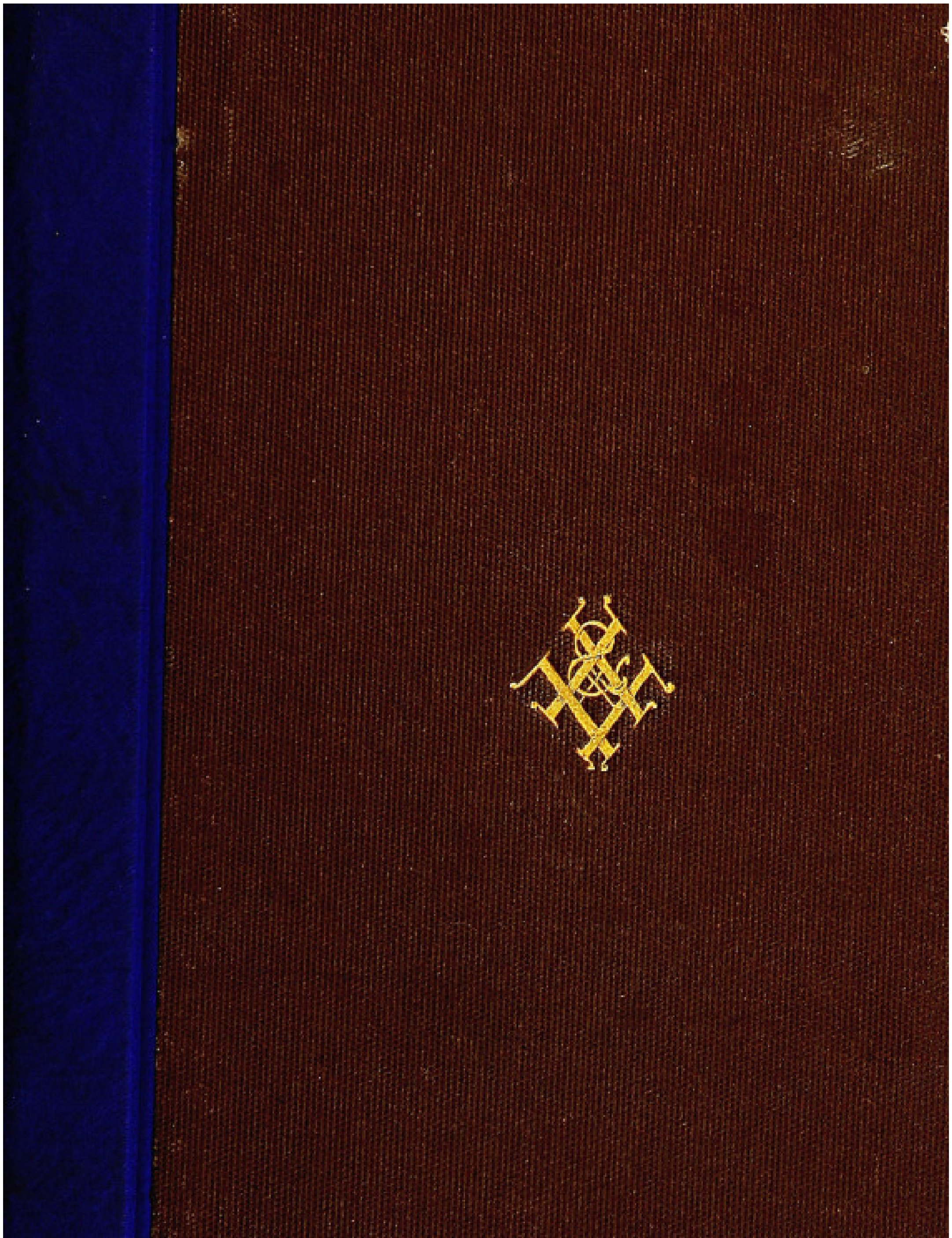

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THE

PHILOSOPHY OF EATING.

BY

ALBERT J. BELLOWS, M.D.,
LATE PROFESSOR OF CHEMISTRY, PHYSIOLOGY, AND HYGIENE.

SIXTH EDITION, REVISED AND ENLARGED.

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TO

THE FIVE THOUSAND LADIES

WHO, FROM 1838 TO 1858, ATTENDED MY LECTURES ON PHYSIOLOGY, CHEMISTRY, AND HYGIENE.

DEAR FRIENDS:

In the reminiscences of the past twenty-nine years many pleasant interviews at your firesides, in social gatherings, on steamboats, and elsewhere, are recalled, in which some mother or teacher has reminded me of facts or statements, physiological, chemical, or hygienic, made ten, twenty, or twenty-five years before, but still remembered; and often has the kind suggestion been made, that those teachings, which had been useful to them as mothers or teachers, when only treasured in the memory, might be more useful to their children and pupils if collected and printed.

These kind suggestions, together with the fact that the application of science to hygiene has been almost utterly neglected, have induced me to collect and condense the ideas of my old lectures, adding to them such as modern improvements in practical science have suggested, and leaving out such as have become obsolete; and the volume thus produced I take the liberty to dedicate to the friends who will be most likely to be interested in it.

With sincere regard,

Yours affectionately,

A. J. BELLOWS.

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PREFACE TO REVISED EDITION.

SINCE the publication of the previous editions, the author, during a visit to England, by the assistance of the best authorities there, carefully revised the work, making many improvements and alterations, particularly in the tables.

He also decided to unite with "The Philosophy of Eating" the best of the contents relating to food, of "How not to be Sick," a sequel to the former work, thus presenting the whole in a much improved, more compact, and cheaper form.

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PREFACE.

WE have excellent practical treatises on Agriculture and Horticulture, and every intelligent farmer or gardener may learn what element is deficient, in order successfully to cultivate his grapes, his vegetables, or his grains; and having also chemical analyses of these fruits and grains, and of the materials from which to obtain his deficient elements, he has the means of adapting his soil to all desirable productions.

We have also treatises on raising horses, cattle, hens, pigs, fishes, and even bees and canary birds, but not a single practical treatise on raising children. We know perfectly well that our horses will not, without care in regard to their food and training, be developed in beauty, strength, or docility. Our cows must be cared for, or they furnish little milk. Our hens must have appropriate food, or they furnish no eggs. Our bees must have their proper conditions of life and health complied with, or they furnish no honey and die. All this everybody knows; but children are expected to live, and be perfectly developed, both mentally and physically, without care or consideration.

And so perfectly ignorant are people generally of the laws of nature, that they give their pigs the food which their children need to develop muscle and brain, and give their children what their pigs need to develop fat. For example, the farmer separates from milk the muscle-making and brain-feeding nitrates and phosphates, and gives them to his pigs in the form of buttermilk, while the fattening carbonates he gives to his children in butter. He sifts out the bran and outer crust from the wheat, which contains the nitrates and phosphates, and gives them also to his pigs and cattle, while the fine flour, containing little else than heating carbonates, he gives to his children. Cheese, which contains the concentrated nutriment of milk, is seldom seen on our tables, while butter, which contains not a particle of food for brain or muscle, is on every table at all times of day.

To supply this deficiency in practical science, and to correct these erroneous and dangerous habits of society, is the object of this treatise.

A. J. B.

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THE

PHILOSOPHY OF EATING.

The Human Body: Its Wants and Resources.

"And the Lord God formed man of the dust of the ground."

THIS statement, incomprehensible to the human mind as it is, is most beautifully confirmed by chemical analysis. At least it is proved, that the elements of the human system and the elements of the soil, taken anywhere on the surface of the earth, from the equator to the poles, are identical; and it is also proved that the "grass, the herb yielding seed, and the fruit-tree yielding fruit after his kind," which the earth brought forth before man was made, all are endowed with power to take from the soil these elements, one by one, and fit them to be received and appropriated directly to the supply of the human system, or indirectly accomplish the same purpose by being first appropriated by the "beast of the field and the fowl of the air," and then in their flesh to furnish these necessary elements to man.

Geological evidence is conclusive that man was not made till this whole arrangement was perfected, so that wherever he chooses to live,—in Africa or Greenland,—he finds at hand food adapted to his wants in the climate in which he finds himself. But when we attempt to trace the process by which this complicated and beautiful arrangement was made for man, we are lost in wonder and admiration. The mineral elements, which constitute the great mass of the surface of the earth, all came originally from solid rock, and must have been produced by the slow process of disintegration, by which, by the action of heat, cold, and water, particle by particle it accumulated, age after age, till the great mass was formed which should afterwards become the place of deposit for water, salt, coal, &c., which man must have, and which also furnishes the fourteen different minerals which were to make a part of the human system.

And then ages of time more must have been required to produce the organic elements, which were formed by the growth and decay of plants and trees, which grew one after another, as the appropriate elements of soil were accumulated, and gave way in turn for more perfect vegetation, till organic elements had accumulated in sufficient quantity to supply the surface of the whole earth with all that should be needed for the composition and repair of the human system.

Then other ages still were required to float these crudely mixed elements over the face of the earth, and so intimately mix them that some portion of every element necessary should be found in every foot of soil on the face of the earth.

And after all this preparation the world was not fitted for man till ages more of time were consumed in raising the hills and the mountains, so that the ocean might be formed and dry land appear, and mists, condensed into rain and dews, be collected in brooks and rivers, to carry the waters back to the ocean, to be again evaporated, and a supply be insured, and the atmosphere prepared with its due proportion of oxygen and nitrogen. And when all the fourteen necessary elements were prepared in the water, and the atmosphere, and the soil, and laws instituted by which they should be forever at his command and forever perpetuated, then man was made; and then, that he might never fail to be supplied with everything he should need, God gave him "dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth," which, with "every herb bearing seed which is upon the face of all the earth, and every tree in which is the fruit of a tree yielding seed," should all contain the necessary elements, so that any one of them would sustain life.

Having thus bountifully provided for every contingency of climate or circumstance, he gave man a test by which he could select that which would be appropriate and reject that which would be injurious — that article which contained the proper elements rightly organized and adapted to his condition at any time, the appetite would demand and the palate and stomach receive gratefully and pleasantly; while that which was not organized according to this plan, or had afterwards become disorganized, or contained the wrong elements, or the right elements in wrong proportions, should offend the taste, and be rejected with disgust; or, if forced into the stomach, should cause an excitement, by efforts to get rid of it, which would be more or less poisonous or injurious according to the degree of harm which it was adapted to do the system. For example, sugar contains important elements rightly organized to supply the system with requisite heat, and it is pleasant to the healthy palate, and gratefully received in proper quantities by the stomach when needed; but alcohol, which is sugar decomposed, and which contains the same elements in the same proportions, is offensive to the natural taste, and if forced on the stomach, produces an immediate excitement, which is injurious and poisonous to the organs engaged in the effort to resist it.

Fish, which was prepared with all the elements rightly organized, and in right proportions to be appropriate food, is pleasant to the taste when properly cooked, and is gratefully received and quickly digested; but being exposed to a hot sun for a single hour, and disorganization or decomposition commencing, it becomes disgusting and poisonous.

Phosphorus, which is valuable and necessary food for the brain, &c., when organized in fish, or peas, or oatmeal, &c., is, when once disorganized, a virulent poison; and thus in physiology as in ethics, "in keeping the commandments there is great reward." To obey the simple laws of our being is to enjoy eating, and the health, vigor, and happiness which come from the appropriate exercise of all our functions and faculties; while to seek to enhance our enjoyment by unnatural combinations of food is to clog the appetite, to lose all real enjoyment in eating, and to burden the system with untold miseries, to be suffered through life and transmitted to children " to the third and fourth generation.'

If science in farming is important, as it is proved to be, may not science in eating be more important?

The scientific farmer analyzes his soil, and ascertains what elements it contains; then analyzes his grains and vegetables, and ascertains what elements they require; then analyzes the different manures and composts, and ascertains which contains, in the best combination, the elements to be supplied. This gives him an immense advantage over the unscientific farmer, who, not knowing the requirements of his soil, wastes his compost by using many materials not necessary, and too large a supply of elements that may be necessary, while many important elements will be omitted altogether.

I propose, upon the same principles, to give an analysis of the human system, — show the elements it contains, and the necessity for their constant supply, — and then to give an analysis of the food which Nature has furnished for the supply of these necessities; and I think it can be readily proved that as the scientific farmer has advantages in point of economy, the scientific eater has not only advantages in economy of living, but vastly greater advantages in the enjoyment of health and happiness. And as a matter of economy, it can be shown

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that in all our large cities more than half the expense of food is lost by want of adjustment of the proportions of requisite elements, just as all the expense of guano would be lost on the land already supplied with phosphorus and ammonia.

Chemical Composition of the Human Body.

The human body is composed of the following elements, all of which are found also in the food provided by nature, or in air or water, and all must be supplied, day by day, or some bad results are sure to follow: —

	lb.	oz.	gr.
Oxygen, a gas, in quantity sufficient to occupy a space equal to 750 cubic feet,	111	0	0
Hydrogen, a gas, in quantity sufficient to occupy 3000 feet, which, with oxygen, constitutes water, the weight of the two indicating nearly the necessary amount of water,	14	0	0
Carbon, constituting fat, and used also for fuel to create animal heat,	21	0	0
Nitrogen, which constitutes the basis of the muscles and solid tissues, and which is supplied by that part of food which we shall denominate Nitrates,	3	8	0
Phosphorus, the physical source of vitality, and the most important of the mineral elements, will represent the whole class which we shall denominate the Phosphates,	1	12	190
Calcium, the metallic base of lime, which is the base of bones,	2	0	0
Fluorine, found combined in small quantities in bones,	0	2	0
Sulphur,	0	2	210

Chlorine, constituting, with sodium, common salt, found in the blood,	0	2	47
Sodium, the base of all the salts of soda,	0	2	116
Iron, which is supposed to give color to the blood,	0	0	100
Potassium, the base of all the salts of potash,	0	0	290
Magnesium, the base of magnesia and magnesian salts,	0	0	12
Silicon, the base of silex, which is found in the hair, teeth, and nails,	0	0	2
The elements of a man weighing	154 lbs.		

Proximate Principles in the Human Body.

	lb.	oz.	gr.
1. Water, composed of oxygen and hydrogen gases, as in the preceding table of ultimate elements,	111	0	0
2. Gelatine, of which the walls of the cells and many tissues of the body are composed,	15	0	0
3. Fat, which constitutes the adipose tissue,	12	0	0
4. Phosphate of Lime, forming the principal part of the earthy matter of the bones,	5	13	0
5. Carbonate of Lime, also a part of the composition of bone,	1	0	0
6. Albumen, found in the blood and in almost every organ,	4	3	0
7. Fibrin, forming the muscles and the clot of the blood,	4	4	3
8. Fluoride of Calcium, found in the bones,	0	3	0
9. Phosphate of Soda, } found in the brain and nerves, and constituting the physical elements of vitality or vital energy,	0	0	400
10. Phosphate of Potash, } found in the brain and nerves, and constituting the physical elements of vitality or vital energy,	0	0	100

11. Phosphate of Magnesia, found with Phosphate of Lime in the bones,	0	0	75
12. Chloride of Sodium (common salt), in the blood,	0		376
13. Sulphate of Soda, in the blood,	0	1	170
14. Carbonate of Soda, in the blood and bones,	0	1	72
15. Sulphate of Potash, in the blood,	0	0	400
16. Peroxide of Iron, in the blood (and supposed to furnish the coloring matter),	0	9	150
17. Silica,	0	0	3
	154	0	0

Classification of Food.

The fourteen elements and seventeen combinations of these elements are all being consumed every day, and, therefore, must be supplied in food, or in the atmosphere, or in water. Food may be divided into three classes. That class which supplies the lungs with fuel, and thus furnishes heat to the system, and supplies fat or adipose substance, &c., we shall call Carbonates, carbon being the principal element; that which supplies the waste of muscles, we shall call Nitrates,* nitrogen being the principal element; and that which supplies the bones, and the brain, and the nerves, and gives vital power, both muscular and mental, we shall call the Phosphates, phosphorus being the principal element. These last might be subdivided into the fixed and the soluble phosphates, — the fixed

* The terms Nitrates, Carbonates, and Phosphates, are not strictly in accordance with chemical nomenclature, these terms being generally applied to salts only; but no other single words would give an idea of the predominant element. See Appendix B. page 343.

being a combination principally with lime to form the bones, and the soluble being combinations with potash and soda, to work the brain and nerves; but our analyses as yet are too imperfect to allow a subdivision, and as all the mineral elements are more or less combined with each other, and all reside together in articles of food, we shall include all mineral elements under the term Phosphates.

The waste, and consequently the supply, of these three classes of elements, is very different, four times as much carbonaceous food being required as nitrogenous, and of the phosphates not more than two per cent. of the carbonates. Altogether, the waste of these principles will average in a man of moderate size,* with moderate heat, more than one pound in a day, varying very much according to the amount of exercise and the temperature in which he lives. These elements must all be supplied in vegetable or animal food, not one being allowed to become a part of the system unless it has been first organized with other elements of food, in some vegetable, or in water, or the atmosphere; but being appropriated by some animal, remain organized and adapted to the human system, so that animal and vegetable food contain the same elements in the same proportions and nearly the same chemical combinations, and are equally adapted to supply all necessary elements.

* Of solid matter.

In Animal Food,	The Carbonates are furnished in	Fat.
	The Nitrates in	Albumen, Fibrin, and Casein.
In Vegetable Food,	The Carbonates are furnished in	Sugar, Starch, and a little Fat.
	The Nitrates in .	Gluten, Albumen, and Casein.

The Phosphates, in both animal and vegetable food, are found inseparably connected with the nitrates, none being found in any of the carbonates, and generally in the proportion of from two to three per cent. of all the principles in vegetable, and from three to five in animal food.

The Carbonates of both animal and vegetable food are chemically alike — fat, sugar, and starch, all being composed of carbon, oxygen, and hydrogen, and in about the same chemical combinations and proportions.

The Nitrates, also Albumen, Gluten, Fibrin, and Casein, are alike in chemical combinations and elements, being composed of nitrogen, oxygen, and hydrogen, and a little carbon not digestible.

The Wants of the Human System, and the Reason for them.

In the foregoing tables are found fourteen different elements of which the human system is composed, not one of which is permanently fixed in the system, but each, after performing the duties assigned it for a time, shorter or longer, according to the nature of those duties, becomes effete, and gives place to other particles of the same elements, which must be supplied in food. Each organ requires different elements, and has the power of taking such as are required from the mass of elements circulated together in the blood, and of rejecting all other elements; and while these fourteen elements, all having been organized in some plant or vegetable, are supplied as they are wanted, peace and harmony prevail in the system, and perfect health is enjoyed; but let any other elements enter the circulation and an excitement is produced, and each organ makes an effort to reject them. Take alcohol, for example, and the stomach is first excited and heated by efforts to expel it. It is then thrown into the circulation so as to be expelled by the lungs, or skin, or kidneys, and the whole system becomes excited, especially the brain, in efforts to eject this enemy to all its functions.

Phosphorus, iron, and all other disorganized substances, whether elements of the human system or not, are thus rejected with more or less excitement, according to their capacity for harming the system; and thus can be clearly read the lessons of nature, teaching us to keep out of the stomach and lungs everything but these fourteen elements, and to admit them only as they are organized and prepared as in articles of natural food in Nature's laboratory — the Vegetable World. But these elements are required in very different amounts, according to the amount of exercise of the different faculties and the temperature of the atmosphere in which we live.

And here we have the foundation for a scientific adaptation of food to our different employments in life. The man who is chopping wood in an atmosphere at zero, and he who sits still, or uses only his brain, in a room at the temperature of seventy degrees, consume very different elements in very different proportions, and therefore require different elements of food. The one needs the muscle-producing nitrogenate elements and the heat-producing carbonates; while the other needs very few nitrogenates, and only carbonates enough to supply the breathing operations with fuel; but he needs more of the phosphates to keep the brain in working order, and we shall find on inquiry that nature has furnished food just adapted to these and other conditions of life, and shall find also that, following these suggestions of nature, we shall obtain a rich reward, both in the enjoyment of health and in the enjoyment of eating.

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Resources for Supplying the Wants of the Human System.

The soil on the surface of the whole earth constitutes the great reservoir of crude elements of the human body, and man is kept alive as he was made by materials obtained from "the dust of the ground," but, as has already been intimated, these elements cannot be made to enter the composition of the system till they are organized — or, being organized, are eaten by some animal, and retaining their organization, are adapted still, in the flesh of the animal, to supply the demand of the human system.

These elements, becoming effete, are excreted from all animals that eat them, and, being then decomposed, enter again into the soil, to be reorganized in other vegetables; and thus, since these laws were instituted, no elements have been lost and none created — indeed, it is no more in the power of man to annihilate an element of matter than to create one. He can disorganize elements, — as he does in converting sugar into alcohol, but he only produces carbonic acid gas, &c., — which are again taken up and reorganized in some vegetable, and are reconverted into sugar; thus entering again their natural circle to go their perpetual rounds.

Every crop of corn, or potatoes, or grass, or vegetables deprives the soil of all the elements of which these crops are composed, and, if carried off and sold, impoverishes the soil proportionately. This the farmers understand, and are therefore careful to supply, with the natural excretions of animals, the elements thus removed, or with decomposed animal, vegetable, and mineral substances containing them; and, so perfect has this knowledge of agricultural chemistry become, that it is known just what elements are needed after each crop, and just how these elements can be supplied — vegetables using only disorganized elements, while animals use only organized elements — a beautiful provision of nature. It is known also what food and management will best develop our animals, and make them subserve our interests.

Scientific laws are applied also to the care of our horses, to make them beautiful, strong, swift, healthy, and docile; and to our cattle, and pigs, and hens, to enable them to furnish us with their invaluable contributions to the necessaries and luxuries of life; and our farmers know just what food to give them in order best to develop these resources. We have also books on bees and canary birds, teaching what they must have and what they must not have in order to be healthy. But our children, without whom all these other blessings would be of little value, are left to die, or grow up if they are sufficiently tough, without the application of science, or even common sense, to their care or culture. What two mothers can be found to agree in regard to the diet or regimen of their children? Who studies as much to learn how to feed himself as how to feed his cattle, or even his pet dog? But are we not better then they? Did God give laws for feeding them and no laws for feeding us and our children?

Wheat—its Origin and Chemical Composition.

The plant producing wheat belongs to the order of Grasses, and undoubtedly came originally from some grass whose seeds are so unlike the grains of wheat, as developed after centuries of cultivation, as not now to be recognized. It is not found wild in any part of the world, but like the other grains, and roots, and leguminous and succulent vegetables and fruits, has been changed from the "herb of the field," which, after the fall, was the basis, or emblem at least, of all the resources that were left to man; so that almost literally, from the "herb of the field," by the sweat of his brow, he has obtained not only his necessary food, but all the choicest luxuries which he now enjoys. Wheat is the most extensively cultivated and the most generally used of any of the grains; indeed, it is grown all over the world, but it flourishes best between the parallels of twenty-five and sixty degrees of latitude. The varieties of wheat are very great, over four hundred being described by the French Academy of Arts and Sciences, and it furnishes the principal food of more people than any other grain. Of these varieties some have sharp awns or beards, and some are beardless. The grains of some are red, some brown, and some white. Some contain more carbonaceous elements, and are therefore better adapted to the supply of heat than others. Some have more nitrogenous materials, and therefore are better adapted to give muscular power. Some have more phosphates, and therefore give more mental and nervous energy.

But the average distribution of these elements more nearly corresponds with the requirements of the human system, under ordinary circumstances, than any other grain; and life and health can be continued on wheat alone for an indefinite period, with good water and good air. Wheat will, therefore, be the standard by which to compare other articles of food.

Analysis of Wheat.

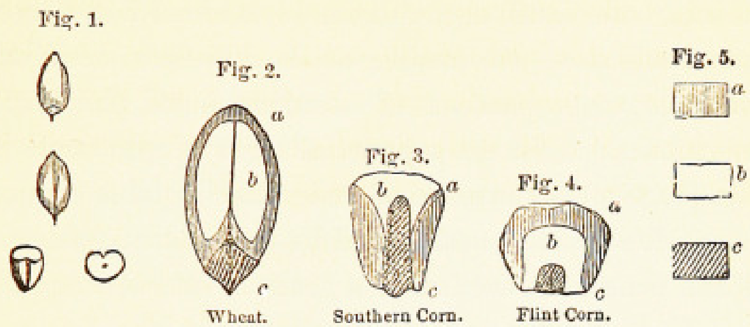
The average Composition of one hundred Parts.

Water,	14.0
Gluten,	12.8
Albumen,	1.8
Starch,	59.7
Sugar,	5.5
Gum,	1.7
Fat,	1.2
Fibre,	1.7
Minerals,	1.6

or,

Water,	14.0
Nitrates, or muscle-makers,	14.6
Carbonates, or heat and fat-producers,	69.8
Phosphates, or food for brains, nerves, &c.	1.6

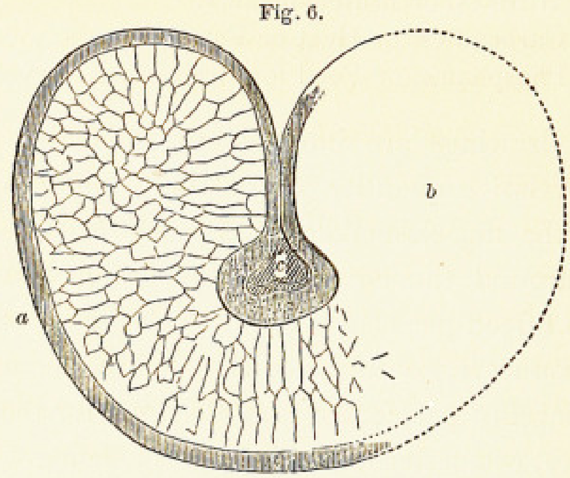
These principles are made up of the fourteen elements which constitute the human system, and the proportion of the muscle-making, the heat-producing, and brain and nerve-feeding elements, are about the average proportions required, in moderate weather, with moderate exercise of physical and mental faculties. But the distribution of these elements is not equal in all parts of the grain; and this, we shall see, is very important to be understood, as ignorance of this fact has led to the sacrifice of the most important elements. This we can understand by reference to the following wood cuts: Fig. 1 being the natural size of wheat, and Fig. 2 being magnified to three or four diameters.



a. Nitrates, or Muscle-makers.
b. Carbonates, or Heat or Fat-producers.
c. Phosphates, or Food for Brains and Nerves.

These drawings are intended to show the position and the relative quantity of the three important principles — the muscle-makers, occupying or constituting a crust around the outside of the grain, being from twelve to fifteen per cent. of the whole grain; the heat or fat-producers, occupying the centre, being from sixty to seventy per cent.; and the food for the brains and nerves, occupying the chit or germ, being from one and a half to three per cent. The limits of these principles are not, however, as circumscribed in the grain as appears by the drawing, a small per cent. of nitrates being mixed with the carbonates, and a part of the phosphates being mixed with the nitrates; indeed, the phosphate of lime, which goes to form bones, is almost all mixed with the nitrates in the crust; while the soluble phosphates, which feed the brain and give mental vigor, are mostly found in the germ; and this arrangement is found to exist in all the grains and all the seeds of grasses, — the smallest seed under the microscope showing the same organization as that exhibited in the cut of wheat, — the smaller seeds, however, containing much larger proportions of the nitrates and phosphates, being intended for the support of birds of great activity. The practical importance of understanding this arrangement will be better understood by reference to a drawing of the transverse section of a grain of wheat magnified to eighteen diameters from the section in Fig. 1.

Fig. 6.



To understand how large a part of the phosphates and nitrates is lost in bolting to make superfine flour, it will be necessary to explain that gluten, which is the principal nitrogenous element in wheat, is tenacious or adhesive; while the starch, the carbonaceous element, is globular and crumbly; the consequence is, that in grinding, the glutinous crust is separated in flakes, and is sifted out, leaving the flour composed almost entirely of starch, which contains no food for brain or muscle.

The outer layers of the wheat, constituting twelve or fourteen per cent. of the whole grain, which are represented by the darkened lines, *a*, in the plates, contain a large part of all the muscle-making elements of the wheat; and, being adhesive, it is easily separated from the more crumbly particles of the starch below, which is represented by the white part within the outer lines, *b;* consequently, it is separated from it in grinding and bolting, and much of it is lost with the bran. The germ also, which contains, with the gluten, the soluble phosphates, which is represented by the darker lines, *c*, in the drawing, is also tenacious, and much of it goes off with the bran. The insoluble or bone-making phosphorus, being mixed with the nitrates, is also lost. Nothing, therefore, can be more clearly proved than that in using perfectly white, superfine flour, we sacrifice the most important elements of the wheat merely to please the eye. And yet this is the kind of flour which probably makes more than nine tenths of all the bread in American cities, besides the large amount used for cakes, puddings, and pastry.

The farmer knows that wheat will not grow in soil out of which is taken any of the essential elements that constitute that grain; and he either supplies these elements, or he makes no attempt to raise wheat. Yet how many of our citizens are attempting to raise children on superfine flour, and butter, and sugar, neither of which contains food for the muscles, or bones, or brains, sufficient to keep these organs from actual starvation!

Every one also who keeps fowls knows, that to get a supply of eggs, and raise chickens, hens must be supplied with other food than Indian corn meal, which contains too many of the carbonates, or fattening elements, and too few of the phosphates and nitrates, to supply the shells of the eggs or muscles of the future chick. They are therefore fed with ground bones and egg-shells for the one, and meat or insects for the other purpose. But how many expectant and nursing mothers, not knowing or considering their responsibilities, live on superfine flour bread, and butter, and puddings, and sweet sauce, and cakes, and confectionery, which contain little else than the three articles of food before mentioned, and in which are only found the carbonates, or fat and heat-producing elements, and only very little of food for the muscles and tissues, or bones, or brain! The results are inevitable. One half of the children die before they are five years old, and many before that age have, for the want of the phosphate of lime, defective teeth and soft and rickety bones. If they live to grow up under the same disregard to their natural requirements, their muscles are poorly developed, their tissues are weak, and susceptible to disease for the want of the nitrogenous elements of food; their bones, and brains, and nerves are weak, and subject to disease for the want of the phosphates; while, by over feeding with the carbonates, the whole system is heated and excited, and ready to be inflamed by the first spark of disease; and the inevitable results are inflammations, fevers, neuralgic pains, consumptions, defective teeth, reactive exhaustion, chlorotic weaknesses, and diseases and pains innumerable.

It seems to me that the arch fiend, who is represented as "walking about seeking whom he may devour," has never devised a more effectual plan for tormenting and devouring the human race than this.

The penalties for the breach of Nature's laws are always severe in proportion to the importance of the purposes to be subserved by them, and they must follow the transgression as effect must follow the cause. No less severe punishments than those mentioned above could be expected to follow the utter disregard for that wonderful arrangement by which in a single grain of wheat could be supplied all the elements necessary for the growth or support of all the organs and functions—an arrangement which even Infinite Wisdom could not effect but by a process that required countless ages of time. To these penalties we shall have occasion to refer again when treating of diet for the sick.

