of the tea user has to contend with when it is stated that tannic acid gets its name from the essential action that this substance has in the process of tanning leather.

COCOA AND CHOCOLATE. The cocoa bean, which was mentioned as a source of chocolate and cocoa butter, is also the source of the beverage known as breakfast cocoa. The cocoa bean contains caffeine, though the per cent is considerably less than in the case of either coffee or tea. Cocoa is practically free from tannic acid. For these reasons, and because of the food value, cocoa is decidedly the least harmful of the narcotic beverages. This, perhaps, explains why cocoa, though being in reality more tasteful and nutritious than either coffee or tea, is less used; it lacks the stimulating or exhilarating effect which is sought by a great majority of people.

Coca Cola is a soda fountain drink that has recently come into extensive use. It contains an alkaloid similar to those of coffee, tea, cocoa, but in much larger quantities. Coca Cola has an enslaving effect similar to that of opium and cocaine, although fortunately not so severe.

The alkaloids thus far discussed will serve to illustrate the general use and properties of this class of substances. We will mention briefly the other more commonly used articles in this list of enslaving drugs. Laudanum is another name for opium. Paregoric is a tincture of opium with camphor and other drugs. Codeine is an alkaloid manufactured from morphine. Lyoscine is the alkaloid or henbane. Atropine is an alkaloid extensively used by oculists. It is contained with other alkaloids in belladonna which, in turn, is prepared from the plant popularly known as the "Deadly Night Shade." Hellebore is one of the old standard drugs and contains several severe and poisonous alkaloids.

Alcohols

The uses and effects of alcohol will not be discussed at length in this volume for the reason that this subject is constantly brought before the public, and the evil effects of alcohol are known to all. I will mention only a few points which are not generally understood. The question of whether or not alcohol is a food has recently received much discussion. The answer of science is that alcohol is a food in the sense that it can produce heat in the body. Starvation is not the danger that threatens mankind, but over-feeding and wrong feeding. To a man in danger of starvation, whiskey at $1.00 a quart will not save the day. In practice alcohol is invariably taken in addition to, and in connection with, other food material, and, therefore, its production of surplus heat within the body and the over-stimulating of metabolism is harmful, and adds one more to the long list of detrimental effects traceable to intoxicating liquor. Alcohol is a food in the sense that dynamite is a fuel. Dynamite produces heat, but it would be an unwise fireman who would use it under his boiler.

Another point regarding the use of alcohol that is worthy of serious consideration, is the fact that improper nutrition, over ingestion of stimulating and heating foods, such as meat, condiments, etc., invariably increases the appetite for intoxicants. The appetite for alcohol seldom, if ever, develops in a perfectly nourished body, and the best cure known for the drink habit is a course of scientific feeding and hygienic methods of living.

Alcohol is a typical stimulant. Its influence is to increase the heart action, the circulation, the production of heat and the general vital activities. When the influence of alcohol has run its course there is a relapse or stupor, which can only be relieved by restimulating the vital functions by continued use of the intoxicant.

This demand for increasing quantities of the drug that causes the stimulating or other abnormal effects upon the body is a law which holds in the case of all drug habits, and explains the so-called "appetite" for drugs. The abnormal effect produced leaves the body in a state of exhaustion, which causes the deluded victim to return to the drug day after day until the craving is beyond his control. At each repetition more of the drug is required to produce the same effect. This leads to a larger and larger use of the stimulant, and a greater and greater relapse or exhaustion after its influence has passed away.

Thus the stimulation of the nervous activities, which in its milder stages produces the good-natured loquacity of the "jolly drunk," ends in the wild ravings of delirium tremens. The temperance people would do well to go into their laboratories and study causes instead of spending so much nervo-mental force in dealing with effects. They would be entitled to the profoundest respect of the thinking world if they would solve the question of why people desire intoxicants, instead of trying to close a few rum-shops by calling on the police.

No man or woman who will live for six months on pure, clean, suncooked foods can possibly keep alive an appetite for stimulants or narcotics. From this rule there is absolutely no variance. There can be no room in the human body, a body made of nature's unchanged foods, for such foreign elements as tobacco and rum.