Butter, Sugar, and Superfine Flour.

The only articles, the common use of which brings upon this community the terrible evils to which I have referred, are fine white flour, butter, and sugar. These articles, made up almost entirely as they are of heat-producing nourishment, are wholesome and necessary food to the extent of more than three fourths of all our solid nutriment, that great proportion of the carbonates being required to supply fuel and fat; but they contain so few of the elements that support the muscles and solid tissues, and so few that give us vital power, that either alone, or all three combined, could sustain life only for a very limited period — probably not two months. These three important elements of food are found in abundance combined with the other important elements which the system requires, and in many they are found combined in just the proportion required; indeed, in all food in such proportions as to adapt them to the different temperatures and circumstances in which we may be placed; so that we have no necessity, or even apology, for separating what God has thus joined together.

Starch, of which fine white flour is mostly composed, is found in the entire grain of wheat, and in many other grains and leguminous seeds, combined with muscle-making and brain-sustaining elements, in just the right proportions.

Butter is found in milk, also combined with all other necessary elements in exactly the right proportions; and sugar in vegetables and fruits; and, it is a fact that our relish for, and enjoyment in, eating these different combinations of necessary food are in exact proportion to their adaptedness to our wants at the time we take them. But for the perversion of our appetites, caused by eating these three articles in an unnatural state, we should always desire most what we most need, and could always eat all we want of what we best like. And, even after our tastes have become perverted, we find, on giving attention to this subject, that the more nearly we conform to Nature's requirements in the selection of food, the more we enjoy the pleasures of eating; so that in the pleasures of the table, as in all other pleasures, they enjoy the least who most anxiously inquire, "Who will show us any good?" while they enjoy most who only expect pleasure in the line of duty.

We all instinctively desire, also, more of these heat-producing articles in cold weather than in warm, and eat, without considering the reasons for doing so, much more of the fats of animals, and butter, and buckwheat-cakes, with sirup, in winter than in summer; and as spring opens we begin to desire cooling green vegetables and acid fruits, and this desire increases till in very warm weather we loathe the food we most esteemed in winter; and if our appetites fail in warm weather it is because our housekeepers persist in supplying us with the same fat meats and the same farinaceous puddings, with sauce of butter and sugar, which were furnished in winter. Let our housekeepers just keep in mind the fact that these articles only stand in the way of gratifying our tastes and inclinations in regard to food, and they will find that the science of cooking is very simple, and the wants of a family are very easily provided for. But we need not abandon either of these perverted articles entirely. Let us only consider how to correct the errors into which we have fallen, and use "all the creatures of God which are good and not to be despised," so as to make them contribute to our health

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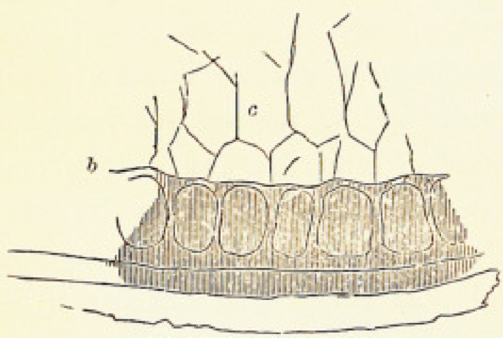
and happiness. Of this perverted trio of good things wheat is the most important, because most extensively used, and by far the most valuable.

Microscopic Analysis of Wheat.

Fig. 7.



Magnified 150 diameters.

a. The outer coat, or true bran, containing iron, silica, and some other elements required in the human system, and not found elsewhere in the wheat, but composed mostly of indigestible woody fibre, which is also useful as waste to keep the bowels in action — even the outer bran should therefore be saved. (page 35.)

b. Gluten cells, surrounded by diffused gluten and bound by it to the true bran, so that in sifting or bolting a large portion is lost. Nine tenths of all the muscle-making elements reside in this coat or crust, and also the phosphates of lime and soda, of which bones are made; the most of which are lost in fine white flour.

c. Cells forming the central mass of the wheat, composed mostly of starch, with a little albumen and gluten intermixed, and also some of the phosphates connected with the gluten.

Starch, though a valuable element of food, and the principal element in vegetable food to keep up animal heat, is so perfectly destitute of the essential element for sustaining life, that living on that alone, as proved by experiment, any animal will die in thirty days. A glance at this plate will enable any one to understand and believe the estimate of Mège Mouriès to be true, that there are fourteen times as much of the phosphates and nitrates "in commercial bran as in commercial superfine flour;" and this important fact is proved by three separate and distinct calculations: by Mège Mouriès of France, by chemical analysis of the bran and flour; by Dr. A. A. Hayes, of Boston, who first suggested the idea of applying tests to the whole grain, showing the arrangements of elements as delineated in Fig. 2,* and other plates, the truth of which statements I have carefully tested, as have other chemists; and Mr. Thomas J. Hand, of New York, an amateur microscopist of great assiduity and skill, who has spent many years in microscopic observations on wheat, and to whom I am indebted for the original drawings of plates 6 and 7, and also for many other facts and observations, fully substantiating the facts above stated. There can be, therefore, no proof more clear and positive than that superfine white flour is deprived of a large portion of the most important elements of food.

Bread-Making.

The most important use of wheat is for bread-making. For this purpose, on many accounts, it is better than any other grain, and being better, is more extensively used in every civilized country.

As bread is the staff of life, wheat, of which it is most extensively made, is called the "queen of cereals."

* Appendix A. page 343.

and though by producing sickness, and suffering, and death, her reign is one of terror, especially in this country and in Europe, it would not be desirable to dethrone her; but it would be desirable to inaugurate such a change as to make her reign a reign of mercy. The necessity and importance of a change in regard to the use of white bread can be understood by considering a few facts.

It is estimated that ninety-five per cent. of bread used in Boston is made of wheat flour, out of which has been taken, by the process of grinding and bolting, all but about five per cent. of its muscle-making and life-supporting elements, so that fifteen barrels are required to furnish as many of these elements as one barrel of unbolted wheat meal. This will be fully comprehended by reference to the grain of split wheat, drawn under a microscope, Fig. 6, and the proportions of nitrates, and carbonates, and phosphates, delineated by different colored lines in plates on a previous page. Carbonates white, nitrates in lines, and phosphates in darker lines. The nitrates and phosphates are inseparable by mechanical means, being bound together by gluten, of which it is mostly composed, while the carbonates, being mostly starch, which is granular, and loosely adherent, is easily separated from the glutinous crust by the process of grinding and bolting.

In making superfine flour twenty-five per cent. of the meal goes off in the siftings, of which fifteen per cent. is of the nitrates and phosphates, and ten per cent. of carbonates.

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A glance at Fig. 6 will also show us the value of bran as food for horses, working cattle, and fowls, and growing pigs, and give us some hints as to the right way of using it. These animals require about the same proportions of nitrates and carbonates as man, under similar circumstances as to temperatures, &c., from twelve to eighteen per cent. of the one to sixty to eighty of the other. The microscopic analysis above referred to gives only about ten per cent. of the muscle-making elements and phosphates, while chemical analysis gives fourteen; but they are both correct, microscopic analysis recognizing only these elements as they exist in the outer shell of the grain, while chemical analysis recognizes them as mixed with the carbonates.*

That superfine white flour bread does not contain all the elements necessary to keep the system in order, under any ordinary condition of life, is universally admitted by all who have given attention to the subject; and that there are objections to the usual manner of making bread, is also well known by all scientific men; and the question has become an important one, How shall wheat bread be made a reliable "staff of life," instead of the broken reed which it is now admitted to be?

* Since writing the above Mr. Hand has sent me a microscopic analysis of the flakes of bran in the excrements of horses and cattle, in which he finds the very important fact that the silex and iron, which in the cereals reside almost exclusively in the outer hull, are all taken out by digestion, leaving only the woody fibre to keep it in form. This may explain the fact that horses and cattle never have chlorosis or bad teeth.

Two New Plans of Bread-Making

Have been devised by scientific men. One by an American, and the other, by Mège Mouriès, of Paris. Both of these have been extensively tried.

The new American plan consists of an attempt to restore to the fine flour the phosphatic elements of which it was deprived by bolting, through the introduction of phosphorus or phosphoric acid obtained from calcined bones.

This is open to very grave objections, and, involving as it does the life and health of those who adopt it, certainly demands a candid, but critical and faithful chemical and physiological consideration.

My first objection to this plan is, that it does not attempt to restore the muscle-making elements of the flour, of which it is mostly deprived by the process of bolting, but leaves out these important parts as a sacrifice to a ridiculous caprice of the community, — a whim, on account of which, flour deprived of its most important elements of nutrition, and those which give its most delicious relish, is preferred and universally used only because it is white, colored bread being unfashionable; and this idea appears the more absurd, when we consider that this same flour is frequently colored to make many common and fashionable articles of food, as gingerbread, rich cake, etc.

The first impulse of science would seem to be to teach us to use wheat, as every other gift of God, just as He made it, adding nothing to it, and taking nothing from it; and this, I propose in another place to show, is perfectly practicable.

Serious Objection to the New American Plan for Bread-Making.

But my great objection to this plan is, that instead of recommending that the phosphatic elements usually taken out with the nitrogenous elements in bolting should be restored in Nature's own way, or rather that they should not be taken out at all, the attempt is made to restore them from the laboratory, by phosphates chemically disorganized, — a plan utterly at variance with Nature's laws, and therefore utterly impossible; and if it were simply a failure, the objection would be of less consequence; but, like all other attempts to thwart the purposes of God, the very effort brings its penalty.

God's plan, as clearly revealed in his book of nature, as I have elsewhere partly explained, is this: having, at infinite expense of time and labor, made the world for man,* and supplied the soil with every element which the human system requires; and having ordained that the vegetable kingdom should be his great laboratory, in which these elements should be fitted for, and placed in harmony with the assimilating powers of the different organs, so that these elements should be gratefully received as they are wanted, to supply the requisite nutriment; God, in infinite wisdom, in order to protect the organs from all elements not thus organized in some vegetable, has made these very elements poisonous, so that they shall be rejected by the different

* Writing after the manner of men.

organs at whose gate they shall call for admittance, and they are therefore made poisonous more or less according to their relative importance in the human economy.

Phosphorus, being the element on which the brain and nerves depend, and, therefore, the physical source of life itself, is, when not thus organized according to Nature's plan, the most virulent poison of any element found in the human system, indeed one of the most virulent poisons in nature; and it is susceptible of proof that the form of phosphorus which is recommended, in making phosphatic bread, is not one of the mildest, but one of the strongest and most poisonous combinations.

Dr. J. Francis Churchill, of Paris, who has devoted more time than any one else to experiments on the different preparations of phosphorus, with a view to find the best form for the treatment of consumption, makes himself believe that while the combinations of phosphoric acid, the acid which is used in this plan for bread-making, is very poisonous — the combinations of phosphorous acid, which he (Dr. Churchill) recommends as medicine, being much milder, are perfectly innocent, if carefully used; but he has the candor to quote from Dr. Buckheim, a celebrated chemist, the following opinion from four other celebrated German chemists, in regard to his own milder form of phosphorus: —

" Woehler and Frenich, basing their opinion as much upon their own experiments as upon those of Weige land Krug, have concluded that phosphorous acid has a poisonous effect analogous to arsenic, . . . and acts upon the economy exactly like phosphoric acid. . . . The same also holds good with the salts (phosphatic salts) of soda."

And this opinion completely covers the ground of the phosphatic bread. "The phosphoric acid used is prepared from the only practicable source of phosphorus — the bones of beef and mutton. They are boiled, then *calcined*." This burning of course disorganizes the bones, and the phosphorus is then in the condition of all disorganized phosphorus, unfit for assimilation and poisonous.

Now, if we apply to this case the law to which I have referred, that elements once disorganized can never be restored to their normal condition till they have been returned to the soil and reorganized in some plant, and, unless thus organized, can never be made to enter into the composition of any organ of the human system, we can understand how the inventor deceives himself. Being an analytical chemist, and not a physiologist, he does not understand that chemical laws must always yield to vital laws, as all lower law must subserve the higher: the laws which control the elements of the earth must yield to the laws which control the life of man, for whom the earth was made.

"The French army was at one time supplied with soup-cakes, prepared from bones, with the aid of Papin's digester. The bones thus liquefied at an elevated temperature and pressure, supplied phosphates in quantity greatly beyond the normal wants of the soldiers' diet;

but Nature appropriated such portions of the nutriment offered as she required, and the remainder was rejected." Does this prove that disorganized phosphates are wholesome? Then it also proves that nitric acid is wholesome: for nitrogen is known to be the basis of beefsteak as well as of nitric acid. It does, however, illustrate the dependence of chemical law on vital law.

Phosphatic salts in bones were organized there through the grass and the grain which the animal ate, which contain these substances; and the process of cooking or softening did not disorganize them. They were, therefore, ready in the soup, to be taken up and appropriated by the organs which needed these elements, and were wholesome; but the phosphatic salts, made as they are from calcined bones, are of course disorganized, and, instead of being wholesome, are poisonous, just as the nitrogen in aqua-fortis, not being organized, is a poison, while the beefsteak, being composed of organized nitrogen, is eminently wholesome, although the elements of beefsteak and aqua-fortis are the same, and in not dissimilar proportions. "The advantages of the new method" of bread-making over those of the ordinary method of making it "light" with acids and alkalies mixed, or sour milk and saleratus, or tartaric acid and soda, are not to my mind obvious; while the disadvantages are in just the proportion as phosphoric acid is more poisonous than the acids in common use for that purpose.

Mège Mouriès' Plan of Bread-Making.

The other new method to which I referred — that of Mège Mouriès, now quite extensively adopted in Paris — is not liable to the objections which have been made to the American plan. It neither leaves out of the flour any important elements, nor adds thereto anything injurious. It simply restores elements of the "groats and bran," as nearly as possible in their original proportions, to the superfine flour out of which they have been taken; but the question to my mind is, why be at such trouble and expense to get out the bran, and then be at equal trouble and expense to get it back again?

All the object claimed to be gained by Mouriès' process is, that while it makes a ferment to raise the bread or make it light, it takes out the color of the bran, and leaves the bread white; but it also takes out the sweet natural taste of the unbolted wheat bread, and is also objectionable on the ground that the bran from mouldy and otherwise diseased wheat cannot be detected in detached bran as in unbolted flour. But thus to attempt to improve what God has made perfect, is too absurd, philosophically, to be worthy of any extended comments; and though less dangerous than the similar effort of his American contemporary.

What advantages, then, has either the new French or new American method over the common method of bread-making by yeast?

Both make science subservient to "prejudice against color" of bread, and seem to think that, at any rate, bread must be white; while the one, to some extent, saves the evils of the loss of the muscle-making elements of wheat, and the other saves the evils of yeast, and substitutes an evil a thousand times worse than that of yeast; and while it has no advantages over the common substitutes for yeast, in the production of carbonic acid gas, as cream of tartar and soda, sour milk and saleratus, or any other mixture of acids and alkalies, is as much more injurious as phosphoric acid is more injurious than the acids in common use.

The object to be gained by using any of these materials for raising bread, is simply this: Flour, especially superfine flour, when wet becomes compact, or solid; and if thus cooked, as in some kinds of pastry, and thus eaten, will allow the juices of the stomach, which produce digestion, to have access only to the surface of the morsel, and of course must be slow of digestion; but if the particles of flour are separated from each other, as in light bread, the juices have access to every part, and the process of digestion is commenced in every part immediately.

To effect this object, some substance is intimately mixed, by kneading, so as to intervene between the particles, which, when heated in the oven, or by gentle heat beforehand, will be changed into gas, and thus separate the particles from each other; then, if the flour be sufficiently glutinous to hold the gas till the bread is baked, the particles remain separated, and the bread is light; but superfine flour is deprived of much of its gluten, and therefore is not sufficiently tenacious without the most scrupulous care to be well raised or to retain its lightness after standing. Unbolted wheat flour, having in it all its natural gluten, is much more easily managed, and indeed may be raised without the addition of any other than natural and useful elements, as we shall further explain.

Two aerial substances are produced by fermentation, carbonic acid and alcohol. These expand the flour and make it light, and though both are poisonous, they do no essential harm to the bread, because they are removed from it, or should be, before eating. The alcohol is all removed in baking, and the carbonic acid gas is very soon displaced by oxygen and nitrogen, on being exposed to the air, and if the bread is placed in the air, the pores will be filled with pure air instead of carbonic acid gas. Bread raised with yeast, therefore, is not unwholesome, unless eaten too soon after baking, while bread raised with phosphatic, or any other acid or alkaline salts, leaves these foreign, unnatural elements in the bread after the carbonic acid gas is evolved. Yeast, however, consumes in fermentation a portion of the gluten and sugar of the flour, which, in superfine flour, are already greatly deficient; but this evil in unbolted wheat flour is of very little consequence. Unbolted flour bread, raised with yeast, loses perhaps six per cent. of its muscle-making element. Bolted flour bread, raised with phosphatic salts, has lost seventy per cent. of these elements.

What, then, is the True Method of making Bread?

My "ideal loaf" is made from wheat perfectly fair, and free from smut or other disease; not having been wet and moulded either before or after harvesting, and not having been heated before or after grinding; carefully kept clean after being properly ground so as to need no sifting, and, not being bolted, it retains every part that belongs to it, and needs no addition, except cold water and a little salt.

Such bread has been made light, and of course digestible, sweet and delicious to the taste, and, containing as it does in just the right proportion every element required by the human system, and being sufficiently porous to allow access to every part by the juices of the stomach, and containing in its cells neither carbonic acid gas, or in its substance any phosphorus,* or soda, or potash, or other deleterious materials, is perfectly adapted to fulfil every requirement of nature, without, so far as I know for general use, a single drawback.

Such bread I have known placed on the table of a large, particular, not to say fastidious family, with the nicest and whitest family bread, and every member take it in preference. Light bread cannot be thus made from bolted flour for want of the natural gluten, and this is an additional evidence that "true bread" requires for its construction no additions to, or subtractions from, its natural elements; indeed, the conclusion is to my mind irresistible, that after such infinite pains in collecting in the soil, and making laws by which they should be collected in a single grain of wheat, all the elements in just the right proportions and combinations necessary to supply the wants of the

* Disorganized Phosphorus.

human system, our heavenly Father would not leave this food so imperfect as to require either addition or subtraction in order to render it digestible.

Recipe for making Natural Bread.

Bread, light, sweet, delicious, and eminently wholesome, may be made by mixing good unbolted wheat meal with cold water, making a paste of proper consistence, which can only be determined by experiments, pouring or dropping it quickly into a heated pan,* that with concave departments is best, and placing it quickly in a hot oven, and baking as quickly as possible without burning. The heat of the oven and pan suddenly coagulates the gluten of the outside, which retains the steam formed within, and each particle of water being interspersed with a particle of flour, and expanded into steam, separates the particles into cells, and being retained by the gluten, which is abundant in this natural flour, till it is cooked, the mass remains porous and digestible, and, containing no carbonic acid gas, is wholesome when eaten immediately, and of course equally so on becoming cold.

But for family bread, if not eaten till it has stood in pure air till the carbonic acid gas in the cells is exchanged for the oxygen of the air, there is no important objection to bread made from good unbolted wheat meal with fresh yeast. It contains all the elements necessary for feeding the muscles and brains, and for producing all the fat and animal heat required, and contains no materials essentially deleterious; and

* The pan must be sissing-hot, and the oven as hot as possible.

bread thus made from good superfine flour is only negatively deleterious, having lost its food for muscles and brains; and it need not, therefore, be discarded if at the same meal these elements are supplied in lean meat, fish, or cheese, or other food containing similar elements; but if eaten with butter or sugar only, and nothing else, would soon make of us bloated and stupid idiots.

Different kinds of superfine flour retain different proportions of food for brains and muscles, and all retain some. Indeed, bread could not be raised from flour absolutely deprived of gluten, which contains these elements.

Gluten absorbs water, and causes the paste to swell. That flour is therefore best which is most glutinous, and it is also most economical, as it will make the most bread. The proportion of gluten in wheat varies greatly according to cultivation and time of harvesting, and to the amount of nitrogen in the soil in which it grows. And by a beautiful provision of Nature, it varies also in a much greater degree according to the climate in which it grows, and this is true of all other grains. In northern climates, where more heat is required, a larger proportion of starch and other carbonates are found, so as to get with the requisite amount of food for muscle and brain more heat-producing elements.

Many hundreds of analyses have been made in Europe by different chemists with very remarkable results. In England and the more northern states the average amount of gluten in the best flour was but ten per cent., while some samples from Italian and Turkish wheat yielded as high as thirty-five per cent. of gluten. In this country, also, a similar difference, but not so great, has been observed between the nourishing qualities of flour from southern and northern wheat. Chemical analyses have not, so far as I know, been made to determine the comparative amount of gluten in southern and northern flour; but the comparison is made by a different process, and the difference between flour from Georgia wheat and that raised in Canada is at least twenty-five per cent.*

The report of the Patent Office for 1848 states that Alabama flour yielded twenty per cent. more bread than flour from Cincinnati. Upon this principle the quality of flour may be tested in a tube graduated like a thermometer, only being large enough to hold an appreciable amount of dry flour, which; on being wet, will swell and rise in the tube in proportion to the amount of gluten contained in the sample used; or the experiment may be varied by noticing the degree of expansion under regular increments of heat. Upon the same principle housekeepers judge of the "strength" of flour, which is only another term for expressing the amount of gluten or strength-giving element, by noticing the height to which a given quantity will rise in a similar vessel in which it is being prepared for baking; and when we consider that flour with the most gluten is not only twenty-five per cent. more economical than flour with the minimum of that im-

* Southern flour also contains more phosphorus than Northern.

portant element, but is also sweeter and more digestible in the same proportion, it becomes a matter of great importance to be able to judge of its richness in gluten.

Another fact worthy of notice in this connection, and which may be made of some practical importance, is, that the gluten of southern wheat, or of any other southern grain, does not, to so great an extent as in northern wheat, reside in a crust around the surface of the grain, but is more enclosed in the starch in the centre — a provision of nature probably for the protection of the germ from inclement weather. This is shown in the plate, Figs. 3 and 4, in the drawing of corn. Superfine flour, therefore, made from southern wheat, is much richer in gluten than the same quality of flour from northern wheat, while the difference is much less between the unbolted flour from the different regions; and this I think accounts for the well-known fact that Italian maccaroni is much more nourishing than American.

Wheat is also made into very valuable food in the form of grits, or cracked wheat. In this form we get, in their natural state, all the elements of the human system; even the iron and silex are all there, which are sifted out of much of the unbolted flour in the outer or true bran. This bran is also the natural stimulant to keep the bowels in proper action, and, for the few exceptional cases in which it proves too irritating, the "cerealina,' or grits, from wheat, deprived of its outer hull, is the very perfection of food. This new article has been lately introduced, and is used to some extent in Philadelphia.

Farina,

Also, as made by Hecker, is an excellent preparation, in which most of the elements of wheat are retained in a form very acceptable to delicate stomachs. It is deprived of some of its gluten, but being made from the varieties of wheat which are richest in that element, is valuable, especially for those who find the grits too irritating.

Rye.

Next to wheat, especially for bread-making, rye is the best of the cereals. It is a favorite article of diet of the people of northern Europe, especially Russia, where it is called "black bread." It contains more of the heat-producing but less of the muscle and brain-feeding elements than wheat, as may be seen by comparing the following analysis with that of wheat: —

One hundred parts of rye contain

Water,	13.00
Gluten,	10.79
Albumen,	3.04
Starch,	51.14
Gum,	5.31
Sugar,	3.74
Fat,	0.95
Woody fibre, .	10.29
Mineral matter,	1.74

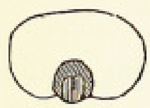
or,

Water,	13.00
Muscle-feeders,	13.80
Heaters,	71.5
Food for brains and bones,	1.7

Containing more waste materials than wheat, it is more stimulating or laxative to the intestinal canal, and may therefore be useful in a constipated condition.

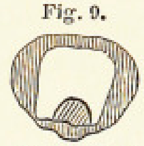
Maize, or Indian Corn.

Fig. 8.



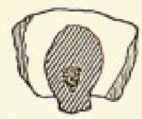
Tuscarora Corn.

Fig. 9.



Northern Corn.

Fig. 10.



Sweet Corn.

Fig. 11.

Southern Corn.

This cereal is generally supposed to be a native of America; but having seen and planted a sample that was taken from folds that had enveloped a mummy for at least three thousand years, which sprouted and grew, and which produced the grain on a bundle of stalks like those of broom corn, or as if the seed-bearing stalks of the broom corn had been tied together and had adhered, as I have described in another chapter, I am of opinion, that, like the other cereals, it was cultivated from grass, at a period too remote to be traced to its origin, and that it came from the same species as broom-corn and sorghum. It contains less muscle-making materials and more heaters and fat-makers than wheat, and consequently is much used in fattening cattle and pigs, for which purpose it is better than any other grain.

Why this grain is better than wheat for fattening animals is seen by the fact that it contains more than six times as much oil. Starch, sugar, and fat are classed together as carbonates, or fat and heat-producers, but the effect of each is different from the other of these elements. Fat giving two and a half times as much heat as starch, there should be added at least sixteen, making the heaters eighty-nine.

The average composition of one hundred parts of Indian corn is about, —

Water,	14.0
Gluten,	12.0
Starch,	60.0
Sugar, Gum,	0.3
Fat,	7.7
Fibre,	5.0
Mineral matter,	1.0

or,

Water,	14
Muscle-makers,	12
Heaters, Fat-producers,	73
Food for brains and bones,	1

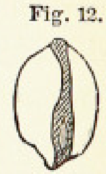
Sugar and starch generally furnish the necessary heat, and have less tendency to be converted into fat, while the oils, as butter, the fat of meats, &c., are without much change deposited as fat. If sugar or starch alone are supplied, they will not only supply heat, but fat; but if oil be added, sugar and starch will supply the heat, and the oil the fat that is necessary, while on the other hand, if sugar and starch be deficient, and oil supplied, it will supply the heat as well as the fat of the system. Sugar and starch, and especially sugar, are supplied for keeping up the necessary animal heat in summer and the oils for winter.

Indian corn, especially northern corn, is excellent food for cold weather. Nature, however, provides that the corn of southern climates has less of the fat and heat-producing elements, as will be seen by reference to the plates, Figs. 2, 3, 9, 11.

Indian corn has too little gluten to make good light bread alone; but mixed with rye meal, which is very glutinous, the most wholesome and best of bread is made, which in many places in New England constitutes the staff of life to the laboring classes. Hominy, especially "large hominy,' which is merely the grain cracked into two or three pieces, is excellent food, and if made from southern corn, as it generally is, contains a full share of muscle-making material, and is well adapted to laboring men; it also contains a large share of the life-giving principles, and is well adapted to sedentary and literary employments. "Small hominy,' which is mostly used in New England, is generally made from flint corn, which contains less of the food for muscles and brains, and more of the heaters, and is therefore best in cold weather. Hulled corn also contains the elements of the corn, except those which reside in the hull; and being soaked in some alkali, the oil is removed, and it is therefore good summer food. Well washed from the alkali used to decorticate it, it is unobjectionable and wholesome to those who like it.

Buckwheat.

Fig. 12.



Buckwheat.

Buckwheat, or "brank," as it is called in England, is cultivated more for feeding fowls and birds in winter than for food for man. It is inferior to wheat in its nutritive elements, containing more heaters and not half the muscle and brain-feeders. Eaten alone, therefore, it is not much better than superfine flour; but with beefsteak or fish, to furnish requisite nutriment, it will serve to keep up the heat for a winter's day.

In one hundred parts of buckwheat are, —

Water,	14.2
Gluten,	8.6
Starch,	50.0
Gum,	2.0
Sugar,	2.0
Fat,	1.0
Woody fiibre,	20.4
Mineral matter,	1.8

or,

Water,	14.2
Muscle-makers,	8.6
Heaters,	75.4
Food for brains and bones,	1.8

Containing a large amount of woody fibre, which is waste, buckwheat is good for constipated habits.

Barley.

This cereal compares well with wheat in nutritive elements, but does not form light bread, and therefore is nowhere used for that purpose, but is in many places used for making barley-cakes, which are valuable for persons inclined to constipation, containing, as it does, more of waste, which is the natural stimulant of the bowels. Barley is peculiar also for the amount of phosphates which it contains, — more than twice the amount contained in wheat, — and therefore might be made useful to literary men of sedative habits, adapted, as it is, both to promote the action of the brain and bowels. For this purpose it would be useful and palatable in the form of cakes or porridge. Pearl barley, which is barley deprived of its outer coat, is also very valuable in sickness when vitality is low.

One hundred parts of barley contain, —

Water,	14.0
Gluten, &c.,	12.8
Starch,	48.0
Sugar,	3.8
Gum,	3.7
Fat,	0.3
Fibre,	13.2
Mineral matter,	4.2

or,

Water,	14.0
Muscle-feeders,	13.0
Heaters,	69.5
Food for brains, &c.	3.5

The Oat.

This plant is found wild in the northern parts of Europe, and is the only cereal except rice that has been traced to its origin; all others having been so changed by cultivation as not to be recognized in their original seeds or plants. It flourishes in northern climates, and degenerates in warm. Unlike the wheat, its muscle-making materials are not connected with the hull, and are not therefore removed in making fine flour. Oat meal is rich in food for muscles and brains, and this may explain the fact that Scotchmen, who are raised principally on oat-meal porridge and oat-meal cakes, are remarkable for mental and physical activity. It is much used also in the northern counties of England, and furnishes the most material for hard work of any known grain. One hundred parts of oat contain, —

Water,	13.6
Gluten and albumen,	17.0
Starch,	39.7
Sugar,	5.4
Gum,	3.0
Fat,	5.7
Fibre,	12.6
Mineral matter,	3.0

or,

Water,	13.6
Material for muscles,	17.0
Heaters,	66.4
Food for brains, &c.,	3.0

Some inferences of great practical importance may be drawn from these facts in regard to the adaptation of different grains for gruels, &c., in the different forms of disease, which will be more fully discussed in a chapter devoted to this subject. By comparing the above analysis with that of wheat, and that showing the loss of important elements in superfine flour, the following conclusions will be irresistible: Of heat-producing material, oat meal and unbolted wheat meal contain about the same; but in one pint of oat-meal gruel there is as much of muscle-making material as in five gills of unbolted meal gruel, and as in three quarts of fine flour gruel.

Rice.

Rice is the only cereal except oats that has been traced to its original plant. It is found wild on the borders of lakes of the East Indies, and is very extensively cultivated in marshy grounds in Asia, the southern parts of Europe, and in some of the southern states of America. It is more largely consumed by the inhabitants of the world than any other grain, wheat, perhaps, excepted; but it is poor in materials for the support of brain or muscle; and rice-eaters are everywhere an effeminate race. It contains, as will be seen by the following analysis, less than half the muscle-supporting elements of wheat, and only one quarter of the supporters of brain and nerve, and containing, as it does, a large amount of starch, can only support a life of indolence and feebleness.

One hundred parts of rice contain, —

Water,	13.5			
Gluten,	6.5			
Starch,	74.1		Water,	13.5
Sugar,	0.4		Muscle-feeders,	6.5
Gum,	1.0	or,	Heaters,	79.5
Fat,	0.7		For brains and bones,	0.5
Fibre,	3.3			
Mineral matter,	0.5			

Rice may be useful as a part of a meal, with beefsteak or vegetables that contain no starch; or, in some cases of sickness, when the stomach is weak, and when little is wanted of food but to keep the bellows of life blowing; but for mental or muscular strength it is the poorest article in the common lists of nutritive food; and this shows the worthlessness of "standard tables," as they are called, and as they are found in our physiological school-books and health journals, showing, as they profess to show, the amount of nutriment in different articles of food, — but making no distinction between nutriment which feeds the system and the fuel which really consumes the system. — See table of comparative "amount of nutriment," in Hall's Journal of Health, page 211, in which rice is said to contain eighty-eight per cent. of nutriment, while beans contain eighty-seven per cent.; whereas, by analysis, rice contains but seven per cent., while beans contain twenty-seven and one half per cent. of real nutriment. This table would indicate that, except in regard to ease of digestion, it would make very little difference whether we ate rice or beans; whereas one pound of beans would support life, in action, as long as four pounds of rice. This is only a specimen of articles in the "standard tables," and shows the importance of a new "standard" by which to judge of the nutritive value of articles of food.

Beans.

Having given an analysis of all the cereals in common use for food, let us now examine the leguminous seeds, or those produced in pods. These are all rich in nutritious materials; but their muscle-making element is not gluten, as in the grains, but casein, as in cheese — a substance not so easily digested as gluten, and therefore adapted to strong healthy persons with good powers of digestion.

One hundred parts of common field beans contain, —

Water,	14.8
Casein,	24.0
Starch,	36.0
Sugar,	2.0
Gum,	8.5
Fat,	2.0
Woody fibre,	9.2
Mineral matter,	3.5

or,

Water,	14.8
Muscle-makers,	24.0
Heaters,	57.7
Food for brains and bones,	3.5

Two pounds of beans will therefore help do more muscular work than three pounds of wheat, and more brain work than three and one half pounds. But, as they contain less by twenty per cent. of their requisite amount of heaters, they are very appropriately eaten with fat pork, or some other heat-making food.

Different varieties of beans contain some different proportions of the same elements; but all are very nutritious. Beans are also eaten green, when the starch is not formed. In that state they are much less nutritious, and require with them butter or some other heat-giving material; but are useful food in warm weather, as are all green vegetables, with other more nutritious food.

Peas

Contain very nearly the same elements in the same proportions as beans. They are, however, more easily digested, and are too rich in true nutrition to be eaten alone, but require some less nutritive article, like potatoes, and also an addition of heat-givers, as butter, or the fat of animals.

In one hundred parts of peas are, —

Water,	14.1	or,	Water,	14.1
Casein,	23.4		Muscle-makers,	23.4
Starch,	37.0		Heaters,	60.0
Sugar,	2.0		Food for brains and bones,	2.5
Gum,	9.0			
Fat,	2.0			
Woody fibre,	10.0			
Mineral matter,	2.5			

Peas also, when green, are excellent in warm weather, containing less starch and less casein, but more sugar than dried peas. They also require butter or other heaters.

Lentils.

Lentils also contain much casein, even more than peas. They are not much used for food, except at the East, where they are the favorite food in connection with rice; and they seem to be intended to supply the deficiencies of each other, rice containing too few and lentils too many muscle-making materials, in proportion to their carbonates, as will be seen by reference to their tables of analysis. Lentils contain, in one hundred parts, —

Water,	14.0	or,	Water,	14.0
Casein,	26.0		Muscle-feeders,	26.0
Starch,	35.0		Heaters,	58.5
Sugar,	2.0		Food for brains and bones,	1.5
Fat,	2.0			
Gum,	7.0			
Woody fibre,	12.5			
Mineral matter,	1.5			

It will be seen that while rice contains but half its true proportion of muscle-making element, — 6.5 in 100, — lentils contain much more than their proportion, or 26 in 100. When used together, therefore, as is customary with the Hindoos, they give sufficient muscular power for such an inactive people. It will be seen, also, that both lentils and rice are deficient in food for brains; and this may likewise be a providential arrangement to adapt the proportion of food to the proportion of brain to be fed. This idea is perhaps corroborated by the fact that the higher classes in the East, who furnish brains for the lower, and do all their thinking, use food containing more of the phosphates, the little seeds of the huge grasses, of the sorghum species, called millet, which forms a large part of their food, being admirably adapted for that purpose, used in connection with rice. It is a curious fact, developed by scientific researches, that the smaller the seed in proportion to the plant of which it is the germ, the larger is the proportion of phosphates which it contains. Millet, being the small germ of the large plant sorghum, abounds in elements of food for the brain, the physical germ of human vitality.

A practical use may be made of this principle, especially with those who use much of fine flour, or butter, or sugar, in either of which is found only a trace of the phosphates, — remembering that in all our nourishment we need but two per cent. of phosphates. We can get sufficient of these elements to produce a sensible effect from the seeds of fruits and berries:

many of them, like those of the tomato, are digestible without crushing; others, like those of currants and most berries and apples, should be crushed with the teeth. The core of the apple should always be chewed, and the fibrous envelope rejected. The pits of all fruits and nuts are rich in phosphates; a small quantity are therefore useful as a dessert after a meal of too carbonaceous food.

Starch.

Of the three principal heat-giving principles of food, starch, sugar, and fat, starch is the most abundant and most important in all vegetable food. It constitutes, indeed, more than nine tenths of all the carbonaceous principles of our grains and leguminous seeds on which we mostly depend.

The ultimate elements are the same in starch, sugar, and fat, — carbon, oxygen, and hydrogen, — and their use in the system is not in building up the structure of the body or in repairing its waste, but is in fact the fuel which keeps up animal heat. This, however, is not a subordinate office, requiring, as it does, more than three fourths of all our food to accomplish it; and the adjustment of scientific principles, so as to keep the internal temperature of the body in summer and winter, in violent exercise or at rest, at just 98° Fahrenheit, is wonderful; and yet it is found that under no circumstances does it vary more than one or two degrees.

The most important principle in the production of heat is starch, which is found in all vegetable food except the fruits.

It exists in irregularly shaped granules, varying in size from $\frac{1}{2000}$ to $\frac{1}{400}$ of an inch in diameter, in different species of plants, each plant furnishing its own peculiar granules. These granules are insoluble in cold water, but are readily diffused through it, so that by bruising or crushing the grain or potato that contains it, and washing in cold water, the starch is separated from the other principles, and, being of greater specific gravity than water, settles to the bottom of the vessel containing it, and may thus be obtained in greater or less amounts from all edible vegetables and grains. On being mixed with water of a temperature of 180°, starch becomes glutinous and loses its granular character, and in this state is much used in the arts to give firmness and inflexibility to fabrics of clothing, &c.

Starch is turned blue by iodine, and the extent of its presence in any grain can therefore be easily tested by carefully slicing and soaking the grain and applying a solution of iodine. From wheat and corn, &c., thus treated, the drawings were made for Figs. 2, 3, 4, &c. The nitrogenous and phosphatic principles may be delineated by other appropriate tests.

When starch is taken as an article of diet, its carbon is burned in the lungs in contact with the oxygen of the air, and gives out heat to warm the system, just as the carbon of wood, uniting with the oxygen of the air, gives out heat to warm our apartments;* but before

* Appendix D. page 343.

it is thus appropriated by the lungs, it must undergo a change in the process of digestion, so that it becomes sugar; and all starch is thus changed into sugar before it can be taken iuto the circulation to be used in the lungs or skin.

When starch and sugar, therefore, are taken into the stomach together, the sugar is first used for fuel; then the starch is converted into sugar, and used till the demand is supplied, and all that remains unchanged into sugar is cast from the system as waste, and if oil or fat of any kind be taken with sugar and starch, the fat will only be used for fuel when the sugar and starch have failed to supply the demand.

From this fact we may derive the important practical lesson of giving to the most feeble stomach sugar for fuel, and next starch, and depending on fatty substances only in the most robust, and in the cold weather, when, being more concentrated, it is useful.

Starch exists in a state of almost absolute purity in arrowroot, tapioca, and sago. These articles of food are therefore only useful by themselves when the muscles and brain are in a state of absolute rest, as in some cases of sickness. Potatoes, rice, and Tuscarora corn also contain so little nitrogen or phosphorus, that life can scarcely be sustained on them alone, but are very useful with lean meat, peas, beans, &c., which, being deficient in carbonates, need some such articles to supply the defficiency. The proportion of carbonates to the nitrates in potatoes, rice, or Tuscarora corn, is fourteen or fifteen to one; while in the standard article of food, — wheat, — it is only four to one. During the growth of plants sugar is first formed, so that in all green vegetables what little of carbonaceous food is obtained is in the form of sugar, which is converted into starch as the plant progresses, and when the grains, or leguminous seeds, are perfected, very little sugar is left, and starch is predominant; but in fruits, the sugar increases as they ripen, and, when perfectly matured, sugar is almost the only principle of nourishment.

Arrowroot

Is a form of starch obtained from the root stocks of plants. The most common source is the maranta, which is a native of tropical America and the West India islands. From these islands and Bermuda this country and England are principally supplied. Another species of the maranta is said to yield the East Indian arrowroot, and the French *tous-les-mois* is produced by another plant of the same order, which is a native of Peru, and is called *canna*. In China arrowroot is said to be obtained from the root of the water-lily.

Tapioca

Is starch from the mandioc plant, a native of South America. This plant contains prussic acid, and is very poisonous. The poison is, however, separated from the root, which, after preparation, yields cassava and tapioca. The cassava, being formed into cakes, is eaten mostly by the natives, while the granules of starch cells and tapioca are extensively used in Europe and this country for the same purposes as rice and arrowroot.

Sago

Is obtained from several plants, the most common being the sago-palm, which grows in the islands of the Indian Archipelago. The sago is obtained from the celular tissue or pith in the interior of the trunk of the tree, and some of these palms, being very large, yield sections of sago pith as large as the body of a man. A single tree, therefore, yields some hundreds of pounds of sago, and the preparation of it furnishes employment for a large part of the inhabitants of Java and the Philippine and Molucca Islands, which furnish it to all the world. In many places it is much used for the sick, it being erroneously understood to possess some peculiar virtues.

Moss and Sea-weeds.

The nutritive properties of these articles of diet consist mostly in starch, but are all too poor in any nutritive properties to be of much consequence, the gelatinous substance, on account of which it is mainly used in making blanc-mange, &c., being like the gelatine in fish and animal flesh, entirely indigestible, and only useful as waste to keep the bowels in order. The nice jellies made from calves' feet, or isinglass, or the mosses, are all destitute of nutriment.

Reindeer Moss.

Reindeer moss, however, must contain some nutritive qualities, as it seems to be a provision of nature to support the reindeer in a climate where almost nothing else grows.

In Iceland and Lapland, in spite of the extreme cold to which it is subjected, this lichen grows in great abundance, and during the winter season, which constitutes the most of the year, the reindeer has no other means of support, digging down for it with his nose through the deep snow; and some arctic navigators in their extremity have been obliged to resort to the same miserable diet, but only with temporary success, the gastronomic capacity of man being too limited to contain a quantity sufficient to sustain life but for a very limited period.

Irish Moss.

A sea-weed known under the names of carragheen moss, pearl moss, and Irish moss, grows on the rocky sea-shores of Europe, especially those of Ireland and the north of England and Scotland. It contains but little nutriment, but is used in England, and sometimes in this country, perhaps with advantage, with our too concentrated nourishment; but alone it can sustain life but for a short time. It is, however, resorted to by the poorer classes on the sea-shores of Ireland when the ordinary crops of corn and potatoes have failed, and for a time will keep them from actual starvation.

Several other sea-weeds are used in England and Scotland as gelatine, to thicken and flavor soups and ragouts, and other dishes of food; but in all there is a flavor of the sea which renders them objectionable and keeps them from general use.

Edible Bird's Nest.

In China, however, the people are very fond of sea-weeds, and many kinds are collected and added to soups, or are eaten alone with sauce. They also esteem the edible bird's nest a great luxury, making it an important article of commerce, and paying for it a great price, a large number of persons making it a trade, and doing nothing else from youth to old age but hunt for these nests in caves of rocks so difficult of access that none but adepts attempt it. They are the nests of a swallow, which are made from the gelatinous substance of sea-weeds, and are therefore valueless for nourishment, and would be almost tasteless but for the flavor imparted by the excretions of the families which have made them their home; but, having been thus occupied, they have a flavor which is relished exceedingly by the aristocracy of China, who alone can afford the expense of such a luxury.

Sugar.

Sugar and starch have very nearly the same chemical composition, but in some of their physical properties they are very different. Sugar is soluble in water, while starch is only diffusible through it. Sugar undergoes the process of fermentation, starch does not; sugar has a sweet taste, starch is almost tasteless. Starch, however, is convertible into sugar, and then assumes all the characteristics of other sugar, being capable of fermentation and of thus being converted into alcohol.

It is converted into sugar by the juices of the mouth and stomach, and this is the first process of digestion with starch. Sugar, therefore, is more quickly prepared to be absorbed into the blood, and better adapted as a heat-giver for the young, and in warm weather when the digestive organs are enfeebled. This is indicated in children by the almost universal love which they manifest for food containing it, and Nature furnishes it in the milk of all animals, and in the summer in fruits and berries and green vegetables, clearly indicating the importance and the appropriate use of sugar.

Sugar assumes three different forms in common articles of diet, which, though very nearly alike in chemical composition, have yet the same peculiarities. These are called cane sugar, grape sugar, and milk sugar.

They vary in composition as follows: —

	Carbon.	Hydrogen.	Oxygen.
Cane sugar,	12	10	10
Grape sugar,	12	12	12
Milk sugar,	11	12	12

They are all alike sweet and soluble in water; but the cane and milk sugars differ from the grape in that they do not ferment till they have first been converted into grape sugar.

Sugar is found in almost all plants at certain periods of their growth and development.

The Process of Malting. — Sugar is formed in the germination of seeds, as is well illustrated in the process called *malting*, which consists in placing the grain, generally barley, in a condition to favor its germination.

When in the process of growth the starch is converted into sugar, that process is arrested and the sugar is secured for the purpose of fermentation.

Alcohol.

All kinds of grain may be thus converted into malt, and used for making wine, beer, and distilled spirits; indeed, all grasses, and fruits, and vegetables, which contain sugar or starch, — and to just the extent of the sugar or starch, — can be converted into alcohol; but the process is one of decomposition, and therefore, according to principles already described, sugar and starch are then brought into a condition to be poisonous. The same elements and the same chemical combinations which in sugar are nourishing food, are in alcohol poisonous; and while the beers, and wines, and distilled spirits may afford nourishment on account of the sugar and starch, and other nutritive elements in them, and although the system may become so accustomed to the influence of the alcohol mixed in them as not to be in all cases, in their moderate use, positively or perceptibly injurious, still their habitual employment is useful or injurious in just the proportion as their carbon, hydrogen, and oxygen are organized as they came from the grain, or disorganized by fermentation.

Sugar in the Sap of Trees.

Sugar is circulated in the sap of trees and plants just before the unfolding of the buds; and in some species, as the birch and maple, is then found in such quantities as to be collected and manufactured in large quantities. The sap of the birch is collected in the spring in Scotland, and fermented, and thus birch wine is manufactured; and in the northern part of the New England States and New York sugar is annually manufactured from the sugar maple to the amount of hundreds of tons.

Vegetables and Fruits, and roots also, contain sugar, and can be fermented into intoxicating beverages; and from some, as the beet and mangel-wurzel, large quantities of sugar are manufactured, especially in France.

The Huge Grasses, as the sugar cane and sorghum, contain it, however, in the largest proportions, and are the principal sources of its supply. Treacle or molasses is that portion of the sugar which will not crystallize, and which is therefore separated by draining from the brown sugar before it is purified, and is not objectionable as carbonaceous nutriment.

Potato.

Of the class of edible roots and tubers, the *potato* stands at the head. It contains but little muscle-forming material, and a large proportion of starch, and is therefore well adapted to be eaten with lean meat, which consists chiefly of nitrogen, and has no digestible carbon.

Its native country is Chili, but it is also found wild in Mexico. Before being cultivated it is a gnarly, bulbous root, not considered edible. From this root grows a stalk, which blossoms and bears seeds. These seeds, being planted in a new soil, produce improved tubers, which, being transplanted, improve from year to year, and form a distinctive character as to shape, color, &c., and receive a distinctive name by which the variety is known, as "kidneys,' "reds,' "blues,' "whites,' "pink-eyes," &c., each of which after a few years degenerates, and, going out of use, makes way for a new variety, produced in the same way; and thus, within the last three hundred years, it has been introduced into all Europe and America, and is an inestimable blessing to their teeming populations.

To this country especially, where every one eats meat, it is invaluable, — supplying, as it does, the elements wanting in that food, and waste material to counteract the influence of our too concentrated nutriment. It is also very valuable to the laboring classes of England, Ireland, and Scotland, used as it is with oat meal, beans, and peas, which supply the muscle-making elements in which it is deficient.

In one hundred parts of the potato are, —

Water and waste,	78.4
Albumen, &c.,	1.4
Starch,	15.5
Dextrine,	0.4
Sugar,	3.2
Fat,	0.2
Mineral matter,	0.9

or,

Water and waste,	78.4
Muscle-makers,	1.4
Heaters,	19.3
Food for brains,	0.9

All the muscle and brain-feeding principle in the potato resides in the rose end, about the eyes or germ.

Sweet Potato.

The sweet potato is used mostly in tropical climates. It differs from the other potato but little, and that difference consists mainly in their relative amounts of sugar and mineral matters.

Water and waste,	68.50
Starch,	15.05
Sugar,	10.20
Albumen,	1.50
Fat,	0.30
Fibre,	0.45
Gum, &c.,	1.10
Mineral matter,	2.90

or,

Water and waste,	68.50
Muscle-makers,	1.50
Heaters,	27.10
Food for brains, &c.,	2.90

Parsnips, Turnips, Carrots, Beets, Onions.

The different varieties of the roots above named are all, besides the potato, that to any extent are used in this country as food for man. So large a proportion of their bulk is made up of water and waste that the stomach of man is not sufficiently capacious to contain enough of either to support life and health alone; but for that reason they are valuable adjuncts to concentrated food, especially in warm weather, when but for these, and other similar vegetables and fruits, we should not get the bulk and waste necessary for proper digestion and intestinal action.

In one hundred parts are, —

In Parsnips.

Water and waste,	90.8
Muscle-makers,	1.2
Heaters,	7.0
Food for brains, &c.,	1.0

In Turnips.

Water and waste,	94.4
Muscle-makers,	1.1
Heaters,	4.0
Food for brains, &c.,	0.5

In Carrots.

Water and waste,	91.8
Muscle-feeders,	0.6
Heat-givers,	6.6
Brain-feeders,	1.0

Beets contain more sugar, and therefore more heating elements, than other vegetables, but contain the same proportions of nutrition and waste, while onions are still more nearly all water and waste.

Other green vegetable food, as cabbage, cauliflower, lettuce, cucumber, &c., and all the fruits and berries which are kindly furnished at the season in which they are most needed, are useful for the same reasons as stated above, and a choice in them can only be made by reference to the particular taste and power of digestion of each individual; that which relishes best is generally most easily digested. No one, therefore, can judge for another what is or is not wholesome.

Every article of food containing the elements of the system is wholesome if it can be eaten with a relish and be digested, and on the other hand, any article is unwholesome which contains elements not needed, and which cannot be relished or digested; and generally they are most desired when most needed, and will be digested if they can be eaten with a good natural relish.

The taste, unperverted, is a sentinel that admits no enemy and rejects no friend to the human system. It is folly, therefore, to dispute among ourselves, or to ask the doctor, whether this article or that is wholesome.

Having determined beforehand, as all intelligent providers easily may by reference to the simple principles herein explained, what class of elements is wanted to adapt the food to the circumstances of the family, they have only to select from the great variety of articles which God has given such as will be best relished, and, with very rare exceptions, nothing thus selected and properly cooked will ever prove indigestible or unwholesome, and these exceptions will only be found where the digestive organs are deranged by previous imprudence.

Animal Food.

The flesh of animals, fat and lean together, contains, as does a grain of wheat, every one of the fourteen elements of which the human system is composed, but not in the same proportions, or in the same proximate principles.

In one hundred parts of the carcass of an ox, of average fatness, are of food for brains, &c., about 4; for muscles and tissues, 15; for heat and fat, 30; water, 50. In wheat, for brains, &c., about 2; for muscles and tissues, average 14; for heat and fat 70; water, 14.

The muscle-making principles in wheat are gluten and albumen, while in beef they are fibrin and albumen; but each of these principles so perfectly agrees in chemical composition as to be considered mere modifications of the same substance, and being dried, contains precisely the same elements and in the same proportions.

The heat and fat-producing principles in wheat are sugar and starch, principally starch, with very little fat, while in beef it is fat only; and as fat produces two and a half times as much heat as sugar or starch, and beef contains more than three times as much water as wheat, the differences of the heat-giving powers of beef and wheat are much more nearly alike than would at first appear.

The five articles of animal food on which in this country we principally depend differ in their proportions of nutritive qualities, and are therefore adapted to different temperatures and different circumstances, as may be seen by the following condensed analysis of each.

In one hundred parts are, —

	Mineral matter, or food for brains, &c.	Fibrin and albumen, or food for muscles and tissues.	Fat, or food for heat.	Water.
Veal, .	4.5	16.5	16.5	62.5
Beef, .	5.0	15.0	30.0	50.0
Mutton,	3.5	12.5	40.0	44.0
Lamb,	3.5	12.0	34.0	50.5
Pork,	1.5	10.0	50.0	38.5

By this table it is seen that while veal contains but little more than an equal quantity of the principles that support muscle and heat, pork contains five times as much of the heaters as of the muscle-feeders. Of course pork is best adapted to food for cold weather, and veal for warm weather

Under ordinary circumstances we require four times as much of food for producing heat as for making muscle, that is, four times as much sugar or starch as albumen, fibrin, gluten, or casein; but one pound of fat contains an equivalent for two and a half pounds of sugar or starch, and therefore in animal food the carbonates, always being furnished in the form of fat, less than half the bulk of animal food is required than the best vegetable food. This, also, renders it necessary to take more animal food in winter than in summer; and hence the provision for animal heat in cold climates is the fat of animals, while in warm climates sugar is the principal provision, or sugar and starch as in fruits and vegetables.

But this table is formed on the supposition that we use an average of fat and lean meat; yet this is only true in the small meats, while in beef and pork we take very little, having an average mixture of fat and lean. In lean beefsteak we get almost all muscle-making principles, while in fat pork we get all heaters. With steak, therefore, we require some butter, or fat of pork, or some farinaceous vegetable food, as potatoes, rice, Indian corn, or wheat; while with fat pork, we require beans, peas, or lean meat, to furnish food for muscle; and if our labor or exposure to cold requires such concentrated nourishment, nothing can be more wholesome than beans and pork — the one containing heaters in the most concentrated form, and the other the most of muscle and life-giving principles of any vegetable food.

But what an absurd meal is that of beans and pork on a hot summer's day, especially on a Sabbath morning! and yet, from the landing of our Pilgrim fathers this has been the Sunday morning breakfast of a majority of New England people, and I have somewhere seen an estimate made by a quaint old divine, as a part of his sermon, of the number of tons of beans and pork preached to in New England every Sunday while the owners were asleep.

On the other hand, seeing the stupefying, and congesting, and heating, and blotch-making influence of these articles on sedentary people, some housekeepers condemn them as altogether and always unwholesome, especially pork, which is supposed to cause scrofula and all manner of diseases, and will not, under any circumstances, use it in the family. But why not use our reason, and consider what pork is, and what it was made for, and treat it as the creature of God, and therefore good, and not to be despised? The elements of the fat of pork and fat of beef, and all other meats, as also of butter, and the oil of corn and oils of the vegetables, are precisely the same, except the osmazome, which distinguishes the taste of each, and gives to one a relish for mutton and another for beef. All are wholesome or unwholesome as they are taken at the right time in the right proportion to other food, &c., and all unwholesome if taken without regard to circumstances.

"Fishes of the Sea."

"Everything wherein there is life," God gave to man "for meat even as the green herb," and of course we find in all these living things the same elements as in the products of the green herb.

An analysis of codfish and haddock gives the same elements, and in just about the same proportions, as lean beef and mutton, the only remarkable difference being in the amount of phosphates, which are much larger in the fish; but varying more in proportion in fishes than in mutton, and varying according to the habits of the fish in regard to muscular power.

Codfish, haddock, halibut, stand in relation to each other in regard to the three classes of elements — the nitrates, the carbonates, and the phosphates — as beef, mutton, and pork; halibut having less of the nitrates and phosphates, and more of the carbonates, than codfish or haddock, as pork less of the former and more of the latter than beef and mutton. Fishes of the same species also have more or less of the carbonates, according to climate, being providentially adapted, as are the grains and the land animals, to supply the heat of man according to his necessities.

In regard to the nitrates and phosphates, a great difference is found in the different species, those which have the most muscular power having, of course, more of the nitrates, or muscle-making element, and those which have the most activity, the most of the phosphates, which not only furnish food for the brain, but for the nerves, and which give vitality and activity.

From a collection of facts, which I will now proceed to give, may, I think, be deduced an inference of great practical importance, both in regard to the selection of food adapted to different degrees of activity of mind and body in health, but also adapted to different degrees of vitality in sickness; and as this, so far as I know, is an application of science to dietetics not hitherto made, and as, indeed, no such effort has been made to apply the plain laws of Nature to the supply of the natural wants of the human system, as have been made by Johnston and others to apply them to the wants of vegetable, I propose to bring together facts, and show the principles upon which I deduce the corollary which I place at the head of the next chapter.

Mental as well as Physical Health, Strength, and Activity, can be regulated by, as it is to a great extent dependent on, Diet.

The vitality of plants, the muscular activity of all animals, and the mental as well as muscular and organic health and vigor of man, depend on phosphorus. These are legitimate inferences from facts, presented clearly, as you shall see, in the organization of plants, animals, and man.

In grains, and all seeds, the phosphates which give vitality, and furnish food for the brain and nerves, reside in the germ or "chit," while the fixed phosphates, which are devoted to bones, &c., are mixed with gluten in the crust under the hull, as seen in the plates of corn and wheat, Figs. 2, 3 &c.

That the phosphates are concentrated in the germ of all seeds, and that they vary in different seeds, is easily ascertained by chemical tests applied to the grain or seed, and the drawing of these plates above was suggested from experiments first made by Dr. Hayes, of

Boston, and then introduced by Dr. Jackson into his geological and mineralogical survey of New Hampshire, in colored plates, showing the extent of phosphates and other elements; but I have not been content without re-testing, and getting re-drawn, each specimen. The process is very simple, and the discovery of it very important, as I have elsewhere intimated. In this manner can be shown just the proportion of phosphates, nitrates, and carbonates each seed contains and therefore which is best adapted to feed the muscle, and which to feed the brain, and give vitality, and which to furnish heat.

It is thus ascertained that some seeds and some grains contain two or three times as much phosphates as others. Wheat, for example, contains two per cent., while millet four per cent. Grass seed from six to seven per cent., and some, as clover and herdsgrass, from seven to nine. In all seeds, and roots, and nuts, which germinate from chits or eyes, the phosphates centre about these eyes, and what is not found there is always found connected with the muscle-making part of the grain or fruit, showing that the phosphates are connected with vitality and the life-giving principle.

The same thing is shown in animals by a test of their flesh, and by their manner of living. The flesh of quadrupeds, and birds, and fishes contain phosphorus in just the proportion to their natural activity, wild animals much more than domestic. The most active birds, like the pigeon and the migrating birds, much

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more than domestic fowls, and quiet and lazy birds. The migrating fishes, whose astonishing muscular power enables them to swim up rapids and over falls, contain more phosphates than the flounder and halibut, which are clumsy and comparatively dormant.

Insects abound in phosphorus in proportion to their activity and strength of muscle, and among them are the greatest gymnasts in the world. The leap of a flea is as great, in proportion to size of muscle, as if a man should jump over the Atlantic Ocean, from Boston to London; and a beetle, not weighing a scruple, will lift and move a junk bottle, with contents, weighing nearly a pound — a weight more than one hundred times as great, in proportion, as Dr. Windship could lift (and the beetle wears no yoke). Being wanted for scientific purposes, a beetle was placed, for safe keeping, under a bottle partly filled with liquid, in the inverted cup made in the bottom of the bottle. Immediately the plucky little insect was seen walking off with the bottle on his back, — as if the strong doctor, being shut up in his own office in the basement of Park Street Church, with a steeple two hundred feet high, should hoist the old thing, steeple and all, over into the cemetery.

Quadrupeds, Birds, and Insects instinctively select Food containing Phosphorus in Proportion to that of which they are composed, and in Proportion to their Activity.

The active bird lives on active insects or small seeds, which contain the most phosphorus, while the sluggish hen or robin is content with corn or worms, which contain much less of the life-giving element; and migratory birds, while they remain quiet, raising their young, live on worms and berries, but in the fall get a supply of strength for annual flight by eating seeds and active insects. The kingbird is the smartest little bird in New England, and gets his name from the fact that he governs all other birds, large and small, or drives them from his domain if they give him offence. Even the hawk, which is such a terror to other birds, seems to be a source of amusement to the kingbird. Many a time have I seen this little bird, not one tenth as large as the hawk, flying just over his back in the air, keeping out of his way by superior activity, occasionally pouncing on him, and giving him such annoyance that he was glad to leave the neighborhood to escape his little tormentor. A brace of these jolly and eccentric little kingbirds are just now affording infinite amusement to the denizens and visitors of Chester Square, in Boston.* Having, according to the custom of other royal families, selected a beautiful city residence for a part of the year, and having built their nest, and the queen being actively engaged in matters pertaining to the

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perpetuation of royalty, the king is obliged to entertain visitors. This he does by pouncing on the backs of dogs and driving them from the square; diving at the bright buttons on the policemen's coats; knocking off tall, black, awkward stove-funnel hats, &c., &c. Looking out at my office window, which looks over an open lot to the square, the other day, I saw this kingbird pouncing with tremendous vigor into a thicket of shrubs, and soon came out a big cat, escaping, as for dear life, to the nearest shelter, with the little bird every moment striking at his back and head. This little kingbird lives on bees and hornets, — insects proverbial for their industry, strength, and persevering activity, — and on flies, whose activity keeps them up in the air for amusement, and the bird amuses himself in catching them.