The prescription of alcohol by physicians is chiefly descended from the old idea that alcohol was strengthening and beneficial to the body. The practice is now discontinued by the majority of reputable physicians. The regular use of alcohol in small doses gives the patient the feeling of physical exhilaration, and is an excellent means of making him believe that he is being cured. For this reason, and because of its cheapness, low-grade alcohol is the chief component of patent medicines.

The following table gives the percentage of alcohol contained in a few patent medicines previous to the enactment of the Pure Food Law:

Peruna	28%
Hostetter's Bitters	44%
Lydia Pinkham's Compound	20%
Hood's Sarsaparilla	18%
Ayer's Sarsaparilla	26%
Paine's Celery Compound	21%

Within the last few years these facts have been heralded before the public, resulting in a heavy falling off of the sales of these nostrums. The number of good temperance people who have been innocently under the influence of alcohol for a good portion of their days can only be estimated by counting the Peruna bottles in back yards.

Chloroform, Ether and Chloral are three drugs chemically related to alcohol. They are typical anesthetics, and produce temporary relief from pain when the vapors are inhaled. They find their chief use in surgical operations, a use which is justified, providing the operation is justified. One death in 3000 occurs from the administration of chloroform, and one in 13,000 from the administration of ether. These products have been used to some extent in patent medicines, particularly consumption cures.

ACETANILIDE is an article made from coal-tar, and is chemically related to aniline dyes. This drug is one of the most remarkable in its physiologic effects of all the narcotic group. It has only come into use within the last few years. Its effect is to produce at first a deadening of the nervous system, which puts it in the " pain-killer " class. Its continued use destroys the hemoglobin of the blood, and produces marked cell-destroying effects throughout the body. Its medical use is for rheumatism, headache, severe coughs, etc., etc. Some doctors say it will cure epilepsy; others say not.

Many of our readers are familiar with the placard, " Orangeine Headache Powders," which flourished before the public the glaring statement, " We print our formula," and so they do, and acetanilide is one of the ingredients so announced. The Orangeine people were safe in printing this formula, because the public does not know what acetanilide is. If they achieved the same results by cocaine or morphine they would not dare to print their formula. The use of acetanilide in headache powders is one of the most glaring crimes of the patent medicine business.

A non-medical writer recently compiled an authoritative death list of something like twenty cases in which death was positively known to be due to the use of headache powders. The headache powder habitué experiences a craving for the drug similar to other narcotic drug fiends. A person who has long used acetanilide powders shows a bluish-white complexion, caused by the destruction of red blood corpuscles. I have selected acetanilide as an example to show that a knowledge of the composition of patent medicines does not protect the people unless the people know more about the destructive drugs they contain. Acetanilide is also extensively sold in the form of the popular "Bromo-seltzer."

Other coal-tar products which have properties related to those of acetanilide are antipyrin, phenacetin and various derivatives of benzol and phenol. The general uses of drugs of this class are to reduce fevers, allay pains, etc. They accomplish this by interfering with the natural action of the nervous system.

Mineral Poisons

Mercury or quicksilver is used very extensively in medicine, chiefly in compounds of mercurial salts. All salts of mercury are very poisonous. Calomel (mercuric chloride) is used widely as an internal medicine. Mercuric bichloride or corrosive sublimate is more destructive to protoplasm, and is used chiefly as an external germicide or disinfectant. The poisonous action of mercurial salts is due to the combination of the mercury with the protoplasm of the bodily cells. When mercurial compounds are taken in poisonous doses, the antidote is the white of egg, with which the mercury combines in the stomach, thus sparing the human protoplasm. The mercurial salts, when given in small doses, produce very remarkable physiological disturbances, notably in-salivation (loosening of the teeth). Mercurial compounds are used by doctors as a sort of last resort. Because of the profound physiological changes produced, these products have been generally administered in cases of incurable disease; probably because the new symptoms of mercurial poisoning masked and disguised the original disorder.

Potassium iodide has a similar remarkable destructive effect upon the natural functions of the body, and for this reason it has been associated with mercury. The medicinal treatment for syphilis, a disease recognized as incurable, is to alternate between potassium iodide and mercurial salts.

The salts of lead and of copper, like those of mercury, are poisonous. These salts have not found so extensive use in medicine, however. The mineral acids, such as sulphuric, are recognized poisons, as well as are the strong alkalies, but their destructive effects upon the living tissue are so apparent and so painful that they have never gained much reputation as medicine. There is one exception to this statement, however; it is "liquozone," which is the basis of the most remarkable patent medicine fraud ever floated. This stuff was heralded as a cure for all ailments in the calendar of disease, and has been especially proclaimed as the twentieth century cure for consumption. Liquozone is made by passing the fumes of burning sulphur into water. This forms an impure mixture of sulphurous and sulphuric acids —two of the cheapest and most common drugs known. Sulphuric acid is an excellent germicide, and is extensively used to disinfect stables and chicken houses. Liquozone, however, is a little too weak for this purpose; if made sufficiently strong to kill germs, it would blister the human tongue.

Liquozone costs about one-half cent a bottle; it sells for $1.00.

Purgatives and Cathartics

The popular term " salts " includes sodium sulphate (Glauber's Salt) and magnesium sulphate (Epsom Salts). These salts cause to be excreted from the mucous membrane of the intestines a large amount of watery mucus, the physiological purpose of which is to wash the offending substances from the body. This produces a purgative effect. Were the large doses of these salts commonly taken absorbed into the blood, death would result at once.

The number of drugs that are prescribed for the purpose of relieving constipation is almost unlimited. Any poison which reacts directly upon the mucous membrane of the alimentary canal has a laxative effect.

In reality, laxative drugs do not act upon the body—the body acts upon them. In throwing out the drug, the food residues of the digestive tract are also thrown out, whether digestion is complete or not. The loss of weight when taking physic is due to this loss of food.

The reason alkaloids and other more subtle poisons are not laxative is because they do not produce their effect until they reach the nerve centers. Laxative drugs may occur in almost any group of chemical compounds. Two are oils—croton oil and castor oil. The pills, candy cascarets, etc., on the market are usually made by mixing several drugs of a purgative nature, the idea being if one does not do the work desired the other will.

In this chapter I have enumerated only a score or so of the many thousand drugs used by the medical profession. To discuss the entire list would require a volume many times larger than this. I have omitted many drugs whose properties and uses would be interesting and instructive, but the writer's work is to impart a knowledge of foods, not drugs.

If the reader would secure at a public library a copy of the "National Standard Dispensatory," the text-book used by prescription druggists, and scan through its

2000 pages, he would realize how unscientific and hazardous is the method of combating human ailments with drugs. In the therapeutic index of the above volume are listed the more common disorders which affect mankind, and for each disorder is given a list of from a dozen to a hundred drugs which are used by the medical profession to drive from its habitat the " evil spirit of disease." For everything, from corns to consumption, the drug-doctor prescribes everything from catnip tea to strychnine. Verily the inconsistencies of the mind of man are marvelous and inexplicable.

There is one means of combating disease, which in the popular mind is sometimes confused with the unnatural drug system here discussed. I refer to the methods of preventing and combating contagious diseases by modern sanitation and disinfection, or the wholesale slaughtering of disease germs outside the body. These results depend, not upon the ignorant and harmful theories upon which drug medication was founded, but upon the latest scientific knowledge.

I am heartily in favor of combating disease by cleaning our streets, foul cellars, tenements and filthy packing houses; and if carbolic acid, quicklime and bichloride of mercury can help along in the process, then we can thank modern science that drugs, which man originally sought out with which to poison himself, have at last found a place of real usefulness.

But dosing the human body with drugs is another matter. Doctors who invented drugs to fit the "devil theory" of disease now use the germ theory to frighten people into submitting to drug treatment. But, in reality, no one knows better than do the doctors that destroying a disease germ in the human body would also destroy the human cells; for both disease germs and bodily cells are formed of protoplasm, and can only be killed by a protoplasm-destroying drug. What usually happens in drug medication is that poisons are given in doses too small to kill either patient or disease germ. The process weakens both, but the patient being the slower-growing organism generally suffers the more.