The wild pigeon, which is said to fly more miles in a day than any other bird, chooses for his food, in preference to all other grain, the millet and barley, which contain three times the phosphorus of other grain, leaving all other grains untouched while these can be had. This, the boys in the country understand, and they take great pains to use barley, millet, or grass seed to decoy them to their nets; but the domestic pigeon, which is comparatively inactive, is content with corn, or the other grains containing much less phosphorus; and thus it is clearly established that active animals require food which contains more phosphorus than inactive animals, and the inference is conclusive that man also will have more or less activity of brain or muscle in proportion to the elements he takes to feed the brain and muscle.

In the preceding chapters we have seen that in the germ of life is found phosphorus in proportion to the future wants of the plant, and that the phosphorus is supplied by, and taken from, the soil as it is required. We have seen that quadrupeds and birds also depend on phosphorus for their muscular activity, and this element is supplied by the seeds of plants, and by insects and other animal food containing it.

We come now to consider that highest and most important order of vitality which is peculiar to man, and to see if the same element, although in a different combination, and the same law for applying it, does not pertain to that, as to the lower orders of vitality.

Of the solid matter of the brain, one twelfth, on an average, is found by chemical analysis to be phosphorus, and the proportion of phosphorus is found to be in proportion to mental development and mental activity. A celebrated French chemist has made many analyses of brains of children, idiots, and men of different degrees of intellect and mental activity, and the uniform results were, that the brains of those whose minds were most developed and active contained most phosphorus. I will transcribe one of his tables.

Composition of Brain and Nervous Substance.

	In Infants.	Youths	Adults.	Aged.	Idiots.
Albumen,	6.67	10.20	9.40	8.65	8.40
Cerebral fat,	8.05	5.30	6.10	4.32	5.00
Phosphorus,	.76	1.65	1.80	1.00	0.85
Osmazome and salts,	5.67	8.59	10.19	12.18	14.82
Water,	78.85	74.26	72.51	73.85	70.93
	100.00	100.00	100.00	100.00	100.00

By this table it is seen that the brain of infants and idiots contains less than half the average of that element in adults.

Another fact, established also by chemical analysis, which, with that above mentioned, proves to a demonstration that the action of the mind is dependent on phosphorus, and is subject to the same law of waste and supply as other faculties, is the following: Immediately after active mental labor the excretions exhibit a larger proportion of phosphates than at any other time, e. g., on Mondays and Tuesdays in clergymen, and at court times in lawyers. Experiments of this kind have gone to show that the amount of phosphates used up and excreted is in exact proportion to the intensity and continuance of the mental effort; and, at these times, observing clergymen and lawyers have told me their appetite calls for phosphatic food, as fish, cheese, unbolted wheat bread, oat meal, and barley cakes, &c., and some desire, and will have made for them, cakes of bran, which contain most of all the phosphorus of the grain from which it is taken.

Food for the Brain and Nerves.

That mental and nervous power is dependent on food, is an idea that may at first strike the mind as absurd, and unworthy of investigation; but the same process that proves muscles to be dependent for development, and vigor, and health on food containing nitrogen, proves the brain and nerves to be dependent for the development, and health, and the vigorous exercise of their functions on food containing phosphorus.

This subject, being somewhat new, and, as it seems to me, of vast importance, requires a little in detail the reasons for the belief that the same laws apply to the brain as to the muscular system, and that as the muscles can be trained, and their power developed by appropriate food as well as appropriate exercise, so that the brains of our children may be developed in the dining-room as well as in the school-room — the caterer and cook being important auxiliaries to the school-master.

All nature is governed by one comprehensive and perfect system of law. The law which controls the circulation of sap in one plant controls it in all other plants. The law by which the bones of one animal are so constructed as to adapt them to the conditions in which the animal is destined to live, is the law which governs the construction of the bones of all other animals, so that the naturalist will take a single bone of any animal which he has never seen, and from it will construct the animal from which it was taken, show his disposition, the arrangements of his digestive organs, his habits, and the kind of food on which he was accustomed to live.

To apply this general principle to the question under consideration, we find that wheat contains phosphorus, which it gets from the soil in which it grows, and which is necessary for its development. If the soil is deficient in phosphates the grain will be deficient in this element, and the proportions which it contains within certain limits are in exact accordance with those of the soil. Now the ultimate purpose of wheat and all its elements is evidently to supply these elements to the human system, and that a part of these elements are intended to give mental support, is proved, I think, by the fact, that the brain contains phosphorus in proportion to its activity or power of producing mental efforts, and that phosphorus is consumed and carried from the system in proportion to mental efforts, just as muscle contains nitrogenous elements in proportion to its size and power; and these elements are consumed, and must be supplied, in proportion to muscular exercise. That mental exercise does thus consume phosphorus, is proved, as I have elsewhere shown, by chemical analysis; proof of the above assertion is therefore complete. Let any man observe his feelings and mental capacity after a breakfast of white bread and butter, or griddle-cakes and sirup, or any other such carbonaceous articles of food, and I am sure he will find himself unable to perform the same mental labor as he can on a breakfast of beefsteak, or fish and potatoes, or unbolted bread and milk, or any other articles abounding in the phosphates. Brains can no more be made or worked without phosphorus than Egyptian bricks can be made without straw.

Why not, then, apply these plain laws to raising children, and cultivating their minds, as we do to the raising of wheat, and hens, and bees, and developing their properties and powers.

No man who understands his business would expect to raise wheat in soil in which is no nitrogen, lime, or phosphorus, or make hens profitable on food containing no lime for egg shells, or keep bees on a desolate island where no flowers could be found. Why, then, expect to develop brains on white bread, griddle-cakes, and doughnuts?

Precocious Children.

Many of the most promising children are sacrificed to a desire to bring them forward in advance of other children, and this desire is stimulated by natural instincts. Every living creature rejoices in the use of the faculties which God has given it, "as a strong man to run a race." The boy whose muscles are well developed will never keep still, but is ready for anything, good or bad, in which he can stir himself. To such a one study is a punishment.

But the boy whose muscles are feeble, and whose brain is largely developed, sits still and reads, and the appetite of course conforms to the kind and amount of exercise. If he wastes his muscles by exercise, his appetite will demand the muscle-making nitrates to supply the waste. If he exhausts the phosphorus of the brain by study, he will desire phosphatic food to restore it. While the fat and stupid boy, who has neither muscles nor brain, will crave carbonaceous articles to feed his stupidity; and indulgence in these appetites will of course increase the peculiarity.

I have seen the plucky little kingbird, after an hour of extraordinary exertions in driving from the neighborhood an intruding hawk, devote the next hour to catching and eating bees and hornets, which abound both in nitrates and phosphates, as a means of restoring his muscular and vital energy; while the dormant robin would be content to live on cherries and worms, which contain very little food for either muscle or nerve. The bird is safe in following his inclinations; living as it does according to natural laws, and having no abnormal development of faculties, and no abnormal appetites, it can eat what it desires, and as much, with perfect impunity.

But the child, changed in its condition as it may be by the ignorance and folly of its parents, even before its birth, is abnormally developed, and of course has abnormal appetites.

Indulging these appetites in case of precocity of the brain, of course increases the excitement of the brain, and the result is inflammation and premature death;

and so common is this result, that it is well understood that a precocious child is short-lived. And is it inevitable that the fondest hopes of parents must always be blasted? A child with a precocious brain, or who is very forward, to use the common expression, is of course more liable to dangerous diseases of the brain than other children; but if parents would give the subject thought, and use their reason in this, as in other less important matters, these diseases might generally be warded off.

If our eyes have been overworked, or are weak and liable to inflammation, we avoid over-using them, especially in too strong light; and if so inflamed that the light, and all use of them gives pain, we shut out the light altogether, and give them rest till they recover. Both light and seeing are pleasant to the eyes in health, and absolutely necessary to give them health and strength, but when diseased, are both alike injurious, and we avoid the influence of both till they recover. And when only weak, and not absolutely diseased, we are careful to have the light, or use the eye only moderately and carefully. So of any other organ or faculty, that which is necessary to it in health, must be carefully used in tendency to disease, and abstained from in actual disease.

Apply this principle to a precocious brain. The brain is as dependent on appropriate exercise, and a supply of phosphorus in health, as is the eye on exercise and light; and as we withdraw the exercise and light from the eye in weakness and disease, so should we allow the brain to rest from exercise and phosphatic food in case of disease or predisposition to disease.

A child with a precocious brain would probably desire fish, lean meats, beans and peas, &c., in which phosphorus abounds; and while in health and perfectly developed, this desire would be an indication that these articles of food were good and necessary; but when the desire is the result of too great activity of the brain, it should be more or less scrupulously and perfectly resisted in proportion to the degree of precocity, and we should give instead cooling fruits and vegetables, with bread and milk, and other articles containing starch and sugar, to furnish the necessary heat, more or less, according to the temperature in which he lives, instead of fat, and oils, and butter, in which the carbonates are more concentrated and more stimulating.

Of the effects of diet mostly carbonaceous, we can judge from the testimony of Rev. Mr. Dall, missionary at Calcutta. In describing the character and habits of Asiatics, who live mostly on rice, an article containing, as you will see by the analysis, very little else than starch, and therefore very like our superfine flour, he says, "With the thermometer at one hundred degrees in the day time, and eighty-five to eighty-eight in the night, wakefulness is the exception and drowsing is the rule — the poor, old or young, who brings you a note from his 'master' (a word in which Asiatic reverence delights), no sooner delivers it than he flings himself on his back at full length, and is sound asleep in three quarters of a minute, so that it is hard to arouse him if you are five minutes penning your reply. This Indian faculty of literally dropping asleep used to make me smile; but I've got used to it. I now expect to see Bengal gentlemen asleep in their carriages on their way to office, and less wealthy, as a matter of course, asleep in their palanquins. When the rajahs, &c., see English people dancing at the Government House, they ask, in wonder, 'Why not let your servants do this?' 'Eternal sleep is the bliss of God — and never be born again!' is Hindooism, is Buddhism, is Asianism, is the Oriental, as compared with our idea of religion.'

That this stupidity is not induced entirely by the climate, is proved by the fact that the English never become so by a residence there, however long, and by the fact that other people who live on less carbonaceous food, in climates equally hot, are not thus inactive and sleepy; but it is the legitimate effect, as I have elsewhere explained, of living on food that has no nourishment for brain or muscle.

Precocity of Muscular Activity.

This is less dangerous, as the steam of vital force can be let off through the muscles till it is exhausted, without much danger, except to outsiders. Still the same law pertains to the muscles as to the brain, and, as a matter of convenience, at least to parents and schoolmasters, such boys should be limited in their supply of muscle-making materials, and might be indulged to a greater extent with the carbonates. Let them fill the stomach with crackers and milk, or vegetables and fat pork, and there would be no room for nitrogenous articles of food — or, at least, they could not be over-stimulated by them.

The daily Amount of Food necessary, and the Proportion of Nitrates and Carbonates.

Experience sustains fully the chemical and physiological deductions of the preceding chapters. Animals have been fed on pure starch, or sugar, or fat alone, and they gradually pined away and died; and the nitrates in all the fine flour bread which the animal can eat will not sustain life beyond fifty days; but others, fed on unbolted flour bread, would continue to thrive for an indefinite period. It is immaterial whether the general quantity of food be reduced too low, or whether either of the muscle-making or heat-producing principles be withdrawn while the other is fully supplied. In either case the effect will be the same. The animal will become weak, dwindle away, and die sooner or later, according to the deficiency; and if food is eaten which is deficient in either principle, the appetite will demand it in quantity till the deficient element is supplied. All the food, therefore, beyond the amount necessary to supply the principle that is not deficient, is not only wasted, but burdens the system with efforts to dispose of it. Food, therefore, containing the right proportion of heaters and muscle-makers is not only best, but most economical.

To make this statement plain, suppose we have a meal composed of roast beef, rare, with potatoes and dish gravy, and as much of unbolted wheat bread, or rye and Indian, and fruits, and cheese, and perhaps, if the beef be lean, or with green vegetables, butter or fat pork, to give them their heating principles. Of such a meal the appetite would be satisfied with just the amount of food necessary to supply either the heating or the muscle-making principles, and they would be taken in the right proportions.

But suppose, instead, we tried to satisfy the appetite with a meal composed of fried fat pork and potatoes, fine wheat bread and butter, griddle-cakes and sirup—articles almost entirely destitute of food for muscle or brain. When the stomach was filled with these articles, there would still be a demand for the nitrates or phosphates, and we should still crave some article to supply the deficiency, and all the carbonates above those which the system required would be wasted.

On the other hand, if we ate only lean meat, or fish, and green vegetables and fruits, which are deficient in carbonates, we should require a quantity of these articles in proportion to that deficiency, or the lungs would not be supplied with fuel sufficient to "run the machine." But in Boston, and probably in all American cities, a large part of the expenses of the table are for butter, superfine flour, and sugar, neither of which contains enough of the muscle or brain-feeding element to sustain life over fifty days, as has been proved by experiment with flour, while butter and sugar would not sustain life a single month without other food.

As far as we have articles of food deficient in carbonates, we can use, without loss, butter or sugar to supply the deficiency; but most of our natural food, both animal and vegetable, contains a due proportion, and if with them we use butter or sugar, they cannot be appropriated by the system, and are therefore lost.

All meats, fat and lean together, all grains and milk, contain all the carbonates that are needed or can be used to furnish heat in moderate weather. All the butter or sugar, therefore, that is added to either of these common articles of food, as they are used in making cakes, custards, pies, &c., are not only lost, but by adding too much fuel, increase the tendency to inflammations, embarrass the stomach, and induce dyspepsia, congestions, obstructions, &c.

With beefsteak, or any lean meats, or fish, or potatoes, or any green vegetables, or dried beans or peas, some oily substance seems to be needed, as all these articles are deficient in carbon, and in common use we have the choice between lard, sweet oil, or butter, or perhaps fat pork, all of which are precisely alike in chemical construction, and that one is most wholesome which is best relished.

Sugar also is needed with the acid fruits and berries, and especially with apples, which in New England are the most valuable of all fruits, either with or without cooking, and which, with sugar, furnish excellent food, especially in winter and spring, when other fruit cannot be had. But to find a good use for superfine flour, out of which has been taken nine tenths of its food for muscle or brains, is exceedingly difficult, indeed, impossible in health; and it can only be useful in disease where the irritability of the stomach or bowels forbids the use of their natural stimulant, just as inflammation of the eye makes it necessary to exclude the light.

Experiments on Prisoners as to the Amount of Food needed.

The best test of the influence of kind and quantity of food in sustaining life and health can be made in prisons, where the habits are all alike, and where the test can be made on a large scale. In five prisons in Scotland experiments were made to ascertain the smallest amount of food, and the proportions of nitrates and carbonates, that would keep the prisoner up to his weight while doing nothing, with results as shown in the following table: —

	Muscle-making Food. Nitrates.	Heat-producing Food. Carbonates.	Total Food given each Day
Edinburgh,	4. oz.	13. oz.	17. oz.
Glasgow,	4.06	12.58	16.84
Aberdeen,	3.98	13.03	17.67
Stirling,	4.27	13.04	17.67
Dundee,	2.75	14.	16.75

Percentage of Prisoners who lost or gained Weight.

Edinburgh.—18 lost $1\frac{1}{2}$ lbs. each; 82 held their own or gained weight.

Glasgow.—33 lost 4 lbs. each; 67 held their own or gained weight.

Aberdeen.—34 lost 4 lbs. 2 oz. each; 66 held their own or gained weight.

Stirling.—34 lost 4 lbs. 2 oz. each; 66 held their own or gained weight.

Dundee.—50 lost 4 lbs. 5 oz. each; 50 held their own or gained weight.

The above is the result of observations for a term of imprisonment for two months.

The Effect on Prisoners of substituting Molasses for Milk.

It is a remarkable fact, which shows the importance of connecting science with practice, that the deterioration in the quality of the diet in Dundee prison consisted in substituting molasses for milk, which had been previously used with oat-meal porridge and oatmeal cakes, molasses being entirely destitute of muscle-making material, while milk contains a full proportion of these important principles. This one experiment, and its results, are worthy of study by every mother and every housekeeper in the land. If any class of persons would suffer less than others from the use of too much carbonaceous and too little nitrogenous food, it would be that class who are idle; and yet the one hundred prisoners of Dundee, with one ounce a day more of the fat and heat-making principle than those of Edinburgh, lost two hundred and seventeen and one half pounds, while the same number in Edinburgh lost only twenty-seven pounds; the difference in their diet being, as stated in the report, that the prisoners of Edinburgh had milk with their porridge and cakes, while those of Dundee had molasses instead.

If the same experiment had been tried on men in active life, or on children, who are never still except when asleep, the results would have been more remarkable, in proportion to the greater waste of muscle in those who are active, and the greater demand for nitrogenous food; and yet how few mothers stop to consider, or take pains to know, whether gingerbread, made of fine flour, which has but a trace of food for muscle or brain, and sugar or molasses, and perhaps butter, which have none, or cakes made with unbolted wheat, mixed with milk or buttermilk, all of which abound in muscle and brain-feeding materials, is the best food for a growing, active child; indeed, the whole food of the child is given with the same want of knowledge or consideration.

But, in view of these simple experiments in the Scotch prisons, who can doubt that a want of consideration of these principles of diet is the means of consigning to the tomb many of our most promising children. An intelligent farmer knows how to feed his land, his horses, his cattle, and his pigs; but not how to feed his children. He knows that fine flour is not good for pigs, and he gives them the whole of the grain, or perhaps takes out the bran and coarser part, which contains food for muscles and brains, and gives them to his pigs, while the fine flour, which contains neither food for brain or muscle, he gives to his children. He separates also the milk, and gives his pigs the skim-milk and buttermilk, in which are found all the elements for muscle and brain, and gives his children the butter, which only heats them and makes them inactive, without furnishing a particle of the nutriment which they need.

The Amount and Proportion of Muscle-making and Heat-producing Elements of Food in Active Employments.

We see by the preceding table that prisoners, without exercise, could not be sustained with an amount of food short of four ounces nitrogenous food and thirteen ounces carbonaceous; all short of that amount being insufficient to supply the waste, and the remainder was drawn from the body itself, constantly diminishing in its weight; and that, whether the diminution was in the nitrates or carbonates.

To supply four ounces nitrogen and thirteen ounces carbon in the most concentrated food, requires of—

	Weight.	Nitrates.	Carbonates.
Lean beefsteak,	4 oz.	1 oz.	0 oz.
Fat pork, or fat of beef, or any meat,	2	0	2
Unbolted wheat bread,	8	1	5
Beans or peas,	8	2	4
Butter,	2	0	2
$1\frac{1}{2}$ lbs., or	24 oz.	4 oz.	13 oz.
With active exercise,	48	8	26 *
Active exercise in winter,	58	10	31 †

Food thus concentrated would be adapted only to the most active employment in the coldest weather. Let us, therefore, make another bill of fare, in which we shall get the thirteen ounces carbonates and four ounces nitrates in a form adapted to warm weather.

	Weight.	Nitrates.	Carbonates.
Codfish,	4 oz.	1 oz.	0 oz.
Potatoes,	1 lb.	$\frac{1}{3}$ oz.	3 oz.
Wheat bread,	$\frac{3}{4}$ lb.	$1\frac{1}{4}$ oz.	8 oz.
Green vegetables and fruits,	1 lb.	$\frac{1}{4}$ oz.	0 oz. 30 grs.
Milk,	1 lb.	$\frac{3}{4}$ oz.	$\frac{1}{2}$ oz.
Sugar,	$\frac{1}{2}$ oz.	0	$\frac{1}{2}$ oz.
Butter,	1 oz.	0	1 oz.
	$5\frac{1}{2}$ lbs.	4 oz.	13 oz.

* In moderate weather the waste is double.

† In New England one fifth more in winter than in summer.

This bill would be extremely diluted, as the first is extremely concentrated; but both together will show how greatly our food can be varied in quantity to get the same amount of nourishment. And with the following tables, with a little study, would enable a housekeeper to adapt the amount and variety of food to be provided to the number and circumstances of her family.

Average amount Nutriment in One Pound of Wheat.

		oz.	gr.
Water,		2 oz.	215 gr.
Gluten,	Nitrates.	2	0
Albumen,	Nitrates.	0	146
Starch,	Carbonates.	9	215
Sugar,	Carbonates.	1	0
Fat,	Carbonates.	0	52
Fibre,	Waste.	0	104
Gum,	Waste.	0	104
Mineral matter,	Phosphates.	0	108

Amount of Nutriment in One Pound of Rye.

		oz.	gr.
Water,		2 oz.	35 gr.
Gluten,	Nitrates.	1	318
Albumen,	Nitrates.	0	213
Starch,	Carbonates.	8	79
Sugar,	Carbonates.	0	262
Fat,	Carbonates.	0	66
Gum,	Waste.	0	371
Woody fibre,	Waste.	1	284
Mineral matter,	Phosphates.	0	122

The average Amount of Nutriment in One Pound of Northern Corn (Maize).

Water,		2 oz.	105 gr.
Gluten,	Nitrate.	1	402
Starch,	Carbonates.	9	262
Sugar,	Carbonates.	0	21
Fat,*	Carbonates.	1	101
Woody fibre,	Waste.	0	350
Mineral matter,	Phosphates.	0	70

The average Amount of Nutriment in One Pound of Southern Corn.

Water,		3 oz.	0 gr.
Gluten,	Nitrate.	4	215
Starch,	Carbonates.	3	218
Sugar,	Carbonates.	0	200
Fat,	Carbonates.	0	20
Woody fibre,	Waste.	1	21
Gum,	Waste.	0	200
Mineral matter,	Phosphates.	0	250

* Or oil, two and one half times more fattening than starch or sugar.

The Amount of Nutriment in One Pound of Barley.

Water,		2 oz.	215 gr.
Gluten,	Nitrates.	2	110
Albumen,	Nitrates.	0	100
Starch,	Carbonates.	7	215
Sugar,	Carbonates.	0	215
Fat,	Carbonates.	0	30
Mineral matter,	Phosphates.	0	215

Average Amount Nutriment in One Pound Oat Meal.

Water,		2 oz.	100 gr.
Gluten,	Nitrates.	2	0
Albumen,	Nitrates.	0	350
Sugar,	Carbonates.	0	360
Starch,	Carbonates.	0	100
Fat,	Carbonates.	0	360
Mineral Matter,	Phosphates.	0	200

The Amount of Nutriment in One Pound of Beans.

Water,		2 oz.	161 gr.
Casein,	Nitrates.	3	368
Starch,	Carbonates.	5	333
Sugar,	Carbonates.	0	140
Fat,	Carbonates.	0	140
Woody fibre,	Waste.	1	206
Gum,	Waste.	1	157
Mineral matter,	Phosphates.	0	245

The Amount of Nutriment in One Pound of Peas.

Water,		2 oz.	112 gr.
Casein,	Nitrates.	3	324
Starch,	Carbonates.	5	403
Sugar,	Carbonates.	0	140
Fat,	Carbonates.	0	140
Woody fibre,	Waste.	1	263
Gum,	Waste.	1	193
Mineral matter,	Phosphates.	0	175

Amount of Nutriment in One Pound of Buckwheat.

Water,		2 oz.	118 gr.
Gluten,	Nitrates.	1	165
Starch,	Carbonates.	8	0
Sugar,	Carbonates.	0	140
Fat,	Carbonates.	0	70
Gum,	Waste.	0	140
Fibre,	Waste.	0	126
Mineral matter,	Phosphates.	0	126

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The Amount of Nutriment in One Pound of Rice.

Water,		2 oz.	26 gr.
Gluten,	Nitrates.	1	0
Starch,	Carbonates.	11	360
Sugar,	Carbonates.	0	370
Fat,	Carbonates.	0	30
Gum,	Waste.	0	40
Fibre,	Waste.	0	215
Mineral matter,		0	20

Amount of Nutriment in One Pound of Potatoes.

Water,		12 oz.	0 gr.
Starch,	Carbonates.	2	205
Sugar,	Carbonates.	0	215
Fat,	Carbonates.	0	2
Albumen,	Nitrates.	0	142
Woody fibre,	Waste.	0	354
Gum,	Waste.	0	20
Mineral matter,	Phosphates.	0	354

Amount Nutriment in One Pound of Sweet Potatoes.

		Ounces.	Grains.
Water,		10	340
Starch,	Carbonates.	2	249
Sugar,	Carbonates.	1	277
Fat,	Carbonates.	0	18
Albumen,	Nitrates.	0	105
Fibre,	Waste.	0	35
Gum,	Waste.	0	77
Mineral matter,	Phosphates.	0	210

Amount of Nutriment in One Pound of Parsnips.

Water,		13	53
Albumen,	Nitrates.	0	87
Sugar,	Carbonates.	0	210
Starch,	Carbonates.	0	245
Fat,	Carbonates.	0	35
Fibre,	Waste.	1	123
Gum,	Waste.	0	52
Mineral matter,	Phosphates.	0	70

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The Amount of Nutriment in One Pound of Turnips.

		Ounces.	Grains.
Water,		14	213
Albumen, &c.,	Nitrates.	0	77
Sugar,	Carbonates.	0	28
Gum,	Waste.	0	107
Fibre,		0	168
Mineral matter,	Phosphates.	0	35

Amount of Nutriment in One Pound of Carrots.

Water,		14	6
Albumen,	Nitrates.	0	42
Sugar,	Carbonates.	1	11
Fat,		0	14
Gum,	Waste.	0	70
Fibre,		0	231
Mineral matter,	Phosphates.	0	70

Amount of Nutriment in One Pound of Cow's Milk.

Water,		13	533
Casein,	Nitrates,	0	350
Butter,	Carbonates.	0	245
Sugar,		0	215
Mineral matter,	Phosphates.	0	70

Amount of Nutriment in One Pound of Human Milk.

		Ounces.	Grains.
Water,		14	41
Casein,	Nitrates.	0	210
Butter,	Carbonates.	0	210
Sugar,		0	300
Mineral matter,	Phosphates.	0	35

Amount of Nutriment in One Pound of Goat's Milk.

Water,		10	0
Casein,	Nitrates.	0	325
Butter,	Carbonates.	0	230
Sugar,		0	280
Mineral matter,	Phosphates.	0	70

The casein and phosphates are in larger proportions in the milk of the cow and goat than in human milk, to adapt them to the different conditions of their young. The calf and the kid, being active from their birth, require the nitrates for feeding the muscles, and the phosphates for vital power, at first; while the child, being dormant and helpless, requires less of these principles; and therefore, to substitute the milk of the cow or goat for food for the child, about one third water is required, and a little sugar — a little more for cow's than goat's milk, — but the difference between the milk of the cow and that of the goat is too little to make it an object to be at much trouble for the choice. The proportions vary in different cows, and therefore it is important, in raising children on cow's milk, to get the milk that suits, and then use the same cow's milk constantly.

The Four Principal Meats, of average Fatness, compared with Vegetable Food.

The Amount of Nutriment in One Pound of Beef of average Fatness.

		Ounces.	Grains.	
Water,		8	0	
Fibrin and Albumen,	Nitrates.	1	122	Equal to same am't casein, gluten, or albumen — 1 oz. 122 grs.
Fat,	Carbonates.	4	340	Equal to 2½ times as much sugar or starch, or 11 oz. 75 grs.
Mineral,	Phosphates.	0	350	
Gelatine,	Waste.	1	122	

The Amount of Nutriment in One Pound of Veal.

		Ounces.	Grains.	
Water,		10	9	
Fibrin and Albumen,	Nitrates.	1	199	
Fat,	Carbonates.	2	281	Equal to 2½ times as much sugar or starch — 6 oz. 265 grs.
Mineral,	Phosphates.	0	312	
Gelatine,	Waste.	1	82	

The Amount of Nutriment in One Pound of Mutton.

		Ounces.	Grains.	
Water,		7	16	
Fibrin and Albumen,	Nitrates.	0	385	
Fat,	Carbonates.	6	176	Equal to $2\frac{1}{2}$ times as much sugar or starch — 16 oz., or 1 lb.
Gelatine,	Waste.	1	52	
Mineral,	Phosphates.	0	241	

The Amount of Nutriment in One Pound of Pork.

		Ounces.	Grains.	
Water,		6	69	
Fibrin and Albumen,	Nitrates.	0	315	
Fat,	Carbonates.	8	0	Equal to $2\frac{1}{2}$ times as much sugar or starch — 20 oz., or $1\frac{1}{4}$ lbs.
Gelatine,	Waste.	0	315	
Mineral,	Phosphates.	0	312	

Rations for the English Soldier.—The amount and proportion of carbonates and nitrates necessary to keep the English soldier in a fighting condition, are found to be five ounces of nitrates to twenty ounces carbonates; and this amount is therefore daily furnished, both in England and in India, and the English colonies; and the English sailor has the same allowance.

Rations of the Dutch Soldier. — When in war, it is five ounces of nitrates and twenty-one ounces carbonates; but when in peace, or in garrison, it is only three and one half ounces nitrates and twenty ounces carbonates; but with this diet he is below fighting condition.

Rations of the French Soldier. — The diet of the French soldier is very different from that of the English or Dutch, they using much more of liquid food; still the proportion or amount of nitrates and carbonates is not very dissimilar. He gets about four and three fourths ounces nitrates and twenty-four ounces carbonates, and on this is always kept in a fighting condition — probably wasting three or four ounces of the carbonates.

English Soldiers in the Chelsea Hospital have their nitrates reduced to three or four ounces, but their carbonates remain the same; as also the sailor in the Greenwich Hospital; but, having no exercise, they need less carbonates as well as less nitrates, it being known that the demand for both nitrates and carbonates is equally increased or diminished in proportion to the amount of exercise.

Rations of Greenwich Pensioners. — They have three and one half ounces nitrates and twenty ounces carbonates.

Rations of Chelsea Pensioners. — They have four and one half ounces nitrates and twenty and one fourth ounces carbonates.

Rations of Old Men of Gillespie's Hospital, Edinburgh. — They have three ounces nitrates and twenty ounces carbonates.

Rations of Paupers. — In all the workhouses of England, Scotland, and Ireland, the average is daily three and one half ounces nitrates and sixteen and one half ounces carbonates.

Rations of Boys of Ten Years old. —In the English schools two and one half ounces nitrates and fifteen ounces carbonates are allowed daily.

Rations of Boys in Christ's Hospital in London.— Only two and one half ounces nitrates and fourteen ounces carbonates are allowed; but the average age is not stated.