As disease germs in the blood cannot be killed by drugs without killing the man, the doctor who prescribes drugs to cure disease is either ignorant or is wilfully practicing a fraud. Perfectly healthy people do not contract contagious diseases for the reason that disease germs cannot live in pure blood.

Pure blood is the only means known to science whereby disease germs in the body can be conquered. Natural foods make pure blood, which is the most potent factor known in the cure of contagious diseases. The wisest and safest plan to prevent contagion and infection is to keep the blood pure. It is then highly germicidal, as nature intended it to be.

Condiments

The use of condiments originated in the desire to supply something that was missing in the taste of cooked food. This is not to be wondered at, for in the process of cooking the nature of many food products becomes so changed that they taste flat and insipid. A sweet turnip or carrot, if well masticated, is delicious in its natural state, but when cooked it seems to need salt or something to give it flavor and life.

In boiling or cooking in heated water the mineral elements are dissolved and lost in the water, which is usually discarded, so we endeavor to restore to them that which we have destroyed. In the use of suncooked or natural foods the taste readily accepts them, and the appetite becomes a perfect guide as to the quantity of food necessary under the varying conditions of man's civilized environment.

Many people go through the world and eat three meals a day until they have marked off their threescore years and ten, and never know the real taste of the commonest article of food. The use of condiments, the pouring of some mixed-up mess of something over foods, in the vain hope of making them better, seems to have become a kind of unaccountable insanity.

Of all the errors and stupid blunders that people have made in their foolish effort to fix up foods, the condiment habit, next to cooking, has the least excuse for existence. Think of taking a pure article of food and pouring over it a muddy-colored liquid concerning which we know not when, where or of what it is made. The imagination fails to answer why.

Most individuals in polite society are extremely careful about their persons. Their dress must fit just so, it must be made of certain choice material, the linen must be spotless, the colors with which they bedeck themselves must harmonize. They are extremely careful about their companionship. Their house must face a certain way, and the furnishings must be just right. They are very cautious about what they say. They are very jealous of their opinions. They select with much care their language. They will not venture out in threatening weather. They restrict themselves in every conceivable thing. They put the chain upon nearly all their liberties, and try hard sometimes to manacle the liberty of others. But these same wise people will sit in a fashionable café and dine upon an undrawn, cold-storage turkey that has been a year dead, and pour over its ancient flesh a tar-colored fluid that was made somewhere in Europe, and that has been upon the shelf of a grocer until it has reached that limit of delicious decay suggested by the green, slimy mildew in Roquefort cheese.

All condiments, especially stock sauces and dressings, vinegar, mustards and such things, possess absolutely no constructive property, but all of them possess to a very large degree the elements of decay and destruction. The great increase in stomach and intestinal diseases among the American people is largely due to the habit of using condiments.

The use of condiments is followed by two other very pronounced evils: First, they cause an irritation of the mucous membranes of the stomach, which excites false appetite and causes over-eating—the origin of a majority of human ills.

Second, they deprive the taste-buds of their rights, thus lessening the desire for perfect mastication.

One of the first steps in adopting a reform or hygienic dietary is to eliminate from the bill of fare all condiments, hot sauces and such stuff. Remember their origin is not very respectable. They seem to have been created for the purpose of covering up something which we instinctively regard as unclean.

Drugging Foods

Foods may be adulterated and not seriously injured. There are isolated cases where by adulteration they may be made even less harmful, as in the case of pepper, coffee and other stimulants, irritants and narcotics, but these exceptions are rare.

Adulteration, artificial coloring, the use of preservatives and the limitless number of drugs and chemical compounds used in corrupting the natural article so as to make it appear that it is not, or to make it conform to some virtue falsely advertised to deceive trusting people into purchasing it, all originate in greed for gain. This may well be called " The Crowning Crime of the Age." It marks the most depraved branch of American commercialism.

It is a well-known fact that the best-paid chemists in this country are hired to adulterate, to preserve, to color and poison food rather than to purify, protect and lift the standard of its life-giving value.

Think of a human being spending days, months and years in his laboratory or over the experimental crucible, employing his brain and genius, not in trying to better the condition and promote the happiness of his fellow creatures, but in compounding some concoction that will swindle, deceive and poison the helpless babe, the innocent youth, the hopeful maiden and man, and those weighted with the burden of years; and yet the scientist or chemist who has worked out this nefarious scheme is a shining star of virtue compared with his criminal master who feeds out this perverted provender to the American people—the most tolerant race beneath the sun.

For his corrupted wares he gets a price—gets money, with part of which he can buy food and shelter, and with the balance of which he can flaunt himself in conspicuous array before the eyes of his fellows. For this he gains their envy rather than their love and respect.

Scientific study of *food diseases,* and the effort to relieve them, has brought these crimes to my attention with an emphasis that is appalling.

The poisonous coloring, preservatives and baser matter used in all kinds of canned, preserved and pickled fruits, vegetables, meats and bread materials is a matter of common knowledge. In a few years from now, when the American people have given to the food question the place it deserves—made it the most important of all the sciences—the disgrace we are now tolerating will be overthrown, and the names of the greedy charlatans who poison us will be a national insignia of dishonor.

The chemical laboratory has exposed these commercial harpies, and the hope of their continuing these crimes now depends upon the power of the lobby they can throw into our national and various State legislatures. In other words, it depends upon their power to purchase the votes of dishonest law-makers, which is another crime, and for which the common law says they shall be deprived of their liberty as common criminals. It is in this foul atmosphere and environment that these practices are born, live, thrive and have their being.

If there was nothing else to recommend the use of suncooked foods, the fact that they offer the public protection against the most dangerous and soulless class of criminals that ever disgraced the flag of any country would be quite enough.

SHALL WE NATIONALIZE THE DOCTOR?

The American Association for the Advancement of Science has appointed a committee of one hundred prominent men to work for the establishment of a National Department of Health in the Federal Government. On this committee are twenty-five doctors and seventy-five eminent men from other walks of life. It includes among its members many of the best-known leaders of thought and action in the country.

This movement will probably be held up for awhile by the immobility of politics. Statesmen cannot be expected to concern themselves about the health of the people so long as the tariff on tooth picks and tripe needs their valuable consideration. The mere appointment, however, of such a committee by the most learned body of men in America points to two very portentous things: First, that the most thoughtful men in our country deem it necessary that a Federal Department of Health be established. Second, that such a movement is not to be controlled by the medical profession. It is eminently proper that our greatest scientists should participate in this movement, for there is no question within the realm of government more important, and no question more definitely within the realm of science, than that of the health of a nation.

A Federal Department of Health, properly conducted, would frame and pass pure food laws that would give protection to the public against criminal food manufacturers, and see that these laws were enforced; and, having the strength of the nation to draw upon, it would cast from our national legislatures the disgraceful lobbyists who were so conspicuous in defeating the real protecting clauses in our present Pure Food Law.

The administration of the Pure Food Law, Meat Inspection and other measures appertaining to health, which are now distributed throughout the various bureaus and departments of government, would come directly under the control of this department. A National Department of Health, controlled by scientists and freed from politics and the tyranny of medical sects and societies, such as now dominate our local health boards, would result in branching out into every field of investigation and education that promise the promotion of public health.

While I write this, from twenty to thirty people are dying suddenly in New York every day from excessive heat, while several hundred more are being overcome and made prostrate. The temperature of the body is controlled almost wholly by diet. Foods of a certain class well known to the food scientist, serve only as heat makers in the body, while another class equally as well known forms tissue. When the sun is giving us our heat directly, we are guilty of almost criminal ignorance if we take heat-making foods into the body in quantities sufficient to en-danger our lives. In the face of these obvious facts, physicians give much advice, in the great daily newspapers, how to avoid heat prostrations and sunstrokes with scarcely any reference to food.

From a National Department of Health the simple rules of diet controlling bodily temperature could be laid out by scientists in the form of government bulletins, and a copy put into the hands of every person who could read at an exceedingly small cost. Emanating from such a source of authority, this and similar advice would be proudly adopted by the people, and would be the means of saving thousands of lives and raising immeasurably the American standard of health and longevity.