Massachusetts State Prison. Average Number of Prisoners, 545. *Food consumed in one Week:*—

			Each man.		Carbonates.		Nitrates.
		Pounds.	lbs.	oz.	lbs.	oz.	oz.
Flour,	13 bbls.	2600	5	0	4	2	6
Meal,	60 bush.	3000	5	8	3	8	8
Beans,	9 "	576	1	0	0	8	5
Peas,	3 "	192	0	5	0	$3\frac{1}{2}$	$1\frac{3}{4}$
Rice,	$4\frac{1}{2}$ "	306	1	8	0	7	$0\frac{1}{8}$
Potatoes,	100 "	6000	10	0	2	8	$0\frac{1}{8}$
Fresh beef,		925	1	8	0	7	3
Fish (fresh and salt),		1100	2	0	0	10	4
Fat pork,		525	1	0	1	0	0
Hard bread,		40	0	1	0	1	$0\frac{1}{8}$
Lard,		60	0	2	0	2	0
			28	00	13	$08\frac{1}{2}$	$29\frac{1}{8}$

Each man consumes in one day thirty ounces carbonates and four and one fourth ounces nitrates.

By comparing the above bill of fare with the standard already given, it will be seen that the muscle-making elements are three fourths of an ounce below the standard, while the carbonates are at least one third too high. It should be considered that living in a moderate and uniform temperature, and using only moderate muscular exercise, neither nitrates nor carbonates need be above the average, — probably not more than twenty ounces of carbonates are consumed: all the remainder is cast off as waste; and not being the natural waste, tends to derange the stomach and bowels, and clog and render dormant the whole system. The prisoners may be fat, and may look healthy, and indeed may be, and should be, with their regular habits, healthy, and the bill of mortality be much below the average; but they cannot have much muscular or mental energy.

By changing the first two articles on the bill, a saving of more than one hundred dollars would be made in a week, and a bill be made giving them more agreeable food, and giving them more of the nitrates and phosphates, and therefore more energy of mind and muscle. Half the amount of unbolted wheat flour, made from good wheat, would give more than the same amount of nitrates, with about one pound less of carbonates, and the bread would be equally satisfactory; and then half the amount of Southern corn (thirty bushels) meal, made from the variety of corn represented by Fig. 3, would give more nitrates and more phosphates than is obtained from sixty bushels of Northern corn, and the bread would be lighter and better, — which would also reduce the amount of carbonates perhaps one pound more. And the bill might be still further improved by substituting for the four and one half bushels of rice as many bushels of peas, which would add an ounce to the nitrates and subtract another pound from the carbonates, as may be seen by the analysis.

The Bill of Fare of Chinese Passengers from China to California.

		Carbonates.	Nitrates.
Rice,	$1\frac{1}{2}$ lbs.	17 oz.	$1\frac{1}{2}$ oz.
Beef or fish,	$\frac{1}{2}$ lb.	$1\frac{1}{2}$ oz.	$\frac{1}{4}$ oz.
Salted vegetables,	$\frac{1}{2}$ lb.	1 oz.	0 oz. 87 gr.
Tea,	$\frac{1}{2}$ oz.		
Water,	3 qts.		
		$19\frac{1}{2}$ oz.	2 oz. 87 gr.

Having a full supply of carbonates, and only half the amount of nitrates necessary for active life, probably they sleep most of the time.

American Army Rations.

		Carbonates.	Nitrates.
Pork or bacon,	$\frac{3}{4}$ lb. if all fat,	12 oz.	0 oz.
Fresh or salt beef,	$1\frac{1}{4}$ lb. average fatness,	7 oz.	2 oz.
Bread or flour,	1 lb. 8 oz. or	1 lb. 6 oz.	2 oz.
Hard bread,	12 oz.	11 oz.	1 oz.
Corn bread,	4 oz.	1 oz.	$\frac{1}{4}$ oz.

8 qts. of beans in one hundred rations; or, in lieu,
10 lbs. rice twice a week; or, in lieu,
150 oz. dried potatoes and 100 oz. dried vegetables:
1 lb. tea, 15 lbs. sugar.

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These rations are very unscientifically made up. If I understand the bill, a man may have three fourths of a pound of fat pork and twelve ounces of hard bread on the same day, and nothing else, and get twenty-three ounces of carbonates and only one ounce of nitrates; or he may have one pound and one fourth of fresh beef and one pound and one half of flour bread, and get twenty-nine ounces of carbonates and four ounces of nitrates; or he may have the same quantity of fat pork, which contains no nitrates, and bacon, which, if of average fatness, would give a good share of nitrates. It is evident that in any combination the rations give too large a proportion of carbonates to beget activity and energy, and a large amount of flour or hard bread must be wasted. A great improvement would be made by leaving out three fourths of the flour and all of the rice, and giving instead Southern corn bread or hominy and beans and peas. This would give much more muscle power, and would save a large amount of expense.

The great dietetic fault of the nation lies in eating too much carbonaceous food, especially with that part of the people who have followed old English habits. Probably the Massachusetts state prisoners live more nearly in accordance with physiological laws than any five hundred men outside; but we see that they waste one third of their food in superfluous carbonates.

By all the bills of fare for soldiers and prisoners, and all other tables by which it could be ascertained how much of muscle-making nutriment is required under different circumstances, it is seen that men in sedentary life, in this country or Europe, are not content with less than four ounces of the nitrogenous elements of food, and, in considerable degree of activity, they demand, and will have, five ounces; and in the same way it is ascertained that from four to five times as much of the carbonates are required as of the nitrates. If food is set before us containing these proportions of elements, we shall eat only just enough to furnish the system with the elements required; but if we have before us food containing ten times as much of the carbonates as of the nitrates, we should then eat twice as much of the carbonates as are required, in order to satisfy the demands of the appetite for the necessary supply of nitrates. We will demonstrate this proposition.

To get muscle-making food in right proportions, take natural food —

	Carbonates.	Nitrates.
1 lb. milk,	0 oz. 245 gr.	0 oz. 350 gr.
1 lb. beef, roasted,	4 oz. 340 gr.	1 oz. 122 gr.
1 lb. potatoes,	3 oz.	145 gr.
1 lb. unbolted bread,	10 oz. 165 gr.	2 oz. 110 gr.
1 lb. apples, .	3 oz.	145 gr.
	21 oz. 313 gr.	4 oz. 335 gr.

To get muscle-making food in unnatural proportions, take food in common use, some of which is in a natural state, others not: —

	Carbonates.	Nitrates.
1 lb. roasted beef,	4 oz. 340 gr.	1 oz. 122 gr.
1 lb. milk,	245 gr.	350 gr.
2 lbs. superfine bread,	22 oz.	370 gr.
$\frac{1}{4}$ lb. butter,	4 oz.	0 gr.
$\frac{1}{4}$ lb. sugar,	4 oz.	0 gr.
1 lb. potatoes,	3 oz.	145 gr.
1 lb. apples,	3 oz.	145 gr.
	41 oz. 143 gr.	3 oz. 258 gr.

In this bill one half the carbonates must be wasted.

Of the first bill, you may take of either of the articles as much as you please without varying the proportions of carbonates and nitrates, and consequently are in no danger of wasting food or embarrassing the system by eating too much, the appetite being satisfied when the requisite amount of nitrates is supplied; or you may vary the amount of different articles, taking more of one and less of the other, without varying the proportions of the nitrates, and therefore still eat all the appetite demands. For example, suppose, instead of a pint of milk and a pound of bread in a day, you take double the amount of milk and one and one half pounds of bread, you would then get four ounces and four hundred and twenty-eight grains of nitrates, — almost the requisite amount, from bread and milk alone; indeed, for a warm day, at rest, the amount of nitrates and carbonates would both be too large; or, with one half or one fourth of the beef, you would take more of the other articles in proportion, and could thus safely trust your appetite to the full extent of its demands without harm.

But with the last bill of fare, you must take double the quantity to get the requisite amount of muscle-making and brain-feeding nutriment, and consequently one half of all the food taken would be lost. All the sugar and butter, and more than half of the flour, would be thrown from the system as waste, and not only lost, but by giving extra and unnatural work for the excretories, embarrass their functions and render them liable to disease; while the presence of these heating articles renders every organ more liable to inflammation and disease, and the efforts of the stomach and bowels to dispose of these offensive materials, together with the fermentation of these undigested elements, would cause flatulence, acidity, dyspepsia, and the thousand and one pains, inflammations, liver and bowel complaints, which are liable to attack us, especially in warm weather, when the system is not as well able to resist these influences.

When we consider how many families, especially among the poor, live very nearly on the same kind of food summer and winter, eating in warm weather butter, fat pork, superfine flour, lard, &c., is it strange that in the height of the warm season we have bowel and liver complaints, gastric and typhoid fevers, dysenteries, dyspepsias, &c.? I think that, considering the articles wasted are among the most expensive, I am sustained in the assertion that more than one half of the expense of food in Boston, to say nothing of all the diseases, would be saved by adapting our food to the wants of the system, and that we should enjoy life, and especially the pleasures of eating, as we never can while living in disregard of Nature's laws.

Analysis of Articles of Food in a Dry State.

Articles.	Nitrates.	Carbonates.	Phosphates.	Waste.	
Wheat, .	16.9	77.2	1.9	4.0	Wheat is the best grain for bread, in unbolted meal. In fine flour, only useful when the stomach and bowels are in an irritable state, as in diarrhœa, cholera morbus, &c.
Barley, .	14.9	60.6	4.9	19.6	Barley is excellent for students, as it abounds in food for the brain, and in waste to keep the bowels active.
Oats,	19.6	58.8	3.5	18.1	Oats are good for active men, either with muscle or brain.
Northern corn,	14.0	78.9	1.2	5.9	Northern corn is fattening, containing as it does more than five times as much oil as is found in wheat.
Southern corn,	39.5	46.5	4.7	9.3	Hominy from southern corn is excellent food in warm weather, abounding in food for muscle and brain, and having few carbonates.

Articles.	Nitrates.	Carbonates.	Phosphates.	Waste.	
Tuscarora corn,	6.0	90.7	1.3	2.0	Tuscarora corn is used mostly for making starch.
Buckwheat,	10.0	61.8	2.1	26.1	Buckwheat is useful only for a ride in the cold, having few nitrates for the muscles.
Rye,	15.9	64.2	2.0	17.9	Rye is excellent for persons inclined to constipation, and with corn meal makes good bread, nourishing and digestible.
Beans,	28.2	46.9	4.1	20.8	Beans and peas, containing double the amount of nitrates and phosphates, and treble of waste necessary, are appropriately used with pork or butter to supply the carbonates, &c.; and being hard of digestion, are excellent for active people whose stomachs are strong. If eaten too heartily the waste gives pain.
Peas,	27.2	47.7	2.9	22.2	
Lentils, .	30.2	45.4	1.7	22.7	Lentils and rice grow together naturally, and are evidently intended to supply each other's deficiencies. Neither, alone, would be capable of sustaining life, but for opposite reasons; the one containing double, the other one half the nitrates necessary.
Rice,	5.6	90.2	0.5	3.7	
Cheese,* about	48.5	44.1	7.4	–	

* Cheese has more than twice the amount of nutriment of any other known substance. It must therefore be used in small quantities, and with such articles as fruits, or fine flour, which contain little nitrogen. It is hard of digestion, but almost any one who is in good health can teach the stomach to digest it by taking very little at a time early in the day.

Articles.	Nitrates.	Carbonates.	Phosphates.	Waste.
Sweet potatoes,	4.6	67.1	8.9	19.4
Parsnips,	10.2	70.4	4.8	14.6
Carrots,	6.3	69.7	5.8	18.2
Potatoes,	5.6	62.7	3.5	28.2
Turnips,	12.5	41.7	5.2	40.6

These and all other green vegetables and fruits, contain all the requisite elements of nourishment, but with such an amount of water and waste, that the capacity of the human stomach is insufficient to contain the necessary supply, while animal food is too concentrated to give the necessary distention and waste; but eaten together they each supply the deficiency of the other class of food.

Articles.	Nitrates.	Carbonates.	Phosphates.	Waste.
Beef,	54.3	40.0	5.7	–
Lamb,	54.3	39.6	6.1	–
Mutton,	56.8	37.8	5.4	–
Veal,	51.6	41.7	6.7	–
Pork,	49.1	44.9	6.0	–

Fat being the source of supply of carbon in animal food, and supplying as it does two and one half times as much heat as sugar or starch, the true amount is obtained in this table by multiplying the figures of the next table by 2½.* While therefore beef is reported to have twice as much carbon as nitrogen, it actually has five times as much. For this reason, animal food is too concentrated, and having also too much phosphorus, requires vegetable food to dilute and modify it.

Analysis of Articles of Food in their Natural State.

Articles.	Nitrates.	Carbonates.	Phosph.	Water.	Waste.
Wheat,	14.6	66.4	1.6	14.0	3.4
Barley,	12.8	52.1	4.2	14.0	16.9
Oats, .	17.0	50.8	3.0	13.6	15.6
Northern corn, or maize,	12.3	67.5	1.1	14.0	5.1
Southern corn, .	34.6	39.2	4.1	14.0	8.1
Buckwheat, .	8.6	53.0	1.8	14.2	22.4
Rye,	6.5	75.2	0.5	13 5	4.3
Beans,	24.0	40.0	3.5	14.8	17.7
Peas,	23.4	41.0	2.5	14.1	19.0
Lentils,	26.0	39.0	1.5	14.0	19.5
Rice, .	5.1	82.0	0.5	9.0	3.4
Potatoes, . .	1.4	15.8	0.9	74.8	7.1
Sweet potatoes,	1.5	21.8	2.9	67.5	6.3
Parsnips, .	2.1	14.5	1.0	79.4	3.0
Turnips, .	1.2	4.0	0.5	90.4	3.9
Carrots,	1.1	12.2	1.0	82.5	3.2
Cabbage, .	1.2	6.2	0.8	91.3	0.5
Cauliflower, .	3.6	4.6	1.0	90.0	0.8
Cucumbers,	0.1	1.7	0.5	97.1	0.6
Milk of cow,	5.0	8.0	1.0	86.0	–
Human milk,	3.0	7.0	0.5	89.5	–
Veal,	17.7	14.3	2.3	65.7	–
Beef,	19.0	14.0	2.0	65.0	–
Lamb, .	19.6	14.3	2.2	63.9	–
Mutton,	21.0	14.0	2.0	63.0	–
Pork, .	17.5	16.0	2.2	64.3	–
Chicken, .	21.6	1.9	2.8	73.7	–
Codfish,	16.5	1.0	2.5	80.0	–
Haddock, .	14.0	0.6	2.6	82.8	–
Sole,	17.0	0.8	2.5	79.7	–
Plaice,	14.0	very little	5 or 6	80.0	
Flounder,	15.0	some fat	3 or 4	78.0	–
Turbot,	14.0	very little	5 or 6	79.0	
Trout, .	16.9	0.8	4.3	78.0	
Whiting, .	15.0	very little	5 or 6	78.0	
Smelt, .	17.0	very little	5 or 6	75.0	
Salmon,	20.0	some fat	6 or 7	74.0	–
Eels, .	17.0	some fat	3 or 4	75.0	–
Herring,	18.0	some fat	4 or 5	75.0	–
Halibut, .	18.0	some fat	3 or 4	74.0	–

Articles.	Nitrates.	Carbonates.	Phosph.	Water.	Waste.
Oyster,	12.6	–	0.2	87.2	–
Clam, .	12.0	very little	2 or 3	–	–
Lobster, . .	14.0	very little	5 or 6	79.0	–
Eggs, white of, .	13.0	–	2.8	84.2	–
Eggs, yolk of,	16.9	29.8	2.0	51.3	–
Butter,		100.0	–	–	–
Artichoke,	1.9	19.0	1.8	76.6	0.7
Asparagus,	0.6	5.4	0.4	93.6	–
Bacon,	8.4	62.5	0.5	28.6	–
Carp, .	18.0	0.8	2.9	78.3	–
Cheese,	30.8	28.0	4.7	36.5	–
Cherries, .	0.6	21.0	1.0	76.3	1.1
Chocolate,	8.8	88.0	1.8	–	1.4
Cream,	3.5	4.5		92.0	–
Currants,	0.9	6.8	0.3	81.3	10.7
Dates, fresh		73.7	-	24.0	2.3
Figs, . .	5.0	57.9	3.4	18.7	15.0
Green gages .	0.3	26.8		71.1	1.8
Ham, .	35.0	32.0	4.4	28.6	–
Horseradish .	0.1	4.7	1.0	78.2	16.0
Kidney,	21.2	0.9	1.4	76.5	
Lard,	–	100.0	–	–	
Liver, .	26.3	3.9	1.2	68.6	
Onions,	0.5	5.2	0.5	93.8	–
Pearl barley,	4.7	78.0	0.2	9.5	7.6
Pears, .	0.1	9.6	–	86.4	3.9
Pigeon,	23.0	1.9	2.7	72.4	–
Prunes,	3.9	78.6	4.5	13.0	–
Radishes, .	1.2	7.4	1.0	89.1	1.3
Suet, .	–	100.0	–	–	–
Venison, .	20.4	8.0	2.8	68.8	–
Vermicelli,	47.5	38.0	1.7	12.8	–
Whey,		4.6	0.7	94.7	–

Fishes.

Of the fishes, there has not yet been made analyses sufficiently accurate to make a reliable table. The nitrates of common white fish, like cod and haddock, are in about the same proportion as in beef and mutton, and of the phosphates rather more; while the more active fish, as the trout, pickerel, shad, &c., contain more nitrates and phosphates in proportion to their activity.

The amount of carbonates depends on the amount of fat; the gelatinous principle, although containing carbon, is not digestible, and therefore furnishes no carbonaceous food; the nitrates consist mostly of albumen, which is easily digested, but furnish less muscular power than fibrine of red-blooded meats.

Fishes, therefore, afford better food for students and sedentary men than for those who work hard.

Except the fatty fishes, most of them require to be cooked with lard, fat pork, or butter, and to be eaten with potatoes, or some farinaceous food, to furnish the requisite carbonates. There is a class of fishes, however, like the salmon, halibut, &c., which are quite well supplied with the carbonates; they are easily digested, or not, as they contain more or less fat; and the cod, haddock, trout, shad, &c., are excellent food, if relished, for invalids, convalescents, &c.; while the fatty fishes and the preserved fishes are more suitable for those who take active exercise in the open air, and have better powers of digestion.

Preserved Fish. — Various methods are devised for keeping fish, as pickling in salt, drying, smoking, &c. Pickled fish are objectionable, having lost most of their nutritive element and their soluble phosphates. The brine in which fish as well as beef has been pickled has been analyzed, and found to contain most of the albumen and the phosphates which are adapted to give vigor to the brain and nervous system; but not the fibrine, which makes muscles, or the phosphates, which make bones. Fish, therefore, which has been in brine, is suitable for laboring men, but not for sedentary persons, or those who use their brains.

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"Every moving thing that liveth shall be meat for you."

This promise was made to man on the basis of immutable law. In every living thing, life and power to move is found to depend on the same elements, — phosphorus and nitrogen, — and of course every living thing is capable of imparting life and power to move to every other living thing which has digestive powers by which to appropriate these elements; and, as has before been intimated, this power of imparting life and muscular power in any article of food is in proportion to the phosphorus and nitrogen contained in it. On the other hand, "every moving thing that liveth" contains these elements in proportion to its own vital activity and muscular power, so that we need not analyze every living thing in order to know its dietetic value. This principle is not only established by chemical analysis, but by observation on the habits of animals, and the experience of every man. (See page 84, 85.)

Who has not experienced the difference of power and activity of mind and muscle produced by different kinds of food? For example, by a dinner from the muscles of an ox, that have been developed by hard work, and one from the muscles of a dormant hog? Indeed, the difference is perceptible between the used and the unused muscles of the same creature.

The breast of the chicken or turkey, which is made up of the unused muscles of the wings, is white, dry, and comparatively insipid, containing but little phosphatic or nitrogenous food, while the muscles which move the legs are dark, juicy, rich in flavor, and contain a very much larger proportion of the life-giving and muscle-making elements. On the other hand, the breasts of the birds which live on the wing are rich in these elements, and their thighs and side bones are covered with poor, dry meat. This principle holds good in relation to all animal food, from quadrupeds, fishes, fowls, and reptiles; and it may be useful in assisting to determine the comparative value of different articles, and in adapting them to our circumstances.

A full understanding of this principle in the community will relieve the doctor from that inevitable question, which meets him wherever he goes. In the sick room or at the dinner table, in the horse cars or at the social circle, wherever he is, somebody bores him with the question, Doctor, is pork wholesome? Are potatoes wholesome? &c., &c.; questions which can be answered yes or no, or both yes and no, with equal propriety, unless, with the answer, he goes into a disquisition on the peculiar properties of each, and the circumstances which make them wholesome at one time and hurtful at another.

A rattlesnake, all but the head, would make a delicious and wholesome meal to a man who was starving, and could get nothing else, while the most delicate woodcock would be poison to a man prostrated with typhoid fever. That abstract question, then, so often asked (is this or that kind of food wholesome), is only consummate nonsense.

"Every moving thing that liveth," and "every herb bearing seed which is upon the face of the earth,' is wholesome under some circumstances, and unwholesome under other circumstances.

Of Reptiles.

Crustacea and mollusks, and indeed "every creeping thing," either from necessity or choice, in some part of the world, is eaten by man; but in this country and in England only a few species are used.

Turtle.

Of reptiles, the turtle only is eaten, unless under this title we class eels. The green turtle is brought from the West India Islands and the Bahamas. It as seldom crawls on the land as the eel, and, indeed, has no feet, having in the place of them little paddles, with which it swims with great swiftness; and being very muscular and active, its flesh is very nitrogenous and phosphatic, and not being fat, is an excellent article of food taken fresh from its native element. I have eaten it cooked in four different ways — fried, broiled, fricasseed, and in soup, and found it a palatable and highly nutritious article of food. In this country it is seldom used except in soup. It is very different in its taste, and far inferior in its nutritive qualities, after being kept out of water, on its back, in the cruel manner in which it is kept on the passage. Fresh from the water, some parts of the turtle resemble the flesh of the chicken, other parts have a fishy taste, other parts are albuminous, like the white of an egg, and all parts seem to be nutritious.

Crustacea.

Many of the species of this class are esculent, and some are excellent food. In this country and England are used the common lobster, the thorny lobster or sea crawfish, the river crawfish, the large edible black-clawed crab, the common or small edible crab, the prawn, and the shrimp. They have all the same characteristics. Being active in their habits, and having powerful muscles, their flesh abounds in nitrates and phosphates, but is rather hard and compact, and therefore requires good powers of digestion, and they are adapted for food to active, healthy persons *to assist in* the labor of the day, but they are most miserably misapplied to evening entertainments in the form of salads. The lobster is the most valuable of this class of food, and is much the most extensively used.

Molluscous Animals.

In this country the only species of this class used as food to any extent are clams and oysters; and in England, besides the oyster, the mussel, the cockle, the scallop, the periwinkle, the limpet, and the whelk. But the oyster holds the highest rank in this class of food, and is used among all classes, forming a branch of trade very extensive and important.

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This class of animals differs from the crustacea in this, that while the crustacea have powerful and active muscles, the mollusks have almost no muscles at all, having no motion except the opening and shutting of the bivalves, and a slight contractile power by which they imbibe their food. Of course they have not as food the muscle-making elements of the crustacea or other active fish; and although their chemical composition indicates phosphatic salts, they are mostly salts of lime, which go to form the shell and to make bone rather than afford food for the brain and nervous system. Oysters, therefore, are very unsatisfactory food for laboring men, but will do for the sedentary, and for a supper to sleep on. They contain but twelve and one half per cent. of solid matter, including fibrin, albumen, gelatine, mucus, and osmazome, and much of that is gelatine, which affords no nourishment, while butchers' meat contains on an average twenty-five per cent., and the poorest fishes contain fourteen per cent. of pure nitrates.

The nitrates in oysters are in the form of albumen, like the white of the egg; they are therefore more easily digested in a raw state than when cooked, but stewed are not indigestible, and for feeble persons and convalescents are better stewed than raw, as in this state they are relished with less stimulating condiments.

To oysters, as to all shell-fish, and indeed to all kinds of fish, there is the serious objection that great care must be used to avoid eating them after the slightest decomposition has commenced, otherwise they may occasion serious disturbance of the digestive organs, and even in some cases terrible and fatal diseases. There is also occasionally a very serious poisonous effect from fish perfectly fresh and apparently healthy, in which chemistry can detect nothing deleterious. I have known but few cases of the kind in Boston, and they were occasioned by eating mackerel; but in the Bahama Islands I saw a man, who, fifteen years before, ate a meal from a fish called there blue fish, though very different from the blue fish of New England coast, which in two hours brought on excruciating internal distress, with painful eruption of the skin, and these turns of awful distress had occurred occasionally ever afterwards, entirely unfitting him for any kind of business, and making his life a burden.

Not one in a hundred of these fishes is poisonous, but no man has sagacity sufficient to detect the good from the bad; and therefore the inhabitants eat none of these fishes till they submit them to a curious test. They place a piece of fish in the way of a species of ant which is common there: if the ant eats it, they eat it with impunity; if the ant rejects it, they of course do not eat it; — an example which gives force to the idea of Pope, —

"Reason raise o'er instinct as you can;
In this 'tis God directs — in that 'tis man."

Classification of Food in common use.

1st Class. — That in which the proportion of heat-producing elements is too large for the common wants of the system, and which alone would sustain life only for a time, shorter or longer in proportion to the amount of other elements which they contain. Lard, butter, sugar, or any animal fats being capable of sustaining life, without other food, only from twenty to thirty days; and superfine flour, being mostly composed of starch, has been proved by experiment on animals to be capable of sustaining life, without other food, only from fifty to sixty days. These are the Carbonates, described in another chapter.

2d Class. — That in which the muscle-making elements are too large in proportion to their carbonates. Some of these articles would be capable of sustaining life only for a limited period without articles of the first class to keep up the steam. These are the Nitrates, described before.

3d Class. — That in which the proportion of elements which support the brain and nerves, and give vital energy both of mind and muscle, is too large for the common duties of life. These are the Phosphates.

4th Class. — That in which there is too much waste material in proportion to nutritive principles, and which, therefore, if eaten alone, produces diarrhœa and debility, but which, taken with other more nutritive food, subserves the important purpose of giving distention, and keeping the bowels in action, and the system free and cool, by preventing a surplus of stimulating food.

The representative articles of these four classes are as follows: —

1st Class. Carbonates.	2d Class. Nitrates.	3d Class. Phosphates.	4th Class. Waste.
Butter and lard.	Lean meats.	Shell fishes.	Green vegetables.
Fat of all meats.	Cheese.	Lean meats.	Fruits, berries, &c.
Vegetable oils.	Peas and beans.	Peas and beans.	
Fine flour, &c.	Lean fishes, &c.	Active fishes, birds, &c.	

Under ordinary circumstances, in moderate weather, with moderate exercise of muscle and brain, the proper proportions of carbonates, nitrates, and phosphates seem to be the average proportions found in unbolted wheat meal, viz.: Sixty-five of the carbonates to fifteen of the nitrates, and two of the phosphates to seventeen or eighteen of water and waste, — or something more than four times as much of the carbonates as of the nitrates, and two per cent. of the phosphates, the amount of water not being of much consequence, as it is supplied as it is demanded, and taken as drink when it is not supplied in the food.

A consideration of this classification will help us to understand and correct many important errors in diet.

Every observing person has noticed that after a meal in which the predominant articles were chiefly composed of fat meat, fine flour, butter or sugar, he is stupid, or sleepy, and indisposed to exercise either mind or muscle; and the reason is plain: as very little food for either brain or muscle is found in either of the articles named, and this torpor will be found to be in exact proportion to the excess of these carbonates over their proper proportion. And this is the inevitable consequence of separating the important principles which God has joined together, and furnished in every article of appropriate food, in the right proportions, as nourishment for every faculty.

If the fat meat had been eaten as it was made, mixed with an appropriate amount of lean, and instead of the flour, the bread had been made of meal from the whole wheat as it was created, and milk had been substituted for the butter, and the sugar taken as it was intended to be taken, with the vegetables and delicious fruits, mixed with such other elements as the system required, then the appetite might have been indulged to the fullest extent, and no organs or faculties would have been oppressed and overburdened while others were not supplied, and every part of the system would have been prepared, without stupor or sleepiness, to perform the duties assigned it.

If we take our food as it is made, with the elements mixed by Infinite Wisdom, we need use our judgment

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only in cooking it so as best to develop its flavor and fit it for digestion, and our appetite would safely direct us, both as to the articles to be eaten and the amount required. But presuming as we do to know better than our Maker how to mix the different elements of food, we have spoiled some of our best articles of nourishment, and have at the same time so perverted our appetites and tastes that they are no guide, at least so far as relates to the use of the articles with which we have thus interfered.

The only articles of diet in this country which to any extent are thus perverted are wheat and milk, and these are perverted in the same way, by taking out and rejecting the nitrates and phosphates, and using the carbonates only. The effects, especially in our cities, are manifest in our liability to inflammatory diseases; in our feebleness and weakness of muscle, for want of the nitrates; in our defective, aching teeth, for want of lime, &c.; in our physical and mental debility, for want of the phosphates; and in our ash-colored, chlorotic girls, for want of the iron, — all of which elements, except the carbonates, being entirely wanting in butter, and almost all in *very nice* white flour. See plate of wheat, Figs. 2, 6, and 7.

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Practical Application of the Analysis of Food to the different Conditions in Life.

Food for Out-of-door Work, with the Thermometer below Zero.

Let us first take a case requiring the most concentrated nourishment, or, in common parlance, the most hearty food.

A man works in the open air in the coldest winter weather: what articles of diet will best sustain him? Under these circumstances he must exercise his muscles to their fullest capacity or he will freeze, and he will therefore require more than twice as much muscle-making food as he would need with moderate exercise: then he would require of the most concentrated heat-producers five times as much as of the flesh-makers. Fat of animals is the most concentrated article of carbonates, and yet we are astonished at the amount necessary to support animal heat in cold climates.

It is said that an Esquimaux woman will eat a gallon of whale oil in one day, or ten or twelve pounds of tallow candles, besides the necessary muscle-making food. The stomach will not, therefore, in active life in the cold, contain food sufficient to sustain life, except in its most concentrated form. For a man, therefore, chopping wood in the cold, fat and lean meats are the articles mostly to be depended on, fat containing two and one half times the heating power of the vegetable carbonates, sugar and starch, while the muscle of meat contains, of course, the concentrated elements for working power.

Of vegetable food adapted to accompany pork and beef, beans, peas, and northern corn bread are best, as may be seen by reference to the analytical table, beans and peas containing more of the nitrates and phosphates than any other vegetable food, and Indian corn containing more carbonates, especially more oil, than other grains. Cheese is also a good concentrated article with corn bread. These articles of food are not easily digested, but are the better on that account, the stomach being subject to the same law as other organs and faculties, — "the more work to do, the more strength to do it."