A National Department of Health would stimulate national interest in the science of human nutrition; it would show that American scientists were at least as much interested in building people as they are in building aëroplanes; it would eliminate from the records of American history the indictment that a great department of government is devoted to teaching farmers how to fertilize their fallow fields and breed pigs and poultry, while nearly one-third of all American babies are doomed to die before they reach the age of five.

Governmental supervision of the public health would place at the service of the people a large and well-organized body of the world's best scientists, whose sole purpose would be to make people more healthy. The public health is now under the control of private individuals whose prosperity depends upon exactly the opposite condition.

Stomach and intestinal disorders are almost universal because no effort has been made to teach people the laws of nutrition. We approach and solve all of these questions by the slow and steady tread of evolution. Man must be shocked or knocked into thinking. It is through our instinctive rebellion against needless suffering that any progress has been made in the science of healing.

Make the physician a government official with no purpose to serve except the common cause of the people, and he will ridicule the pill box in his public life as every intelligent doctor now does behind the scenes, among his intimate friends and professional colleagues. A man may lie for profit, but rarely for pleasure.

That a revolution in the teachings and practice of things that tend healthward will come when the government assumes control of the problem is indicated by what happened in the field of American agriculture. Forty years ago, before the establishment of the Department of Agriculture, a man either reared his domestic animals and tilled the soil in profound ignorance, or, if something did go wrong, rushed to the horse doctor, who came with a pill case and a drenching bottle and put the sick animal through an ordeal not unlike that to which we still subject human beings. This custom still prevails in the backwoods communities, but the intelligent farmer now reads scientific books and government publications that teach him how to breed, feed and shelter his animals so as to raise and keep them up to the highest standard of development. Doctoring domestic animals in our best agricultural colleges and among educated farmers is a practice comparatively obsolete. The veterinarian of to-day is chiefly an inspector or examiner of the soundness of animals, not a pill vender, as is the human medicine man.

The history of old methods of treating disease with drugs forms the most interesting and eventful chapter in the evolution of civilization. The drug theory was handed up to us by the skeleton hands of an ancient superstition. About 2000 years before Christ, disease or any abnormal condition of the body was conceived to be the workings or manifestations of an evil spirit or devil. The principal work of the ancient doctor, therefore, was to drive this devil from the human domicile. Ancient history and the sacred literature of all countries testify to this fact. The first means he employed, of which there is any record, was ceremony, a weird sort of incantation or coaxing process. It took many centuries for the ancient mind to discover that this plan was worthless.

The next method employed by the ancient doctor was the noise scheme. This system consisted in an effort to oust the evil one with hideous and ear-splitting noises. The most learned and accomplished physician of that day was the one who could invent the most infernal combinations of sound. What happened to the patient, history does not tell, but we suppose their spirits departed along with the devil, and the treatment, like many great surgical operations of the present day, was pronounced successful.

A thousand years or so and the noise remedy was abandoned, not by the noise doctor, but by the people who lost faith and forced a change.

Then came the new theory of dislodging the devil by putting into the body something so filthy, bitter and poisonous that His Highness would have to vacate the premises. Both the vegetable and mineral worlds were diligently searched for things that would accomplish this end. The most poisonous things that could be conceived were considered the best medicines—the best remedies for the sick.

The collector of these poisons was the apotheke and the modern druggist is his lineal descendant, just as the allopathic physician of to-day, with his phenacetin and acetanilide is the successor of the ancient medicine man with his lizards' tongues, snakes' brains and polecat's blood.

To-day the medical profession deny the devil theory of disease, but the methods invented 2000 years ago with which to destroy His Satanic Majesty they still practice.

Those who study history, who go back to the beginning of things, will understand how an idea, a mere superstition, that has been commercialized, could take possession of the primitive mind and be handed down through generations in almost its primeval crudity.

This is the true origin and history of the practice of medicine. Separated from the homage we are inclined to pay to the one who watches at the bedside of our dear ones, and the tragedy that sometimes follows, it would be a matter of laughter.

The modern doctor knows something of fresh air, exercise, food chemistry and sanitation, but he clings to the ancient drug theory. Because people have been trained to "take something" for every ill, and the doctor lacks the courage to tell them the truth, preferring to pursue lines of least resistance.

The wisest, most courageous, and most successful doctors to-day are those who prescribe fresh air, sunshine, exercise, pure food, tinted water and bread pills, and charge the biggest fees.

Hippocrates, 400 years B. C., undertook to make medicine a science, but failed; yet he is called the father of medicine. His true greatness consisted in diagnosis rather than in treatment. The two greatest books he left to the world were "Diet in Acute Disease," and "Air, Water and Place." It looks, therefore, very much as if Dr. Hippocrates thought much more of diet than he did of drugs, and he surely thought more of air, water and sunshine (place) than he did of the poisons his predecessors had discovered with which to defeat and dislodge the devil.

In the history of medicine you hear nothing about Hippocrates' works on diet, air, water and sunshine, because there is neither mystery nor money in such a theory.

That the government has established astronomical observatories and bureaus of research in cranberry culture and sheep breeding, and has never before considered a department of human health, is due to the fact that the idea has prevailed that the health of the people was being well cared for by doctors, and that a National Department of Health would be governmental interference with private business interest—and so it would be. To educate people how to maintain their own health would seriously interfere with the doctor's business; but why should the people not interfere with a business that thrives upon disease instead of health—a business that is most prosperous when the most people suffer—a business conducted by private individuals who, if they were to keep the people healthy, would impoverish themselves—a business that is supported by exactly the opposite conditions that all good people desire? Doctors are but human, no better or worse than any other large class of American citizens and they can no more be expected to spend their lives seeking ways to put themselves out of business than stage drivers could be expected to "whoop it up" for a new line of railroad, or cab drivers hurrah for automobiles.

The present practice of medicine contemplates disease. It waits until disease appears—waits for the crisis, and then undertakes to combat it with drugs. Under the wise administration of a National Health Department, the object would be to prevent disease by removing its causes. Doubtless the medical profession will remind the public of the dangers that lurk in governmental control of what is now a private industry. Why should the government not control that which determines its strength or weakness? Surely all of the people (represented by their government) should have a voice in a matter that concerns every one's happiness. Health and education, physical and mental upliftment, go hand in hand; they are the things that can be controlled by the people, for they appeal to and interest all alike, and are too vital to every citizen to permit of inefficiency or graft. Progress in the educational world is now measured by the distance we have traveled from the fee system—the system on which the medical profession still operates.

Should we have a National Department of Health, the bureau of pure foods should be its chief subdivision. This bureau would not only forbid the manufacturer from putting sulphites in his deviled ham, but would teach the people by popular publication and by co-operation with the public school system, that deviled ham is at best a poor substitute for natural food. A National Department of Health, working in conjunction with our public schools, would indeed go to the bottom of the health question.

There is no reward so great, no fame so towering, and no chord in human emotions so responsive as gratitude for those who lead us to the priceless goal of health. Under a National Department of Health the doctor, as an educator, would have life's greatest reward and highest inspiration to move him to duty.

When public attention is once turned toward the possibilities of a National Department of Health, it will become the most popular political propaganda of its day. Such a movement would meet with no resistance except from those who thrive upon the impaired health of the nation. Such a department would promise that which every sincere citizen most desires. It would become the crowning glory of America's public institutions.

The theory of curing disease with drugs is wrong. It is wrong because it is opposite to and in violation of every natural law governing animal life. The drug theory consists in giving sick people the things which will produce disease in well people. Sickness is merely an expression or symptom given off by the body of some form of congestion or poisoning. It is utterly absurd to think that this condition can be removed or cured by introducing into the body any kind of drugs, and especially another poison. Sickness can only be cured by removing its causes—by employing as remedies for sick persons those things which preserve health in well persons. These are not theories but laws—fundamental, infallible, unanswerable.

The thought forces now arrayed against the drugging system are from the thinking classes of all nations. The drug cure will go—it will perish—it will pass away. Just as the incantation cure and the noise cure passed, so also the drugging habit will go, and the future mind will place them all in the same group—weigh them all on the same scale; and as the shuttle of history moves back and forth it will weave all these superstitions into the fabric of civilization as the darkest shades upon her endless roll.