Exposure to cold, without exercise, requires different and more digestible articles. Carbonates, such as sugar, buckwheat or flour cakes, rice, &c., and even the less digestible articles which cannot be eaten in summer, as cheese, beans and pork, &c., may be eaten with impunity in winter, upon the principle stated above, much more food being required in winter than in summer, proportionate powers of digestion are given to correspond. And hence we seldom find trouble from dyspepsia in cold weather, especially with those who exercise in the open air; and it is always best, in order to strengthen the stomach, to take articles of food that will tax the full power of digestion, just as it is best to take active exercise in order to strengthen the muscles. One who lives on rice, can digest nothing else; but one who can eat and digest beans, cheese, &c., can generally digest everything.

What Articles of Food are best adapted to Warm Weather?

If it be true that in cold weather we need, and the appetite demands, concentrated carbonaceous food, as has been explained in the preceding chapter, it is also true, as might be expected, and as we all know, that the appetite demands in warm weather a very different class of articles of food; and the reason is obvious.

Four fifths of our food being devoted to the production of heat, we need four times as much in cold weather as in warm. If, therefore, we ate the same articles in summer as in winter, and only what our nature required, the stomach and bowels would collapse into one quarter of their size, and could not properly carry on their functions. Nature, therefore, provides for warm climates and the summers of cold, food in which all the elements are greatly diluted, and in which the proportions of carbonates are much smaller than those provided for cold weather. This you will see in the analysis of southern and northern corn, in a very remarkable degree (Figs. 3 and 4). While the proportion of northern corn is six of the carbonates to one of the nitrates, the proportions of these principles in southern corn are nearly equal: it would therefore require six times the bulk of southern corn as of northern to support the same degree of heat; and this disparity is still more strikingly seen if we compare northern corn with some of our common vegetables. Corn contains seventy-three per cent. of carbonates, turnips four per cent., and cucumbers one per cent. Consequently it would require eighteen pounds of turnips, or seventy-three pounds of cucumbers, to furnish as much heat as one pound of northern corn meal.

The comparative proportions of carbonates and nitrates in wheat, and indeed all the cereals that grow both in northern and southern climates, as well as those of all other natural products of the soil, plainly declare the will of God in regard to summer and winter food, as do also our appetites and tastes.

In the spring we lose our desire for butter and buckwheats, and begin to crave some acid fruits and green vegetables. And yet how many thoughtless housekeepers at the north go through nearly the same routine of cooking in summer as in winter, with just about as much butter and lard and fat beef, and even pork, and fat gravy, and flour puddings, with butter sauce; not because they like it as well, or think it as wholesome, but only because "their mothers did so before them!" And so powerful is this thoughtless and absurd habit in the Southern States, that it is said that however plentiful may be the supply of milk, and cheese, and green vegetables, fresh lean beef, and fruits, &c., a southern family always has on the table a smoked ham or a "side of pork," and their vegetables are cooked swimming in fat; and to force an appetite, they use the most stimulating spices and condiments. In short, their food in the hottest weather is suitable only for the coldest northern winter weather. Is it strange that diseases prevail?

We need in summer or winter, whether using muscles or brains, or neither, every day food containing carbonates for the lungs, nitrates for the muscles and tissues, and phosphates for the vital powers, but we need them in very different proportions, according to the temperature in which we live and our habits of life. These elements are furnished at our hands, varying in proportions so as to be adapted to the different temperatures and habits; and for animals that have instincts and not intellects to guide them, from the elephant to the smallest animalcule, these different elements are so mixed and prepared, and the appetite so adjusted to them, that they always want, and always have, and always eat the right kind of food at the right time, and the right quantity.

But man, who has intellect, is expected to understand the laws of his being, and to adapt his food to the wants of his nature, varying it according to circumstances. We are creatures of habit, and our systems have wonderful power in adapting themselves to circumstances; and therefore we do not all die, however thoughtlessly we live, and however perseveringly continue the wrong habits to which we have been accustomed; and our appetites falling in with our habits, the evils of wrong living are perpetuated. Still it is true everywhere that the average amount of health and the average length of life are in exact proportion to the care we take to live in accordance with the laws of our being. This statistics show, and our own observations confirm.

But what a responsibility these considerations place upon wives and mothers, who have, or ought to have, the direction of these matters! To them, in providence, as in the word of God, the injunction emphatically is, "Keep my commandments, for length of days, and long life, and peace shall they add to thee," and to thy family. This important promise is fulfilled literally to those who study to obey physical laws, however figurative its fulfilment may be in regard to moral law.

Does any one doubt that peace to the digestive organs, and freedom from fevers and summer complaints, and many other fatal diseases, would result from a strict observance of the law, so clearly revealed, that fat meats, and butter, and fine flour, and other stimulating carboniferous food should be avoided in warm weather, while such articles should be substituted as contain the carbonates in a less concentrated form, combined with such acid fruits and vegetables, and the grains which contain less oil and starch, and more of the nitrates and phosphates?

With half the study that is required to learn a complicated piece of needlework, or a difficult piece of music, any intelligent housekeeper could learn the dietetic laws, and institute an arrangement adapting them to the mental or muscular employment of her family, so as to give them the requisite variety of wholesome food for summer and winter; for work of brain or work of muscles; and add immeasurably to the length of life and to the comfort and health of her family. But how little attention is given to this important subject!

Adaptation of Food to different Conditions and Employments in Life.

Food for Old People.

Is your fat, good-natured old grandfather living on fat beef and pork, white bread and butter, buckwheat cakes and molasses, rice and sugar, till he has lost all mental and physical energy, and desires to sit from morning till night in the chimney-corner or at the register, saying nothing and caring for nothing? — change his diet, give him fish, beefsteak, potatoes, and unbolted wheat bread, or rye and Indian, with one half or three quarters of the carboniferous articles of his former diet, and in one week he will cheer you again with his old jokes, and call for his hat and cane.

Is he lean, and cold, and restless, and irritable? — give him the fattest meats, with the best of butter, and as much sugar and molasses as he desires, not taking away entirely food for the brain and muscles, but adapting them to his circumstances. Perhaps his brain has been overworked, and exhaustion and fitful action follow. If so, he needs some form of phosphatic food to which he has not been accustomed, as oat-meal porridge, or oat-meal cake, with milk, or a diet of fish, and pearl barley, or pea soup. Or perhaps his restlessness comes from inactivity of the bowels: if so, he needs fruits, vegetables, unbolted wheat bread, &c., with care to keep his mind at ease, and to have only such company as is soothing and agreeable.

Or perhaps his irritability arises from the use of too much meat and other phosphatic food: if so, keep him on a diet in which the phosphates are deficient, as rice, flour bread and butter, &c., with other food adapted to his other conditions and habits. But that a regard to these different conditions, and an adaptation of food to conform to them, will very much contribute to comfort and happiness in the declining years of life, there is not a shadow of doubt.

Food for Children.

Is your nursing babe, eight months old, feeble and inactive, its teeth coming through the gums already black and defective, and its soft, flabby flesh indicating a want of muscular fibre? — change your own food at once, and give up butter, and fine flour, and cakes, and puddings with sweet sauce, and take instead beefsteak, oat-meal or barley porridge, with milk and unbolted wheat bread, grits, pea soup, &c., which abound in phosphates and nitrates, and in one week you shall see an improvement in the condition of the child; but if your own health will not admit of such a change, wean the babe, and give it the milk of the cow, oat-meal gruel, &c.; and for the next child, be sure and commence furnishing the material for bone and muscle at least fourteen months earlier, and its teeth will not be defective, or its muscles feeble and flabby.

Nor are defective teeth and undeveloped muscles the only or the greatest evils that accrue from neglect to furnish suitable material for the foundation of that structure which is so important as to be denominated the "temple of God.' "Know ye not that ye are the temple of God, and the Spirit of God dwelleth in you?"

All nature, as well as the word of God, testifies that the crowning work of creation was man; indeed, all other creative work was but a preparation for man, and so far at least as relates to this planet, all creative work ended in making man.

But man was not created from nothing, but from elements which had for ages been collecting in the "dust of the ground;" and having at first taken these elements directly from the soil, and constructed a perfect man, God, with wisdom as incomprehensible to man as that by which the first man was created, instituted laws by which all necessary elements should be taken out of the soil by plants, and so organized as under certain laws and conditions to be able to construct other perfect human beings, and thus perpetuate the race, as we have before explained.

These fourteen elements, which were at first taken directly from the soil and atmosphere, are now all found deposited in the grains, and flesh of animals, and fruits and vegetables, and for the construction of a perfect human being must all be used, at first through the mother's system, and afterwards directly from the food in which they are deposited. This wonderful arrangement can be better understood by further explanation.

A grain of wheat, as proved by analysis, contains every one of the elements found in the human system. Plant a grain of wheat in soil in which is no lime, or phosphorus, or nitrogen, and the plant may grow from the carbon and hydrogen, and other elements which it can get from the soil, the air, and water, but the grain would not be developed, and analysis would show that phosphorus, lime, and nitrogen would be wanting in the plant and grain as it was wanting in the soil. Now, as in such imperfectly developed grain the phosphorus, and lime, and nitrogen, which were intended for forming brains, and bones, and muscles, are not there, is it not certain that such grain could not develop brains, and bones, and muscles? — for if wheat does not contain phosphorus, lime, and nitrogen, unless the soil in which it grows contains these elements, is it not certain that the human system cannot be developed by food wanting in these or any other important elements?

In soil containing as little phosphorus, lime, and nitrogen as are found in superfine flour bread and butter, the grain of wheat would not be developed at all; and can a child, for which wheat was made, be developed on white bread and butter? Milk of the cow contains all the elements of the human system, and in the right proportions; and if concentrated, or if the stomach were large enough to contain these elements in their diluted state, in sufficient quantities, would support the life and health of any man indefinitely.

Primarily it was intended to develop the calf, and it does develop every part perfectly; but feed the calf on cream alone, or butter, and it would die in two weeks. Can butter, then, develop a human being? And yet how many expectant and nursing mothers thoughtlessly provide themselves and their precious little ones with food made up mainly of superfine flour, butter, and sugar, without knowing or thinking that sugar and butter have no elements at all for muscles, or bones, or brains, and white flour very little.

If they ate nothing else, of course their children would all die within a month; and as it is, only one half in all Christendom, and not one eighth in all Heathendom, have vital power to carry them through the first five years. Those that live have a life of struggle with disease and suffering in just the proportion as they are deprived of food containing elements adapted to develop the whole system, and give power to resist and overcome disease. The inevitable effects of the diet almost universally adopted is, to stimulate all the organs by the undue proportion of carbon, of which the butter, fine flour, and sugar are composed, which form so large a part of our diet, and which render all organs more susceptible to inflammations and other diseases; while the deficiency of the nitrates and phosphates, weakening the organs and diminishing the powers of life, renders them less able to resist and throw off diseases as they occur.

Take, for example, the lungs, whose duties are to keep up the steam and "run the machine,"—duties, the importance of which is seen by the fact that, if for a single moment they cease to act, every operation of the system is suspended and life becomes extinct. Overburdened with work in order to dispose of the great excess of fuel imposed upon them, the tissues are feeble for want of their appropriate food; and is it strange that they fail, and become diseased?

Or, take the brain and nervous system, which, being overheated with carboniferous blood, and weakened by want of phosphorus, become sluggish and inactive, or act fitfully, and headache and neuralgia ensue; or, being nervous and irritable, a thousand ills, real and imaginary, render life a burden.

Or, take the liver, whose office is to eliminate effete elements from the system and assist digestion. Overburdened with work, especially in the spring, after the steam has for months been kept up to the highest practicable point, it gets tired and sluggish, and the bile becomes obstructed, and jaundice and many other bilious difficulties ensue, and thus all organs are made more susceptible to disease, and less able to resist it, by too much of the carbonates and too little of the nitrates and phosphates.

While, therefore, all animals, in their natural state, living as they do according to natural laws, raise all their young, and bring them perfectly developed to full maturity, a perfectly developed young man or woman, at full maturity, with perfect teeth and sound lungs, and well developed muscles and brains, is a rare exception to the general rule; and to every reflecting mind the reason must be obvious: we neglect to learn, and utterly disregard the plain laws of our being, and these terrible sufferings and bereavements are the natural and just penalties for our disobedience.

Can any other explanation be given, why beings supported by the same elements, and subject to the same physical laws, should be found in such different physical conditions? Mothers' milk, if the mother live on proper food, is undoubtedly the best, as it is the natural food for children till teeth are formed, which indicate a maturity that requires some other food; but sickly mothers, and those who live on white bread and butter, would subserve the interests of their children by weaning them, and substituting the milk of the cow. For young children the cow furnishes milk with too much of nitrogenous matter; and the reason for this provision is obvious, as I have explained.

When other food than milk is required, that containing some nourishment for the muscles and brain should always be selected, which can readily be known by reference to the tables of analysis; but starch, and arrowroot, and sugar, and cream, all of which are sometimes given in ignorance of their character, contain no element of food but carbon, and would only tend to develop torpidity and foolishness; but, on the other hand, beefsteak and oat-meal, and such other articles of food as contain large proportions of nitrogenous and phosphatic elements, tend to develop the muscles and brain too rapidly, and render the child liable to congestion of the brain; and a special regard should be had to this consideration where the child is very active and precocious. Such children always die young, unless special care is taken of their diet and general management.

Food for Children deficient in Vital Energy and Muscular Power.

That muscular power is increased by exercise has been long known. More than seven hundred years before the Christian era the Olympic games were celebrated, consisting in throwing quoits, leaping, wrestling, boxing, &c., which were held on a certain day corresponding to the 11th of July, and lasting five days, for which the competitors prepared themselves by training in the gymnasium for ten months. For a thousand years at least these games, with a few temporary interruptions, were regularly celebrated, occupying the minds of the whole Grecian nation; and at that age the training of muscles was considered vastly more important than the training of mind. Of the diet used in this training but little is now known; but Pliny says, "the gladiators ate only barley bread, and hence they were called Hordearii,' hordeum being the Greek name for barley.

Jackson, the noted English trainer of prize-fighters, feeds his men on the lean muscle of fat beef and mutton, with coarse barley and wheat bread. It is not likely that ancient gladiators or modern prize-fighters understood either the chemical elements of the human system, or the adaptation of those articles of food to supply the requisite elements of muscular power; but it is interesting to notice that experience brought them to the same conclusions as chemical analysis.* The muscles of beef and mutton contain the same elements as human muscles, and are therefore adapted to nourish them, while unbolted wheat and barley furnish also a due proportion of flesh-making materials; and also in each of these articles are the phosphates, which give vital force, wheat containing them in proportions necessary for common exercise, and barley and the flesh of beef and mutton more than double the proportion of those of wheat.

If, then, both science and experience show that muscular power can be increased by muscle-making food, is it not reasonable that feeble children should be made stronger by application of the same principle? What duty, then, can be clearer than the duty of feeding our dormant, sleepy, and feeble children on food containing a full share of nitrates and phosphates, as lean meat, oat meal, barley cakes, beans, peas, &c., rather than the stupefying carbonates, as fat meat, fine flour, butter, sugar, or puddings and pies, cakes, &c., which are made up of these articles?

* Jockeys also reduce their weight by living on fish and lean meat with little carbonaceous food.

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How the Blood becomes Impure.

We find by chemical analysis that the blood is composed of the fourteen elements which make up the different parts of the system, and such other elements as have been taken into the system with improper food and drink, and are allowed to go into the circulation, although not wanted for the use of any organ or function, because they cannot be removed in any other way than through the lungs, or skin, or kidneys, and must go into the circulation to get out of the system. They are, of course, not permanently found in the blood, but vary in proportions and character according to the care we take in regard to our food and drink.

If we ate only natural food, and drank only pure water, and breathed only pure air, the blood would consist of the fourteen elements only which constitute the solids and juices of the human system. It is evident, therefore, that pure blood is made from pure air, pure water, and natural food, and that while nothing else is admitted into the system, the blood cannot be impure; and if the blood in any case is found to be impure, it is because the food, or drink, or air are not plentifully supplied, or are not pure or natural, and in just the proportion as they are not pure and natural, or are not supplied in sufficient quantity.

We come, then, at once to the only way in which the blood can be kept pure, or renovated when found to be impure. If the blood is impure in consequence of additions to its natural element derived from the food, or air, or water, our first duty is to see that the source of impurity is stopped, and then Nature will soon remove the impurities. If it is impure from want of supply of its natural elements, then our duty is also plain, for every necessary element is supplied in natural food, and we have only to use our judgment in selecting the articles which contain such as are needed.

How can we know what Elements are wanted to make the Blood Pure?

Just as we determine what is wanted to supply any requisition—by comparing the supply with the demand. If a merchant were required to furnish a dozen different articles of merchandise, including gloves, and should by mistake deliver only eleven articles, he would have no difficulty in determining that gloves were the item wanted, if the other articles had all been supplied. Suppose we have a daughter of sixteen, ash-colored, feeble, and undeveloped. If we look over the list of elements, and the proportions of them required to keep the system and blood in perfect condition, as shown by the table of analysis of different articles of food, and as compared with elements of the human system, we shall probably find that, instead of the necessary elements for the blood and the vital powers, she has been accustomed to food made up to a great extent of butter, superfine flour, and sugar, which contain but very little nutriment for the blood or vital powers, mixed perhaps with other articles containing the requisite elements, but out of proportion to the wants of the system. Being supplied to repletion with carbonaceous food, there was no room for other requisite principles, and the results were inevitable. Her blood is colorless and impure, and she is feeble and chlorotic, because her food was deficient in the elements which constitute good blood.

I have investigated scores, and perhaps hundreds of such cases, and invariably find the principal cause to be, that from childhood they have been fed on white bread and butter, sweet cakes, flour puddings, pie-crust, confectioneries, &c., which had kept the system in a heated, feverish condition, with a deficiency of fruits and vegetables, that assist in eliminating from the system the impurities engendered by the excess of carbon in the system, and a deficiency of coarse bread, milk, fish, lean meat, &c., which contain the phosphorus, iron, and other mineral elements necessary for the purity of the blood; and they had generally lost their appetites for the necessary articles of food, and had acquired instead a morbid desire for something strange and unnatural, as chalk, slate pencils, pungent spices, pickled limes, &c. The evils of these habits are generally increased by want of exercise to carry off accumulated impurities, and the blood becomes too poor to be able to carry on the functions of the system. The tissues of the lungs break down under the burdens imposed upon them, consumption ensues, and we lose our daughters, murmuring, perhaps, at the mysterious providence by which we are so afflicted.

How to Purify the Blood.

We have seen that impurity of the blood consists of excess of some elements and deficiency of others, and that by comparing the list of elements required with the list habitually supplied, we can ascertain what elements are wanting and what are in excess; and having an analysis of all the articles of food in common use, which contain all the elements of the human system in different proportions, we have but to use our common sense in selecting such as will supply the deficient elements, or avoid the excessive.

The intelligent farmer finds that some of his land will not produce wheat; and by analysis he will be sure to find that the elements of wheat are wanting, or are excessive. If wanting, he supplies them in such manure as is known to contain them, and is sure of a crop of wheat; or, if excessive, he plants the ground with other crops that need the excessive elements, and after they are thus removed he can get a crop of wheat.

What should we think of the farmer whose land needed phosphorus, and nothing else, for a crop of wheat, who should follow the advice of his neighbors, as ignorant as himself, and use lime, and ashes, and salt, and a dozen other things that contained no phosphorus, because somebody else had used some of these articles on land perhaps entirely different, and had found them useful. No article in the world could do good unless it contained phosphorus, but might do harm if it contained elements already sufficiently supplied, and perhaps already in excess. But this is the method almost universally adopted by mothers, in order to purify the blood of their children. That mother is indeed a rare exception, who does not, when her daughter is pale, and she fears impurities of the blood, or perhaps to prevent such an evil, resort to something which somebody says is good for the blood, for she has tried it, without stopping to consider the absurdity of the experiment, or whether it may not, as it must, do harm by troubling the stomach with elements never intended for the human system, and therefore necessarily injurious.

In this way are annually expended millions of dollars in Purification, or Plantation Bitters, "Important Medical Discoveries, that cure all humors but the Thunder Humor,' Oxygenated Gas, Compound Sarsaparilla, and the thousand and one other advertised sovereign remedies, not one of which contains a single element of the blood, or can by any possibility do good, and all must, from their want of adaptation to the plain requirements of the system, if not from their poisonous character, do more or less harm; and that they cannot as medicines do good, can be shown by principles as simple. But this subject will be considered elsewhere.

All Elements of Food must have been organized in some Vegetable, or they are rejected.

Not only is it impossible to purify the blood by the use of articles recommended by ignorant empirics, as we have endeavored to show, and useless to attempt any purification except by the common-sense expedient of supplying deficient elements, and removing or withholding redundant ones, statements, the truth of which will be understood and appreciated by all, learned or unlearned; but it is also true, as I shall endeavor to prove, that no element, however much it may be wanted in the system, can be made to become a constituent of the blood, or be appropriated by any of the tissues, unless that element has been organized in some plant, and is thus fitted to be received according to the law of nature.

I make this proposition with diffidence, because it has not been considered by our scientific physicians; and every day, chlorotic girls and other patients are furnished with disorganized iron, and other elements from the shops, with the expectation that they will supply the deficiency of the elements which are supposed to be wanted to restore the blood to its normal condition; and one learned professor, as I have before stated, is endeavoring to supply the posphorus, which had been taken out of the wheat, where it was organized and prepared to supply the system with that important element, by adding to the flour salts made from disorganized phosphoric acid.

I have elsewhere referred to the great plan of nature, by which all the elements necessary to be used in making or repairing the system were deposited in the soil before man was made, to be taken up in the sap of plants, and vegetables, and fruit trees, and deposited in the seed, and fruits, and juices of these trees and plants, in just the proportions necessary to supply every organ and function; then to be eaten, and digested, and made a constituent of the blood, and appropriated by the organs and tissues; then to be cast off by the excretions, and again deposited in the soil, to be again taken up by vegetation, and continue their rounds perpetually.

Now this is undoubtedly the best arrangement for supplying the human system with all necessary elements that even God could make — an arrangement, to short-sighted man, wonderful and incomprehensible; and is it for us, who have not intellect sufficient to understand one of the processes by which this plan is executed, to say that any part of it is unnecessary? — that iron and phosphorus, prepared from crude, unorganized materials, in the laboratory of any chemist, are just as well adapted to supply the wants of the human system, as these elements prepared in Nature's own laboratory? Why not, then, take carbon and nitrogen, or the other elements, directly from the ground, and repair the whole system, or make a new man, by a shorter and cheaper process?

The Penalty for taking into the Stomach Elements of Food not organized.

After such infinite pains to perfect a plan for supplying the human system with every necessary element, it seems to me reasonable, and perfectly consonant with Nature's other laws, that an ordinance should be instituted requiring that no elements should be admitted into the system except in accordance with this arrangement, and that every attempt to introduce them should be visited by punishment, more or less severe, according to the importance of the element; and this we find to be true.

Not an element is allowed to be incorporated into, and become a part of the blood, or any organ or tissue, that is not fitted for digestion in some vegetable; and if any element is offered that is not thus prepared, a rebellion ensues, more or less energetic and severe, according to the importance of the element. This rebellion, or excitement, is injurious to the system, and all the organs and functions involved; and this is what is meant by the word *poison*, and constitutes the penalty.

Phosphorus, for example, is a very important element, being the element on which the action of the brain depends, and the physical source of vitality, and an important constituent, as well, of bones and other solid tissues. In a common-sized man there are found to be nearly two pounds of solid phosphorus, doing its important work quietly and harmlessly; but take two grains of the two pounds which have been disorganized as can easily be done by calcining a bone, and attempt to put them back and reorganize them, by giving them at once to a healthy man, and such an excitement is produced, especially of the brain, that delirium, inflammation, and death might ensue within a single hour; but give ten times that amount, organized in oat-meal or barley cake, or any other natural food containing it, and the system will quietly and gratefully appropriate what it needs, and reject the remainder without excitement or harm.

And can we resist or gainsay the evidence thus furnished, that oat-meal and barley cakes, and unbolted wheat flour, are the appropriate means of introducing phosphorus into the system, rather than phosphatic bread, the phosphorus in which was taken from calcined bones?

The Penalty of taking Disorganized Iron.

Iron is a necessary, but less important, element of the human system than phosphorus. It is found in the bran of wheat and other grains, and vegetables, and, being transferred from them, is found also in the muscles and blood of animals, and in the curd of milk, and other natural food, in quantities as large as can be appropriated by the system; and this is proof to my mind that Nature intended it to be furnished through these articles of natural food.

Being less important than phosphorus, the penalties for attempting to introduce it in any other way are less severe and less manifest, but are still sufficiently apparent to corroborate my position.

Dr. J. Francis Churchill, a French author, who has given great attention to the effects of different mineral elements on the human system, in an article headed "Danger of Iron in Consumption and Chlorosis," says, that M. Trousseau, another very celebrated French physician, whose authority in this country to-day is as high as that of any man living, has carefully investigated the effects of iron, and from a synopsis of a report of these investigations he makes the following quotations: "M. Trousseau has just given utterance to an authoritative and positive statement, which will, no doubt, surprise the profession everywhere. He declares that iron in any form, given in chlorotic affections, to patients in whom the consumptive diathesis exists, invariably fixes the diathesis, *and hastens the development of the tubercles*. The iron may induce a factitious return to health; the physician may flatter himself that he has corrected the chlorotic condition of his patient; but to his surprise, he will find the patient soon after fall into a phthisical state, *from which there is no return*. This result, or at least its hastening, M. Trousseau attributes to the iron. The assertion is a most startling one. M. Trousseau is nevertheless so certain of what he says, that he denounces the administration of iron in chlorosis as *criminal in the highest degree*." (The Italics are as in the quotation.)* This opinion is confirmed by my own observation in a practice of forty years, and furnishes proof sufficient that iron as well as phosphorus must be introduced into the system only as organized for digestion in some plant, or a penalty must be paid. The excitement that follows the taking of iron is less active and less dangerous than after taking phosphorus, because it is less important to the system to reject it immediately; but it illustrates the arrangement of Providence, and establishes the same principle.

Can phosphorus, iron, oxygen, hydrogen, nitrogen, carbon, or any other of the fourteen elements which constitute the human system, be made to form a constituent of the blood, or any organ or tissue, unless introduced as they are organized for that purpose, in the atmosphere and water, and in vegetable and animal food, before they have become fermented or decomposed?

To comprehend the importance of this question, let us first glance at the various methods in which important elements are forced upon the human system, with the expectation that they will be received and appropriated as if they were introduced in accordance with natural laws, keeping in mind what I have endeavored to prove in the preceding chapters, that all elements offered are either kindly received and appropriated, or are rejected as poisonous.

Thousands of invalids, feeble children, and especially feeble girls, are taking every day some preparation of

* Since making this quotation M. Trousseau has deceased.

iron, with the expectation that it will supply the supposed deficiency of that element, and thus give them health and strength.

Phosphorus, also, is introduced in superfine flour bread, with the understanding that it can be made to take the place of that element, which had been bolted out; and it is also used to supply the supposed deficiency of that element in consumption and other diseases. Oxygen, likewise, in the form of gas, is taken to purify the blood and give vigor to the system.

Carbon and hydrogen are taken in the form of alcohol, with the expectation that they furnish natural heat to the system.

These ideas seem to have come from Liebig, a very learned German chemist, who gave to the world much valuable information on the subject of the chemistry of food, and whose ideas for the last twenty years have been very generally adopted, but who ignored the vital law as controlling chemical laws, and classed alcohol with sugar and other carbonaceous food, because it contains the same elements, and who offered the analytical table of alcohol and sugar which I have copied in another chapter, as proof that alcohol must be nutritive because sugar was nutritive, notwithstanding the fact that the taste and smell, and perceptible effects of the two articles, were no more alike than any other two articles containing different elements. The same argument is still used by eminent chemists, which may be condensed from an argument already quoted, as follows: Phosphorus, taken from bones without decomposition, is wholesome, as proved by experiment; therefore phosphatic bread, although containing phosphates chemically decomposed, cannot be unwholesome.

Arguments relied on to sustain the Use of Disorganized Elements, and to prove that such Elements may be and are incorporated into the Blood and Tissues.

Practically, as has been said, it is generally conceded that elements wanted by the human system can be supplied, and will be received, whether they have been prepared in any vegetable organization or not; but when the question is put directly to our chemists and scientific physicians, as it lately was before the committee of the Legislature on licensing the sale of alcohol, "Is alcohol, or any other disorganized element, actually appropriated by the organs or tissues as food, and incorporated into them as nutrition?" the answer is, "That question is not settled;" very few being ready to make the assertion that it is.

And the reason is obvious. There is no proof that a single element ever was made to enter into the blood, or any organ or tissue, as a part of their constituents, unless it was taken with, and formed a part of, some food organized directly or indirectly by passing through some vegetable. I find but one author who claims to bring such proof, and this proof I think can be clearly shown to be fallacious.

Frederick William Headland, of the Royal College

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of Physicians in London, has written a book on the action of medicines, which has recently been published in this country, and which is adopted as a standard work. It goes more thoroughly into the subject than any other author.

He places alcohol as a stimulant and narcotic, without the pretence that it can be appropriated by the system, to make any part of its tissues or fat, or even be used as fuel to produce animal heat; but in proof that iron from the shops does enter into the blood as a part of it, he says, "In some cases of chlorosis the blood was analyzed before giving iron and after it had been given for a few weeks, and the blood was found to contain more of red globules after taking the iron than before." And this is accepted as proof positive that the red globules, or at least the color of the globules, were produced by the iron thus introduced.

But scores of cases can be brought, where, under a different treatment, the results were the same, and even more striking, without using a particle of iron; and my explanation is, that the effect of the iron was that of a mere stimulant, promoting sanguification, from food taken in the mean time containing iron. Of abundance of testimony on that point, I will bring only one witness.

Dr. Churchill, whom I have already quoted as condemning iron on account of its tendency to develop tubercles, says, in his book on "Pulmonary Phthisis and Tubercular Diseases," that phosphoric acid and its preparations "are the most valuable blood-creating agents known, as is shown by the fact that more rapidly than any other medicine it increases the quantity and color of the blood;" and he gives cases to prove it quite as remarkable as those referred to by Dr. Headland, and thus the proof that iron produces the red globules directly is entirely neutralized.

Now let us bring into one view the different parts of that wonderful, and to us incomprehensible arrangement, made "in the beginning," when "God created the heavens and earth," by which all the solid elements that man should ever require should be placed where, by laws ordained for that purpose, they should be pulverized, and mixed, and scattered, and deposited, and after countless ages be fitted to supply all his physical wants. And then "the Lord God formed man of the dust of the ground," and instituted laws by which the elements of which he was made, and which would ever afterwards be needed for his repair and reconstruction, should be taken up in the sap of herbs, and grasses, and fruit trees, and deposited in seeds, and juices, and grains, and fruits, or in the flesh of animals, and birds, and fishes, in such abundance and profusion over the face of the earth, that anywhere, and in all circumstances, to the end of time, these elements should be ready at his hand, requiring only the use of his intellect and physical faculties to procure them and fit them for his digestive organs.

With this arrangement, so perfectly adapted to all the exigencies of human life, so clearly revealed as the plan of Infinite Wisdom, is it reasonable that we short-sighted beings should presume to say that any part of it is unnecessary or unimportant, and that elements not prepared in accordance with it are just as good, and this on no other ground than that they have the same chemical character as organized preparations of the same elements? — while the evidence before us is abundant that the same elements, with the same chemical combinations, are wholesome food or virulent poisons as they are or are not organized according to this wonderful plan? Beefsteak and nitric acid both owe their distinctive characteristics to nitrogen; but one is wholesome nourishment, the other a virulent poison. Sugar and alcohol contain not only the same elements, but very nearly the same chemical combinations; but they neither taste alike, or smell alike, or, if taken into the stomach, produce any effects on the system in common. In short, one is good carbonaceous food, the other is a poison.

What folly, then, to attempt to decide on the influence of any substance by its chemical combination! Chemical must always obey vital law, as lower law the higher.

Note to Fifth Edition, March 12, 1869. — In a recent lecture before the American Institute, Professor Horsford offered the following extraordinary indorsement of his claims by Baron Liebig: "It is certain that the nutritive value of flour will be increased ten per cent. by your phosphatic bread preparation, and the result is precisely the same as if the fertility of our wheat fields had been increased by that amount!" There is no claim that phosphatic yeast powder adds any element of nutrition but phosphorus, and the average amount of all the phosphorus in unbolted wheat meal is less than two per cent. Eight per cent. therefore of the Professor's improvement is an improvement on natural wheat. It is easy to prove that not a particle of nutriment is added by this or any other chemical process; but if it were, what would be gained? Why be at such pains to get out the phosphorus, and then at such pains to get it back again? Why not take wheat as God made it?

WATER.

We have seen that mineralogy, geology, and natural history all corroborate that incomprehensible statement of the word of God, that man was made from the "dust of the ground;" and I have endeavored to delineate also the great law of nature by which the solid elements of the human system are constantly supplied; and we have seen that less than one quarter of the weight of the system is composed of solid matter, more than three quarters being water.

We come now to consider the arrangement, equally wonderful, and above human comprehension, by which water, without which life could not have been begun or continued for a single day, should, with unfailing certainty, always be supplied. And here we shall also find in the book of nature the same interesting and complete corroboration of the word of God.

Away back in the ages of eternity, farther than the imagination of the human mind can reach, — "in the beginning, God created the heavens and the earth," the sun, moon, and stars, and every element of matter contained in them; but for ages the condition of things was such that all we could understand, and therefore all that is revealed, is, that the "earth was without form and void."

The first intimation we have of the particulars of its construction, is made concerning water, in this statement: "And the Spirit of God moved upon the face of the waters." And this is all we know, or could be made to understand, and therefore is all the explanation given till the first day, or period, when "God said, Let there be light, and there was light.' This, too, being incomprehensible to the human mind, unenlightened by scientific developments, is not explained.

In the description of the second day, or period, we begin to get a glimpse of the condition of things. "And God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament." "In the beginning,' the earth was made of molten rocks: this is clearly understood by the condition in which we find it; and of course the water existed only in a state of vapor, or in gaseous elements. To "divide the waters from under the firmament from the waters above the firmament," was, therefore, to cool the outside and form a crust of the earth, so that the vapor could be condensed into water, and thus be separated from the vapors in the regions above the earth. The second day, or period, seems, therefore, to have been devoted to a preparation of the supply of water for man, who was not to be created till the sixth day, or period, when all necessary preparations for him should be completed.

The third period seems to have been devoted to the same work of perfecting an arrangement for the supply of water. And God said, Let the waters under the heaven be gathered together in one place, and let the dry land appear." How this was accomplished can now be read much more clearly in the "book of nature" than in the written word.

The internal fires of the earth, pent up as they were by the solid crust that enclosed them, began, in their efforts to escape, to throw up the surface of the earth into ridges, and hills, and mountains, and of course the waters retired from these ridges, and hills, and mountains, and they became dry land; and one third of the earth being thus raised, the other two thirds were of course depressed, and there the waters gathered into oceans, and seas, and lakes: and thus was completed the third period of preparation for supplying man with water.

That the mountains were once raised from level layers, or strata, which had previously for ages been covered with water, there is not in the mind of any reflecting man, who knows the facts, a shadow of doubt. Look into any cave, or excavation, or mine, in any mountain on the face of the earth, and we can see that the strata of different materials, such as coal, slate, &c., which must have been formed under water, and of course on a level, have been pushed up from a level to the position in which they are now seen, by some power from beneath, as if the wet leaves of a pamphlet had been pushed up into an inverted cup, and there left to dry. Finding such a semi-globular mass of printed matter afterwards, and separating these leaves, it could be seen that they once were on a level, and that in that position the words must have been imprinted on them. In a similar manner can be seen, in the leaves or strata of sandstone, evidence, in the position of the strata, and in the shells and other materials imbedded in them, evidence unmistakable that these strata were for ages under water, and of course on a level, and had been pushed up to their present position, and there left to dry and consolidate.

Thus was so far accomplished the work of supplying water for man, that some vegetation could grow; and before the close of the third period we find "the herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself after his kind.' But the earth was not yet ready for man, for mists and clouds in the heavens had not yet dispersed, so that the sun had ever shone, or even penetrated but imperfectly the darkness that shrouded the earth, "for the Lord God had not caused it to rain on the earth, but there went up a mist from the earth, and watered the whole face of the ground."

But the fourth period of creation seems to have been devoted to clearing off the mists from the face of the earth, so that the rays of the sun could penetrate through them, and divide the day from the night; and then for the first time appeared the sun and the moon in the revelating vision to Moses, as if they had just been created and set there, "the greater light to rule the day, and the lesser light to rule the night;" and as if then "He made the stars also,' their light having never before reached the earth. Then came the fifth period, when the sun, having cleared off the mists and clouds from the earth, a system of distillation could be commenced from the surface of the ocean and the earth, and pure water be taken up to be condensed, and fall in dews and rains, and be collected into rivulets, and streams, and rivers, and the great system be inaugurated which to the end of time shall circulate the waters from the ocean to the air and from the air to the ocean, supplying men, and animals, and the minutest insect, without cessation, with this necessary element.

Then, and not till then, was the earth prepared for animals, whose life depends on a constant supply of water for the circulation of the food, for perspiration, and the necessary secretions; and not till then were created "every living creature that moveth," "and every winged fowl after his kind," that could in any way contribute to the support or comfort of man. And then, everything being made ready, God said, using for the first time the plural pronoun, as if the councils of heaven were called for the crowning work of creation, "Let us make man in our image, after our likeness; and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth on the earth."

Let us now review the history of this preparation for the advent of man, and notice the perfect harmony between the revelation to us through Moses, twenty-five hundred years after the work was finished, and the revelation to us in the mountains, and rocks, and rivers, and the chemical character of the elements that compose them.

This harmony is the more striking when we consider that Moses knew but little of astronomy, mineralogy, geology, or chemistry, as is evident from his descriptions, in all of which he gives us not the actual condition of things, or the actual development of events, but only a description of things and events as they appeared to him, or as by a kind of panoramic vision they were revealed, to be described in his own words.

Thus, in his description of the sun, moon, and stars, as they appeared when the mists had cleared off so as to reveal them, as if they were then created, he says, "And God made two great lights, the greater to rule the day, and the lesser to rule the night;" "and he made the stars also." "And God set them in the firmament of the heavens to give light upon the earth." This was on the fourth day, but on the second day, he says, "God said, Let there be light;" and this was when "God moved upon the face of the waters," and the mists were so far condensed that light from the sun began to shine through them. It is evident, therefore, that Moses wrote in his own language a description of appearances, as revealed by a kind of panorama, as suggested by Hugh Miller in "The Testimony of the Rocks."

First, he saw the earth, so enshrouded in mists that not a ray of light could penetrate to its surface, and it appeared "without form and void;" then, next, as it appeared when the mists were partly condensed into water, so as to let in a little light; then, as the mountains and hills were raised, and the waters settled into seas and oceans; and finally, when the arrangement was fully perfected, so that every blade of grass, and every little insect should be sure of a supply of water, and the earth was fully prepared for the advent of man, for whom all this preparation was made. Now, astronomy, geology, and chemistry all demonstrate that all that was thus revealed to the vision of Moses, and all he describes as appearances, were in perfect accordance with, though not a revelation of, scientific truth. The earth must have been enshrouded in darkness, for water cannot exist at a temperature above 212°; and of course a temperature sufficiently high to melt the rocks must have driven all the water into vapor around the earth. Now, if the little fog which gathers over a city, as it sometimes does over the city of London, can so obstruct the light as to leave the inhabitants groping in darkness, what must have been the darkness when the whole ocean was in vapor around the earth?

And as the surface of the earth cooled, and the vapor condensed, after a while the light of the sun must have begun to shine through, according to the description of the first day, and there would be a manifest division between the water and the fog, described as the firmament dividing the waters below from the waters above, which constituted the work of the second day. And when the hills and the mountains were raised, as geology teaches they were raised, to form the dry land of every continent, then the waters must necessarily have been "gathered together in one place.' The sun must have been in the heavens when "darkness was upon the face of the earth,' but it could not "divide the day from the night,' and "be for signs and for seasons, and for days and for years,' till the mists should have been dispersed so that its light should shine on the earth. And then, to complete the harmony of the testimony of Moses and the testimony of nature, in the chemical composition of plants and animals, we find a description of the earth as being covered with vegetation, and the animals as being created, which was to finish the preparation of the earth for man, just when the arrangement was completed by which vegetation and animals could be perpetually supplied with water. If, then, we take the view of Dr. Kurtz, that the narrative of Moses was "simply prophecy described backwards,' and of Chalmers, Pye Smith, and Hugh Miller, and other Christian philosophers, "that the Mosaic account of creation can only be regarded as a record of appearances," we find in the record of Moses respecting the formation of water, and the arrangements for its perpetual supply, and in the records of geology and chemistry, the most perfect harmony and consistency. That this view is true, not only of the revelations of Moses but of all Old Testament revelations, is now almost universally admitted by all Christian philosophers; and, being admitted, there is no longer among them the least anxiety lest the truth of the Bible should be overturned or weakened. But until this was understood, there was a constant jealousy lest some astronomer or geologist should discover some discrepancy between the written word of God and the book of nature. Thus, when Galileo announced the discovery through his telescope that the earth revolved around the sun, the Christian philosophers of his day, with that strange perversion of intellect by prejudices which always characterized the human mind, demanded as security for their precious Bible that he should retract his opinion, and let the sun go on its revolutions around the earth, and even demanded that he should do so on pain of death. Not one of them dared to look into the telescope, lest they might be convinced of the revolution of the earth; for if the earth did revolve, then Joshua's testimony was not true. Joshua said, when "the sun stood still in the midst of the heavens, and did not go down about a whole day," "there was no day like that before it or after it." Galileo said the sun had always stood still, and the revolution of the earth divided the day from the night; and so determined were these philosophers to preserve the Bible from harm, and so darkened were the minds of these the best men of the age, that they deliberately concluded to take his life as a choice of evils, — the life of one man, even one of the best of men, being considered of little value compared with the value of the precious word of God. But now that it is understood that Joshua only described a miraculous event, as it appeared to him, there is no difficulty on that point in the mind of any intelligent Christian, whether philosopher or not.

In our day, also, we have seen the jealousy awakened among intelligent Christian men, and even philosophers, upon the statement being made that the earth, according to its geological construction, could not have been formed in a single week. All Christendom was thrown into alarm and excitement again, lest the Bible might be discredited, and many an anathema was heaped on the names of good men who dared to interpret the Bible by the revelations of Nature. I remember, as if it were but yesterday, though now forty-five years since, the day and the room in which I began to read the then recently published "Book of Nature," by J. Mason Good, in which the idea first struck my mind that the six days of creation, as recorded by Moses, really meant six periods, or ages, of indefinite and inconceivable length. The idea did literally *strike* my mind with such force as to produce an effect almost stunning; and for that day I read not another word in the book, but gave up my mind to the strange reveries which it excited. I trembled lest the Bible should fall under such a plausible statement of geological revelation; but, looking into the subject, I found that the record of Moses and Joshua must be understood as a record of appearances; and since then I have felt no apprehensions for the revelations of the Bible, and no difficulty in reconciling them with the revelations of geology or chemistry.

Uses of Water in the Human System.

By the table of analysis of the human body, we see that three fourths of its weight consists in water. Without water no vital process could be carried on for a single moment. The blood must be liquid or it could not circulate, and not circulating, no elements could be supplied, and none could be removed; and then oxygen and hydrogen are very important elements in the composition of the organs as well as the blood. And thus water occupies a position in the economy of the system which fully explains the importance which seems to be attached to it in nature, rendering it necessary to institute that complicated arrangement for its production, circulation, and minute distribution over the face of the earth which we have been considering.

But one of the most important, and to me the most interesting purposes subserved by water, is that chemico-vital process by which the temperature of the body is regulated so as, under all circumstances and external temperatures to which it can be exposed, internally to remain of the same temperature. That certainly is an admirable adjustment of vital and chemical principles, which, without regard to external clothing, or external temperature, or the kind of food taken, or the amount of exercise used, shall keep the internal temperature at 98°, so that in the same individual, under all ordinary circumstances in health, it will not vary from that point more than one or two degrees, in summer or winter, at rest or in violent exercise.

In a series of experiments on one hundred and fourteen individuals, of both sexes, of different ages, among various races, in different latitudes, and under various temperatures, Dr. J. Davy found that a thermometer placed under the tongue indicated a temperature varying only from 96.5 to 102—only $5\frac{1}{2}^{\circ}$; and the extremes of these cases were found very rarely, and always in individuals of great peculiarities of constitution.

The process by which this adjustment of temperature is made, as I have said, is partly vital and partly chemical. That part which is vital I will not attempt to explain; but the chemical process is in accordance with a law instituted "in the beginning," and instituted especially for this very purpose (if we believe that the earth was made for man, and all the laws which govern it). This law is easily understood, and is worthy of particular consideration.

If a solid is changed into a liquid, or a liquid into a gas, heat is required, which is taken from surrounding objects to supply it. If you place a pot of cream within a vessel, in which it will be surrounded by ice and salt, both of which being solid, the action of the salt on the ice changes it into water, which, requiring more heat, takes it from the cream, which is the nearest object, and freezes it into ice-cream.

If you allow moist clothing to remain touching the surface of the body, the moisture, by the heat of the body, or by the atmosphere, is changed into vapor, and produces a dangerous sensation of cold. I have often amused the class to whom I was lecturing by an application of this law, in freezing water in a warm lecture-room. Take two watch crystals, and put in one a little water, and in the other a little ether, which being light, boils at the temperature of the atmosphere when the pressure is taken off. Put these together, under an air-pump, and take off the pressure: the ether will boil, and give off vapor, which, abstracting the heat from the water, causes it to freeze; so that in the same temperature we have the processes of boiling and freezing at the same time.

This principle is used in warm climates in cooling water and other drink. A porous jug, called a *monkey*, or a bottle with a wet cloth around it, is always seen hanging in the window where the breeze is drawing through, and the evaporation from the surface of the jug or bottle abstracts the heat from the water within; and I have drank it as cool as was desirable, with the sun directly overhead.

We have seen also the operation of this principle in heating and boiling water. Apply heat to water, and its temperature increases till it comes up to 212°; then a violent agitation commences, and steam is evolved more or less rapidly in proportion to the heat applied; and this evolution keeps the water at the same temperature, so that no amount of heat in the open air can raise the temperature above 212°.

And this is the principle which regulates the temperature of the human system, and keeps it at 98°, regulated by the operation of a vital law which we do not understand, and the evaporation of water, as before described, so as to keep the internal parts of the body at 98°, while water, under the regulation of physical law alone, is kept, when boiling, at 212°.

By this law all animals can, to some extent, adjust themselves to different temperatures; but each species, being intended to occupy only a limited range of heat and cold, each being limited to a few degrees of latitude, have not the necessity for that power to a very great extent. But man, who is destined to have dominion over all animals in all latitudes, must have power to adapt himself to a great range of temperature. In many parts of the tropical zone, the thermometer rises every day, through a large portion of the year, to 110°, and in British India it is occasionally recorded at 130°; while the arctic voyagers frequently record it as low as 55° below, and Captain Franklin at 58°, and one record by Captain Back is made as low as 70°; making a range of temperature in which men live from 130° above to 70° below — two hundred degrees.

Workmen in furnaces are accustomed, in some places, to enter a room where the floor is red hot, and the temperature of the air stands at 350°; and the "Fire King" Chabert was in the habit of entering an oven, at a temperature of from 400° to 600°; and it is not an uncommon feat to take beefsteak into an oven and wait for it to be cooked; indeed, the temperature which Chabert was accustomed to endure would crisp a steak to charcoal.

This almost miraculous power of resisting the effects of heat is evidently not purely chemical, as is shown by the different effects of the same temperature on the living and dead muscle; but that chemical law comes into play in this power to sustain extraordinary heat, is shown by the fact that the evaporation of water on the surface of the body is in proportion to the degree of heat to which it is exposed, and of course the heat is evolved from the body according to chemical laws. It is, therefore, a power partly chemical and partly vital, — great changes can therefore be endured with impunity only by persons with good vital powers and in good health. Young children suffer greatly by changes of temperature, and many an infant is killed by treatment which would be safe at maturity, the nurses or mothers exposing them to the influence of cold air or cold water, not knowing their want of power to resist the cold, or perhaps having the idea that exposure will render them tough.

Old people also suffer from exposure to changes, and statistics show that from the age of eighty and upwards more than twice as many die in January and February as in July and August; indeed, the mortality of all ages is greater in winter than in summer.

M. Quetelet gives, as the results of a large number of statistical observations in Brussels, the following table of the mean monthly mortality at different ages, reckoning the average of the whole year at one hundred per month: —

Mean Monthly Mortality in Brussels.

	First Month.	2 to 3 Years.	8 to 12 Years.	25 to 30 Years.	50 to 60 Years.	90 Years and above
January,	139	122	108	105	130	158
February,	128	113	106	104	122	148
March,	121	130	127	111	111	125
April,	102	127	134	106	102	96
May,	93	112	121	102	93	84
June,	83	94	99	102	85	75
July,	78	82	88	91	77	64
August,	79	73	82	96	85	66
September,	86	76	81	95	89	76
October,	91	78	76	93	90	74
November,	93	91	80	97	100	103
December,	109	101	96	97	115	129

This difference in the rate of mortality in summer and winter physiologists have generally supposed to depend on the changes of temperature and the want of power to resist them, especially in infants and old people, and to a great extent this explanation is undoubtedly correct; but experiments to which I have elsewhere referred, made in the Foundling Hospital and in the Zoölogical Garden of London, thirty-five years ago, by which the length of life of infants and monkeys were increased one hundred per cent. in two years, by a new system of ventilation, would seem to indicate another reason for the difference of mortality in infants and old people in summer and winter. Probably in Brussels, where the winters are long and cold, as a matter of economy in heat the houses are not well ventilated, and infants and old people, not being able to go out, are exposed constantly to impure air, which would help to account for the facts presented in M. Quetelet's bill of mortality. In July and August old men and infants breathe pure out-of-door air; in January and February that luxury perhaps cannot be afforded.

There is, however, no doubt that the power of generating heat and of resisting cold is very different at different ages; and this depends entirely on the degree of activity. The young Guinea pig, which can run about and pick up food for itself as soon as it is born, is no longer dependent on its mother for heat, or the power of resisting the effects of cold; but young dogs, cats, and rabbits, which are born blind, do not for some weeks acquire the power of resisting the effects of cold, and would die but for the warmth imparted by the mother. The infant is the most helpless of all animals, and is longest in arriving at maturity sufficient to resist the cold air, and it cannot be too carefully protected, unless in our care to protect it from cold we deprive it of pure air, which is quite as essential as a regular temperature.

Demand for Water in the Human System.

Besides the great demand for water, especially in warm weather, for the purpose of evolving heat, as I have described, it is wanted in large quantities to supply the excretions, and thus carry off effete matter from the system. Three quarters of the system is water; and if the waste of water were no more rapid than that of the solids, we should require half a gallon in a day, the waste of solids being reckoned at nearly two pounds, but the waste of water in warm weather and in active exercise is many times greater than the waste of the solids.

The amount of water excreted by the kidneys varies, being to some extent in the inverse proportion to the excretions from the skin. In summer it is less than in winter; the quantity, therefore, excreted in twenty-four hours cannot be exactly ascertained. It is estimated at about thirty ounces in summer, and forty ounces in winter, for a person who only drinks what nature requires; but many persons drink, from mere habit, twice as much as is needed, which must of course pass off in excretions. From the skin is excreted, in ordinary circumstances, from one pound and three fourths to five pounds in twenty-four hours, and in extraordinary circumstances, as in the case of glass-blowers, furnace workmen, &c., it has amounted to sixteen or twenty pounds. More than half as much as the ordinary excretions from the skin is also excreted from the lungs, besides an indefinite and very variable amount from the bowels. We require, therefore, from four to twelve pounds of water daily to keep all the organs and functions in healthy working order.

Importance of Using Pure Water.

Water, to perform perfectly the duties assigned it in the human economy, must be perfectly pure; nothing but oxygen and hydrogen combined can pass through the system to accomplish the various purposes which I have described, and every element combined with them in water must be disposed of by the excretories, and must be a source of embarrassment and disease to the delicate organs whose duty it is to expel all intruding elements from the system. Our study, therefore, should be to get water as pure as possible. Nature has provided, in two ways, never-failing sources of supply of pure water, — in the juices of all natural food, animal or vegetable, and in the condensation of vapor in the atmosphere. By comparing the analysis of the human body with that of different articles of food, we shall be interested to find on an average as much water in the different articles in their natural state as in the system, and that to compensate for the increased expenditure of water in summer, the amount of water in the fruits and vegetables intended for summer food is vastly greater than is found in the grains and fat meats that are intended for winter. The average amount of water in fruits, and vegetables, and berries, is more than ninety per cent., while seal oil, of which an Esquimaux will eat a gallon in a day, contains no water at all. This interesting provision of nature will be impressed on our minds by bringing together the different articles of food, with the amount of water in each, as in the following table, from analyses already given: —

Quantities of Water in One Hundred Pounds of Vegetable Food.

	Pounds.		Pounds.
Indian meal,	14	Potatoes,	75
Rye,	13	Carrots,	86
Peas,	14	Turnips,	87
Rice,	13	Parsnips,	79
Beans,	14	Mangel-wurzel,	85
Lentils,	14	Cabbage,	92
Buckwheat,	14	Apricot,	75
Barley,	14	Green Gage,	71
Oatmeal,	13	Peach,	80
Oyster,	87	Cherries,	75
Egg,	67	Gooseberries,	81
Milk,	87	Cucumber,	97
Beef without fat,	74	Apples,	84
Veal, "	75	Pears,	84
Mutton, "	71	Butter,	None.
Pork, "	76	Lard,	"
Chicken, "	73	Almond oil,	"
Codfish,	79	Olive oil,	"
Haddock,	82	Mutton suet,	"
		Fat of all meats,	"

From the above table it will be seen that five sixths of the food usually eaten consists of water; and therefore, using an average amount of vegetable food, we get more water than the natural proportion of that element in the human system. And if our liquid excretions were no greater in proportion than the solid, we should need no drink. Noticing this fact, some of our ultra dietetic reformers have inferred that the intention of Nature was that water should be supplied through food alone; and Alcott succeeded in abstaining entirely for a whole year from all kinds of liquids except such as were furnished in natural food, as milk, vegetables, fruits, &c.; but I often thought, when seeing him moping about the streets, looking like a walking mummy, that his personal appearance did not very highly recommend his principles. He said, however, that he did not experience the sensation of thirst more than two or three times, and that after copious perspiration from working in hot weather. His food was entirely vegetable, and he ate six pounds in a day, which would give him five pounds of fluid daily, — an amount, it would seem, abundantly sufficient for such a desiccated specimen of humanity. — He needed more nutriment rather than more water, his gastronomic capacity not being sufficient to contain, in such food, the requisite amount of nutrition.

But that Nature intended partially to supply water to the system through the medium of food, is evident from the fact to which I have before alluded, that food produced in warm climates, and intended for warm weather, when water is most needed to supply the excretions, contains a much larger proportion of water than food intended for cold climates and cold weather. This is seen in the above table, the green vegetables and fruits showing from eighty to ninety-seven per cent. of water, while the fat of all animals contains none. Still, there are very few animals, whatever their food may be, who do not drink water. Mice, quails, parrots, and a few other birds and quadrupeds, are said to drink no water; but cattle, which live on grass alone, containing more than ninety per cent. of water, still require drink, and perish without it; which to me is proof positive that food was not intended to supply all the water needed in the system.

It is, however, best to use as far as practicable food containing water, especially in places where pure water cannot be obtained, as water combined in natural food is absolutely pure, and perceptibly different from the purest water obtained outside of this natural organization. This, in regard to milk, has been proved by experiment. Carefully add to a dish of pure fresh milk a few drops of pure Cochituate water, and almost immediately, under a microscope, can be seen commencing a change which will result in decomposition. Place a dish of pure milk, containing eighty-seven per cent. of water, as it came from the cow, where it will keep sweet twenty-four hours, and place beside it another dish of the same milk, adding only one per cent. of pure water of the same temperature, and the milk last named will be changed in less than twelve hours. When our milkmen, therefore, dilute their milk, they not only defraud by selling water for milk, but they actually adulterate it in the true sense of that term. From this fact housekeepers and milkmen may get an important hint. It is not only necessary, in order to keep milk from changing, to have the dish or can containing it well scalded and sweet, but also perfectly dry, a single drop of pure water being sufficient to start the process of fermentation, or change, and the more impure the water the greater will be its influence.

No water can be obtained perfectly pure, as even that which comes directly from the clouds contains slight traces of mineral, animal, and vegetable matter. Carbonate and muriate of ammonia have been obtained by distillation from pure river water, and this ammonia is the cause of that feeling of softness which is even greater than in pure distilled water.

Collected in the cleanest and purest vessels, it also contains organic matter and the germ of animal and vegetable life sufficient to produce putrefaction, animalcule and vegetable moulds; and when collected in large cities it is less pure than in the country, containing as it does, besides the impurities already mentioned, creosote, carbonic acid gas, and other materials resulting from combustion, decomposition, and evaporation. Still, next to water contained in milk, and the juices of fruits, rain water is the purest.

Snow Water.

Snow, being rain congealed, contains the same ammoniacal impurities; but being congealed in the upper and purer regions of the atmosphere, it brings down with it less of the organic impurities, but being in other respects the same, cannot be injurious to health, as is commonly supposed. It will not, however, quench thirst unless melted before it goes into the mouth, the loss of heat in melting counteracting entirely the natural effect of water, so that the natives of arctic regions, according to the testimony of Captain Ross, "prefer enduring the utmost extremity of thirst rather than attempt to remove it by eating snow;" but after it is melted it is as nearly pure as any water, and quenches thirst as well.

Spring Water.

Water falling in rain on the surface of the earth percolates through the soil and substratal gravel or sand, till it comes down to an impervious stratum, carrying with it of course all soluble substances that have been taken up but not filtered out by the sand through which it passes. It passes along this impervious substratum till it comes to some opening in a valley, or remains to be obtained through a well. It is of course affected by the salts of the soil, and by the soluble minerals in the gravel, or sand, or rock through which it passes, and the quality of the water depends on the character of the soil and the gravel. If the soil be thin and poor, and the foundation rock and gravel be granite, as in New England, there are few soluble salts or minerals to be taken up, and the water is pure; but if the soil is rich, and the subsoil and rocks are mixed with soluble mineral compounds, as in most of the rich valleys of our great rivers, the water is filled with organic and mineral matters, and is the source of many diseases.

River Water

Is generally a mixture of rain water and spring water, and of course varies in its impurities according to the character of the soil of which it is the wash, and rocks and gravel through which it is filtered, and according to the amount of impurities which it receives in its passage to the ocean.

From water the system obtains nothing of value but oxygen and hydrogen. This, I think, has been shown by the explanation of the law which makes provision for the fourteen elements in pure air, pure water, and in organized vegetable matter. I cannot, therefore, agree with Dr. Lankester in his "Guide to the Food Collection in the South Kensington Museum." * That waters from rivers, surface wells, and deep artesian wells, containing saline and mineral matters in solution, "provided they are not in quantities so large as to act injuriously on the system, may become a source of supply of these constituents to the body.' Having proved, as I think I have, that Nature accepts of no

I take pleasure in acknowledging my indebtedness to Dr. Lankester for many analyses of grains, &c., and for many other interesting facts which have been of great service in the preparation of this treatise; also to Drs. Johnston, Pereira, and other distinguished English authors.

supplies of elements but in accordance with her own definite provision for these elements, as before explained, I cannot think that she trusts to chance supplies, and would allow the human system to depend for the supply of any elements on waters, some of which contain no inorganic elements, and some quite too many. On the contrary, the first process in the use of water in the system is to remove all elements but oxygen and hydrogen from drinks of any kind as soon as they are taken into the stomach. If the drink contains sugar, or the juice of meat, or any other appropriate element of food, these elements are first abstracted and digested, and if it contains inorganic substances, or organic substances not needed in the system, they are first cast off by the excretories, so that whatever we drink, nothing but pure water is used, or can be used, by the system. If we take brandy, or wine, or beer, or coffee, or tea, or whatever else we take, it quenches thirst because it contains water, and to just the extent of the water. It is therefore important that our drinks should contain nothing deleterious.

The importance of pure water, as a means of preserving health, will be understood by all who have given attention to the laws which I have endeavored to explain, by which all elements not organized in pure water, pure air, and appropriate food, are rejected by the system as poisonous; but we have also facts which place the subject in a very strong light. In a case at the Nottingham Assizes, in July, 1836, it was proved that dysentery in an aggravated form was caused in cattle by the use of water with putrescent vegetable matter, produced by the refuse of a starch factory; proving my position true, that nutritious elements, if disorganized, become poisonous. The fish (perch, gudgeon, pike, roach, and dace), and even frogs in the pond through which the brook ran, were destroyed. All the cows, calves, and horses which drank of this water became sick, and in eight years the plaintiff lost twenty-four cows and nine calves, all of dysentery. It was also shown that the mortality was in proportion to the quantity of starch made at different times, and that when the water containing the putrescent matter was not allowed to pass into the brook the mortality ceased, and the frogs and fishes were restored.

Dr. Bell, surgeon to the barracks at Cork, found dysentery prevailing among the soldiers, till he suspected that it arose from water contaminated by the drainage from the city, and, changing the water to that of pure spring water, had no more of the disease; and in our late rebellion, it was found that whenever the soldiers were obliged to drink water containing organic impurities, as in the swamps of Chickahominy, they soon became sick of dysentery, or some other disease of the digestive organs.

Waters containing Inorganic Substances usually denominated Hard Waters.

Those waters which are usually obtained from wells, contain salts of various kinds, derived from the soil and subsoil through which they percolate, and of course are more or less injurious as they contain elements and combinations more or less active. The most common salt found in hard water is sulphate of lime, the elements of which and the elements of soap have a mutual affinity for each other, and when soap is used with such water a double decomposition takes place, — the sulphuric acid unites with the alkali of the soap, setting free the fatty acids, which, uniting with the lime, form an insoluble earthy soap, which floats on the surface, and the soap losing its influence, the water feels hard and very imperfectly performs the functions of ablution. These salts also have a very unfavorable effect in the animal economy, as the elements not being wanted in the system have to be cast out through the excretories, causing, in their passage out, diseases of the kidney and of the skin, and it is found that gravelly deposits and eruptions of the skin are frequent in proportion to the inorganic substances in the water habitually used. Horses seem instinctively aware of the evils of hard water, and prefer even turbid river water to hard well water. Mr. Youatt, an English writer, in his book on the Horse, published in London, 1831, says, "Hard water, drawn fresh from the well, will assuredly make the coat of a horse, unaccustomed to it, stare, and it will not unfrequently gripe and otherwise injure him." And Mr. Chadwick, in his report to her Majesty's principal Secretary of State for the Home Department from the Poor Law Commissioners, on an inquiry into the sanitary condition of the laboring population of Great Britain in 1842, observes that "water containing animal matter, which is the most feared, appears to be less frequently injurious than that which is clearest, namely, spring water, from the latter being oftener impregnated with mineral substances." These considerations are sufficient to show that pure water is important for the preservation of health; but in one respect pure waters are more dangerous than those containing salts, especially the salts of lime. Pure water will, under some circumstances, corrode lead pipes, and dissolve more lead than those containing salts of lime, especially carbonates, which form a crust on the surface of the pipes, and thus protect them from the action of water, while even rain water, on surfaces of lead exposed to air and water alternately, as in lead gutters, cisterns, pipes, &c., acts with considerable energy, as may be seen by examining any pipe at the surface of a cistern of water, or any cistern lined with zinc or lead, at the surface of the water, or the top of a closed cistern, where the steam or moisture gathers. The drops of water which condense on the top of a cistern of water are impregnated with the oxide of zinc or lead (both to some extent poisonous), and dropping into the water, impregnate the whole mass, and render it unfit for drinking purposes. There are also places in all lined cisterns, and all pipes where two metals are united or come in contact, forming a galvanic battery — as in soldered joints, supporting bars of iron, copper faucets, &c., and the action on the water, however pure, in these parts will cause decomposition of the metals; and thus in the purest water, if we obtain it through lead pipes, or zinc-lined cisterns, or copper boilers, we get some very deleterious mineral matters, which affect the system, even though we get them in very minute quantities.

The worst of this influence is, that it is cumulative; and no particular effects being perceived, perhaps, for a long time, we come to doubt whether water which we have used with apparent impunity for months, and perhaps years, can in any way be injurious; and many a disease, such as colic, numbness, pain in the bones, constipation, fits, spasms, cramps, &c., is charged to something else, or the cause of which is not known, is really induced by the cumulative influence of lead, zinc, or copper from our water pipes or cistern linings, &c. Cases frequently occur in which whole families are afflicted with some mysterious and complicated diseases, from which they suffer for months and years, and which destroy all their comfort and all their usefulness, and even the life of some of the members, before they suspect the cause; but when scientific investigation is finally obtained, the cause is found to be lead pipes, from which they had used water from the same well for years, much of the time enjoying good health. Not one half of the evils from metallic water pipes are known, or ever can be known, till they are utterly discarded, and we experience the blessings of health which come from pure water.

Every scientific man, and every other man who realizes these evils to the community, ought to "cry aloud and spare not," till our city authorities, and every individual householder, shall open their eyes to see them, and shall banish forever all unprotected metallic service pipe. Let the people once make up their minds they will drink no water poisoned with lead, or zinc, or copper, whatever it may cost to get pure water, and there will be found means of procuring pure water; but as long as we deceive ourselves as we do with the idea that however others may suffer from water impregnated with lead, or zinc, or copper, we are safe, — our well of water, and our Cochituate, or Croton, or Schuylkill water does not corrode pipes, — we shall continue to take water poisoned with lead and other mineral matters.

The truth is, we who laugh at the silly ostrich for poking her head under the sand, and thinking herself safe because she can see no danger, are after all but little wiser. We blind our eyes to a thousand evils, and bear their consequences rather than take the trouble to remove them.

Ask a man who lives on the border of Chickahominy Swamp, or any other notoriously vile and sickly locality, about the health and comforts of his home, and he will tell you he has "a heap" of good and pleasant things about him, and no annoyances or sickness of any kind. "They have the dysentery and bilious fever over the other side, a few miles off, and the mosquitoes are awful;" but he has none of these troubles.

Ask a man, as I did, who had always lived on the Mississippi River, and always drank water so thickened with organic and inorganic impurities that it looks like gruel more than like water, why he did not filter the vile stuff, and he will tell you, as he told me, "There was never sweeter, or better, or more healthy water drank in the world; it is much better without filtering, as it has more *body to it*." I asked him if in his neighborhood they were not subject to dysenteries, bowel complaints, bilious fevers, and the like. He said, Yes; but the water had nothing to do with such troubles.

Ask the Cochituate Water Board about Boston water, and they will tell you truly that it is the purest water used by any large city on the face of the earth; that, according to Prof. Benjamin Silliman, it is capable of dissolving only forty-six hundredths of a grain of lead in a gallon, and therefore cannot corrode leaden pipes; but they will not tell you that, open any cistern or any pipe that is not all the time full, and you will find the lining coated with carbonate of lead, and that near the soldered joints a galvanic and chemical action is constantly going on, so that the pipes are eaten off and burst very frequently (in my house the pipes are eaten off and burst five or six times a year, and always near some soldered joint).

Deceive ourselves as we may, there is no water incapable of acting on lead, or zinc, or copper, under some circumstances, and these metals should never be used for, or connected with service pipe; and the sooner the people fully understand this fact the better. But how shall we protect ourselves in the mean time? It takes a long time for the most palpable truths to get control of corporations, proverbially conservative. Meantime we should never use water to drink or for cooking that has stood for any length of time in the pipes, and never use at all for these purposes water that comes from a leaden or zinc-lined cistern.

Water containing organic matters can be filtered through sand and charcoal. Boiling also purifies water, the salts that are held in solution by carbonic acid, as the carbonate of lime, or carbonate of iron, or lead, the heat of boiling water driving off the carbonic acid, and leaving the lime, or iron, or lead deposited on the vessel in which it is boiled. In travelling in regions where the water is impregnated with lime, or organic materials, it is a good precaution to drink no water that has not been boiled, and a better plan still, to get as much as possible of the necessary supply for the system from milk, and vegetables, and fruits, from which we get water absolutely pure, and fitted to be appropriated, without any process of purification, in the stomach. Another reason for not drinking water which contains organic matters, without boiling, is, that all such waters contain animaculæ, and the eggs of insects and vermin, some of which are capable of resisting the action of the gastric juice, and will live and grow in the stomach; thus leeches, and snakes, and other disgusting creatures have been known to be taken in impure or stagnant water in which they are hatched, and live in the stomach for a long time, causing great annoyance and distress. No animalcules are found in water absolutely pure, and none are known to exist that are not destroyed by boiling water.

And now, having explained the process by which, at such infinite expense, water is furnished to every living thing, everywhere and at all times, and having shown that pure water, and nothing else, can dilute the blood and prepare it to circulate, carrying to every part the nourishment needed, and taking from every part the effete materials no longer wanted, and that nothing else can supply the hydrogen, and other elements, as they are needed in the system, and that, therefore, all other drinks subserve these different purposes because they contain water, and in just the proportion as they contain water, all other drinks might be summarily disposed of as useless and injurious; but wedded, as every nation is, to some artificial drink, and biased, as scientific men are, in favor of that to which they themselves are accustomed, there is need of applying chemistry, physiology, and common sense to our drinks, as well as to our solid food. For, though it be true, as we have said, that pure water is the only true drink, and that therefore there can be no substitute for it; and though it be true that all the living creatures which

God has made, some of which, as we have seen, are subject to the same physiological laws as man, and take the same kind of food, all take water alone for drink, and are all contented with it; still, to conform to his cosmopolitan character, man sometimes needs some modification of water for drink to avoid and counteract the influence of impure water, to which, in our present ignorance of the means of correcting the evil, we are sometimes subject. Even a teetotaller ought to be excused for breaking his pledge if so situated that he could get nothing else, and must choose between wine, although it did contain a little poisonous alcohol, and impure waters, containing materials a thousand times more deleterious than a little alcohol.

The substitutes for water, commonly adopted in civilized nations, are alcoholic drinks, including distilled spirits, beers, cider, wines, — and tea, coffee, and chocolate; each of which deserves, and shall have, a passing notice.

Tea.

That infusion which is usually denominated Tea, which is used by five hundred millions of the inhabitants of the earth, is made from the leaves of several varieties of a small shrub found in China and India, and now cultivated in many other parts of the world. The leaves are not gathered till the plant is four years old; and the plant is renewed every tenth or twelfth year. The shrub is closely allied to the well-known

Camellia Japonica. The difference between teas of the two general classes in common use — the green and black teas — is accounted for in different ways by different authors. Lankester says the difference is partly the result of soil and growth, and partly from the mode of curing. "Black tea consists of leaves slightly fermented, washed and twisted. Genuine green tea is made of exactly the same leaves, washed and twisted without fermentation; but commercial 'green' teas are often black teas colored with Prussian blue." While Mr. Reeves, whose opinion, according to the authority of Pereira, is entitled to great weight, expresses his surprise "that any person who has been in China, or indeed any one who has seen the difference in the color of the infusions of black and green tea, could suppose for a moment that they were the product of the same plant, differing only in the mode of curing, particularly as they do not grow in the same neighborhood of each other." But whether the difference consists in the manner of preparing, or the species or varieties of plants, chemical analysis shows that green tea, as it comes to us, contains more tannin, and more of that peculiar principle which is found combined with tannin, which is called theine, or theina, which is the same principle found in coffee, and called caffeine. The tannin is injurious on account of its astringent effects, and the theine and caffeine are injurious to many people on account of their peculiar influence on the nervous system, inducing restlessness and wakefulness. On that account green tea disagrees with more people than black tea, and, in this country, is almost given up for black tea.

Dr. Lankester estimates that in the United Kingdom above thirty-two thousand tons, or seventy-three millions of pounds, are annually used, or about two pounds and three quarters for every person in the kingdom; and he has given a table showing the relative consumption of tea in different countries; and I transcribe below his estimate for the United Kingdom, France, Russia, and the United States.

Annual Consumption, in Ounces, per Head of the Population.

United Kingdom,	$35\frac{1}{4}$ oz.
France,	1 "
Russia,	4 "
United States,	16 "

The property which distinguishes the different kinds of teas from each other, and gives them their flavor, is found in the form of volatile oil. This flavor, or osmazome, is, as I think can be shown, the source of all the benefits that can be derived from tea, and the source of one class of evils which arise from its use in excess. By the chemical analysis of pure tea, of any variety, we find no elements capable of doing harm to the system, except tannin and osmazome. Osmazome in tea seems to be a flavor universally admired, and therefore the cause of its extensive use all over the world. It is only injurious when taken in excess, being the element diffused through all natural food, and which is useful in giving a relish and in promoting digestion; but in excess, produces nervous excitement and subsequent depression. These effects are, however, evanescent, and soon pass away unless the cause is continued. But tannin, or tannic acid, is a medical agent, permanent in its effects, and undoubtedly injurious to the system in proportion to its use. It is found combined with theine, the peculiar principle of tea, and constitutes more than twenty-five per cent. of the dry leaf.

According to Dr. Lankester, one pound of good tea contains —

Water,	0 oz.	350 gr.
Theine,	0 "	210 "
Tannic acid,	4 "	87 "
Casein,	2 "	175 "
Aromatic oil,	0 "	52 "
Sugar,	0 "	211 "
Fat,	0 "	280 "
Woody fibre,	3 "	87 "
Mineral matter,	0 "	350 "
Gum,	2 "	385 "

The chemical difference between black and green teas may be seen by the following table from Mulder, comparing two kinds of green tea with two kinds of black: —

	Chinese.		Japanese.	
	Green.	Black.	Green.	Black.
Chlorophyll,	2.22	1.84	3.24	1.28
Wax,	0.28	.00	0.32	.00
Resin,	2.22	3.64	1.64	2.44
Gum,	8.56	7.28	12.20	11.08
Tannin,	17.80	12.88	17.56	14.80
Theine,	0.43	0.46	0.60	0.65
Extractive matter,	22.80	19.88	21.63	18.64
Apotheme,	.00	1.48	.00	1.64
Ext. obtained by hydrochloric acid,	23.60	19.12	20.36	18.24
Albumen,	3.00	2.80	3.64	1.28
Fibrous matter,	17.08	28.32	18.20	27.00
Volatile oil,	0.79	0.60	0.98	0.65

By this table we see why green tea is more injurious than black, containing as it does nearly one third more tannin, and from one third to one quarter more volatile oil, while of the other important element, theine, there is a little more in the black tea. That it is not theine, but tannin and volatile oil, that produces tremor, anxiety, sleeplessness, &c., is therefore proved, black tea containing most theine, and yet producing least of these nervous symptoms. On the other hand, I cannot believe with Liebig that theine or caffeine have any important influence in the change of the tissues or in the composition of the bile, and "are better adapted to this purpose than all other nitrogenized vegetable principles."

We have seen that every principle, important to the human economy, is so carefully provided for, that wherever man may choose to live, he finds all these principles prepared for his use ready at hand; but caffeine and theine are only found in tropical climates, and are indeed quite local in their production. We find, also, that more than three quarters of all the people in the world live and enjoy health without ever tasting these principles. Liebig's theories, therefore, in this matter, as in many others, are not sustained by facts or general principles. Theine, caffeine, or any other peculiar principles found in tea or coffee, cannot be proved to be essential to health in any circumstances or conditions of life; but I am not, on the other hand, prepared to prove that to everybody they are essentially injurious.

The truth, it seems to me, lies between the extremists, on the one hand, who think theine and caffeine, to use again the words of Liebig, "are capable of supplying the place of the nitrogenized product produced in the healthy state of the body," and the extremists, on the other hand, who condemn tea and coffee "as evil, and only evil, and that continually." Tea and coffee are sometimes useful; but not for nutriment, or to take the place of nutriment: Nature furnishes no substitutes. They are useful for their osmazomes, and are useful or injurious as they are used or not used in accordance with the purposes of that principle; and here, perhaps, as well as anywhere, I may explain what is meant by osmazome, and its purposes in the economy of nature.

The Principle which gives Relish to Food and Drink.

Much too little has hitherto been thought by physiologists, and almost nothing has been written on that beautiful provision for our happiness by which everything that is useful as food or drink is made agreeable to the palate, so that the higher our relish for any given article, the more perfectly is it digested and made to supply the wants of the system, we have therefore a natural guide to the right kind of food at the right time, and, on the other hand, have a disrelish for articles which, not being suited to our condition, would be injurious. But a little reflection will show us that, in this adaptation of our palates to the peculiar taste or osmazome of every distinct article of food, we have a faithful sentinel, inviting the admission of friends and protecting us from the approach of enemies.

Place before a child, who has never tasted of sugar, or butter, or superfine flour, or any other elements of food that have been separated from their natural connections, and whose tastes are therefore unperverted, milk, unbolted bread, meats, fruits, or any other natural food, and he will choose just that article which is best adapted to his condition at the time, and may be trusted to eat as much as he pleases.

At first, after being weaned from his primary milk, he will prefer the milk of the cow, and after a while need, and choose with it, some more concentrated food, as unbolted wheat, or other bread from grains in their natural state, and then meats, and potatoes, and fruits, according to their season; and he never will desire any other than natural food till his appetite is perverted by sugar, or butter, &c., which, being separated from their natural elements, contain their osmazome in a state too concentrated. After that, his bread will be insipid without butter, and his milk must have sugar, and the natural relations of his tastes to natural osmazomes is broken up. And so dependent are the digestive organs on the osmazome to which they are used, that, after becoming accustomed to butter, sugar, tea, coffee, or any other food or drink in which is a concentrated and agreeable flavor, they will not readily digest food without them. Thus we become accustomed to, and dependent on, articles of food and drink which are temporarily useful, but permanently injurious.

Many a man becomes so accustomed to alcoholic drinks, as wines, beers, and even laudanum, that he suffers from indigestion and loss of appetite unless they are constantly supplied. Now this, as I understand it, is the source of benefit from tea and coffee. The agreeable osmazome promotes digestion, as all other agreeable flavors do; and with a dinner or breakfast of food which, from improper cooking, or for any other reason, is not relished, a small cup of pure aromatic coffee or tea is undoubtedly a real benefit.

The French people seem to understand this principle better than the English or Americans, not only in regard to tea and coffee, but in regard to all kinds of food and drink, adjusting the articles to each other, so as not to burden the system with redundant carbonates while the nitrates and phosphates are deficient, and always making them relish by delicate condiments. Instead of drinking with a breakfast three or four cups of coffee or tea, boiled so as to extract all the tannin and lose most of the aroma, they take only moderately of an infusion made so quickly as to extract only the aromatic properties, while the more deleterious tannin remains with the dregs. And this, after all, to my mind is a solution of that vexed question which has so puzzled and deceived Liebig and other physiologists.

That coffee, tea, fragrant wines, and other alcoholic drinks, &c., do under some circumstances take the place of food, or at least enable men to keep the flesh and strength with less food than without them, there is no doubt; but that this is done according to the theory of Liebig, "by retarding the metamorphosis of the tissues,' or by furnishing actual nourishment from alcohol or any peculiar principles in coffee or tea, there is not a shadow of proof. On the other hand, the evidence is clear, that not in proportion to the alcohol, or theine, or caffeine contained in these articles is the benefit to be derived from them, but in proportion as the osmazome of each is agreeable to those who take them; and the benefit is derived from the perfect digestion of food which is caused by this agreeable osmazome. No man of careful observation has failed to notice that a little food, well relished, will keep us in better condition than large quantities of the most

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appropriate elements so badly cooked, or so miserably served, as not to be eaten with relish; and this explains the well-known fact that Frenchmen live and keep in good condition at one third less expense than Americans or Englishmen.

Having now given my views of the sources of benefit to be derived from tea, coffee, and all other agreeable beverages, and shown that they are useful in promoting digestion by their osmazome, and not by any special principle contained in them, it will be useless to go into an analysis of each beverage. The whole matter may be summed up as follows: The system needs the three classes of elements included in the terms Nitrates, Carbonates, and Phosphates, and pure water; and these elements, to be rightly appropriated, must be presented to the digestive organs flavored so as to be agreeable to them; and this flavor is as important as the other elements.

The experiment has been tried of shutting up a dog, with good natural food, containing all needed elements but osmazome, but having been cooked and re-cooked till all taste and smell were removed; the stomach would not receive it, and the dog pined away until it was evident he would starve without this element, although all others were supplied. And this one experiment, it seems to me, is worth more than a volume of commentaries on the importance of osmazome. It shows us not only that it is duty to eat good food, containing nutritive elements in right proportions, but it is duty to eat it also with a good relish.

Does any one say he cannot afford to eat good ripe fruit, and berries, and well-flavored meats, and vegetables? let him make a calculation, comparing the amount of fine flour, butter, sugar, and other carbonaceous food consumed by his family, with the requisite amount of that class of elements, as shown by the tables, and calculate the amount of money thus uselessly expended, and he will find that, by bringing his commissary department under physiological rules, he will have surplus funds sufficient to procure every natural luxury which is needed to enable him to enjoy, to the fullest extent, the very highest gustatory pleasures of which he is capable.

And here again we are liable to err. Our gustatory pleasures are not in proportion to the amount of osmazome in our food or drink. Nature's flavors are very delicate, and the very choicest relish is that produced by very slight traces of osmazome. For example, take nutmeg, a very slight grating of which will flavor a large bowl of porridge. Attempt to increase the relish by increasing the quantity of the spice, and you utterly fail, making your beverage less and less agreeable as you increase the quantity of nutmeg, till it becomes disgusting, and positively injurious to the digestive process; and this is true of all other condiments, and indeed all other good things. Delicate flavors are agreeable and useful in promoting digestion; but every article which is capable of promoting health and happiness, in appropriate quantities, is capable of doing harm in unnatural quantities, just as every other blessing is converted into a curse by being perverted and misused.

Just here human nature, especially Yankee human nature, is prone to deceive itself. A man finds himself very happy with his family in a little tasteful cottage home, with an income sufficient to meet his expenses, and save a little every year for future contingencies; but he wants a larger income, that he may increase his conveniences, enlarge his establishment, and lay up more money. But does his enjoyment increase with his means? On the contrary, his cares increase, and his real enjoyment diminishes at every step, till long before he becomes a millionnaire he is decidedly miserable.

The doctor thinks by taking medicine twice a day his patient may get well in two weeks; but the patient prefers to wait only one week, and therefore takes his medicine four times a day: but if the directions were judiciously given, the patient finds himself worse and not better at the end of the week.

A cup of very weak, well-flavored tea or coffee may be very agreeable, and promote digestion, and be of real service, especially if taken with food which is not well relished; but if we follow our inclinations, and attempt to increase the enjoyment and the advantage of the beverage by increasing its strength or its quantity, we may get instead nervous excitement, restlessness, and indigestion, and a thousand other troubles, and the evils will increase, while the pleasures and benefits will diminish, pro rata. And thus we find everywhere the same law, encouraging us to be content with Nature's simple arrangements for our welfare and happiness, and warning us of the danger of disregarding them. My position in regard to condiments and aromatic drinks is this: If we could always get good natural food, adapted to our constitutional condition, and have it cooked so as best to develop its natural osmazome, and if we could get with it pure water, we should need nothing else to enable us to enjoy to the fullest extent our gustatory pleasures, and the enjoyment arising from the highest degree of health and activity of all our faculties; but that, with unsavory food and impure water, we derive great benefit from delicately flavored condiments and aromatic beverages in moderate quantities; that a choice in these beverages is to be determined by consulting the taste of each individual; that in preparing these beverages the question is how to get the osmazome without getting the deleterious qualities with which it is connected; and that the advantages to be derived from osmazome are never in direct proportion to the amount taken, but are more nearly in the inverse proportion, while the deleterious elements connected with almost all the beverages in common use increase in direct proportion to the quantity used.

The deleterious element in tea and coffee we have already shown to be tannin, and this element can be avoided by making these beverages quickly, never allowing but a few moments in steeping. By this process the osmazome, being volatile, is all obtained, while the tannin, being extractive, remains with the dregs. Made in this way, and used moderately, there are very few individuals to whom they are injurious.

Beer, Cider, Wine, &c.

Of the other aromatic beverages in common use, — beer, cider, wine, &c., — the deleterious principle is alcohol; but the principle which distinguishes each, and constitutes its value, is osmazome; all other principles of any consequence, are sugar, starch, &c., which they hold in common with articles of food, and which are derived from the grains and fruits from which they are made; but the osmazome in these beverages, as in those already considered, constitutes their commercial and their real value. The only chemical difference between the highest and the lowest priced wines consists in the "bouquet," or osmazome, but alcohol is the principle for which these beverages are universally demanded; and as there has been, and is still to some extent, a difference of opinion among chemists and physiologists respecting the relation of this principle to the human system, it will be necessary to give it a careful consideration. (See page 220.)

Cocoa and Chocolate.

The chocolate plant, of which cocoa is the seed, is a small tree, with dark green leaves, growing in Mexico, Caraccas, Demerara, and other places. It produces an elongated fruit, in shape like a cucumber, but more blunt, which grows from the stem or main branches. The seeds, or beans, that furnish the cocoa, are imbedded in the fruit in rows, in a spongy substance, and are about fifty or sixty in each fruit. When ripe, the seeds are taken out, cleaned and dried. The best cocoa is made from seeds shelled and roasted, but inferior cocoa is made by grinding with the seeds a part of the shell. *Cocoa-nibs* are made from seeds merely roasted and crushed after being shelled; *Cocoa-paste* is the seed ground down, and mixed with sugar; and if flavored with vanilla, it is called CHOCOLATE.

Cocoa differs from tea and coffee in that it is rich in nutritious food, and having in it no tannin or other deleterious elements, its theobromine, or characteristic property, being connected with albumen — a muscle-making element; as the characteristic element of tea, theine, is connected with tannin. Containing also a large share of butter, and four per cent. of phosphates, it is supplied with all the requisite elements of food, and to those who like its flavor, it is a very agreeable and useful beverage, having all the advantage of tea and coffee, without their deleterious qualities. Its nutritive elements are, however, too concentrated to agree with very delicate stomachs, as may be inferred from the following analysis. One hundred parts *cocoa* contain, —

Water,	5.0
Albumen.	20.0
Theobromine,	2.0
Butter,	50.0
Woody fibre,	4.0
Gum,	6.0
Starch,	7.0
Red coloring matter,	2.0
Mineral matter,	4.0
	100.0

or,

Water,	5.0
Nitrates,	22.0
Carbonates,	69.0
Phosphates,	4.0
	100.0

One pound of Cocoa-nibs, or two pounds of Cocoa-paste, contain, —

Water,	0	350 gr.
Nitrates (Albumen and Gluten),	3 oz.	85
Theobromine,	0	140 gr.

Alcohol.

I have already adverted to alcohol as being the result of the chemical decomposition of sugar. (See page 70.) We come now to consider and establish the fact that, though sugar and alcohol are composed of the same elements, viz., hydrogen, oxygen, and carbon, the one is a useful carbonaceous food, while the other is a poison.

Alcohol is sugar disorganized by the process of fermentation, and is subject to the same law as phosphorus and iron. It is composed of carbon, hydrogen, and oxygen, as is also sugar, from which it is made, — elements which are wanted in the system, as well as phosphorus and iron, and if taken into the stomach organized, as in sugar-cane or beet, are all gratefully received and easily digested; but taken in a disorganized state, as in alcohol, they cause immediate excitement, by the efforts of all the organs to expel them as intruders.

Let us see how nearly alike, chemically, are sugar and alcohol, and the change effected by the process of fermentation.

One atom of sugar contains, —

Carbon.	Hydrogen.	Oxygen.
12 atoms.	12 atoms.	12 atoms.

These are converted, by fermentation, into two atoms of alcohol, containing, —

Carbon.	Hydrogen.	Oxygen.
8 atoms.	12 atoms.	4 atoms,

and four atoms of carbonic acid gas, which accounts for the lost carbon and oxygen, the carbonic acid gas containing, —

Carbon.	Hydrogen.	Oxygen.
4 atoms, and	None.	8 atoms, and
8 "	12 atoms.	4 "
12 atoms.	12 atoms.	12 atoms.

Thus we see that the same elements are found in sugar as in alcohol, and combined in the same proportions; but sugar, being organized for digestion, is agreeable to the natural taste, and is readily appropriated as carbonaceous food, while alcohol, being disorganized, creates a rebellion, and is rejected from the system as an intruder; so that we find in alcohol, as in the preparations of phosphorus and iron, the elements are agreeably and usefully appropriated by the system or rejected as poisonous, as they are or are not organized in Nature's own laboratory. And this consideration, it would seem, should forever settle the question whether alcohol is nutritious, and clearly show that vital law is higher than chemical law, and must control it; and that therefore the same chemical combinations of elements may be poisonous or nutritious as they are or are not subject to vital law, as we have before seen in combinations of phosphorus and iron.

Liebig's Theory respecting the Nutritive Qualities of Alcohol.

It is now more than twenty-five years since Liebig commenced his valuable chemical investigations of food, and its relations to the human system. He discovered that some elements of food — carbon, hydrogen, &c. — were appropriated for the purpose of producing heat, while others were devoted to the growth and strength of the muscles; and finding sugar and alcohol both to be composed of these carbonaceous elements, he classed them together as heat-producing articles of food; and that idea has since been adopted by many, perhaps most chemists, and some physiologists; but I have endeavored to show (pages 37–41) that the same combination of elements may be, and are, nutritious or poisonous as they are or are not organized by the process which Nature has provided; and that while sugar is a valuable principle in food, alcohol contains no power of sustaining life, but, on the other hand, produces in the human system "evil, and only evil, and that continually;" and this I shall endeavor to prove.

Professor Carpenter, of the London University, has published a book on physiology, which as late as 1860 has been republished in Philadelphia, edited by Professor Francis Guerney Smith. From that Physiology, which is now the standard work in this country and England, I copy these words: —

"It may be safely affirmed that alcohol cannot answer any one purpose for which the use of water is required in the system, but, on the other hand, it tends to antagonize many of those purposes."

'Alcoholic liquids cannot supply anything which is essential to the due nutrition of the system.'

"The action of alcohol upon the living body is essentially that of a stimulus, increasing, for a time, the vital activity of the body, but being followed by a corresponding depression of power, which is the more prolonged and severe in proportion as the previous excitement has been greater."

The U. S. Dispensatory, compiled by Professor

Wood, of Philadelphia, the standard work on that subject in the United States, also expresses similar opinions on the character and effects of alcohol. Professor Bigelow's Materia Medica, the standard work when I was a member of Harvard School, expresses a similar opinion. All agree that alcohol is a stimulus which, literally, means a *goad*, a *whip*. When a horse gets stuck with a load too heavy for him, we use the goad or whip to excite the muscles to take the load up the hill. But, when once up, the careful driver will be sure that next time the load shall be lighter, or the horse made stronger with oats. What should we say to the teamster who persisted in the opinion that the whip afforded nourishment to the horse because he could be made to draw a heavier load by whipping, and therefore persisted in whipping him more severely as his strength became exhausted? But if this is not the position of those who think that alcohol is nutritious I cannot understand them.

Is alcohol useful in promoting digestion, or in consumption or general debility?

Keeping in mind the fact that, upon the highest medical authority alcohol is only a stimulant, I have no difficulty in determining how far alcohol is useful and how far injurious.

I have sat by the bedside, and, watching the sinking pulse, and fearing lest Nature might not be able to carry the load, have put in the goad, and in three minutes have felt the circulation rise; but in a few minutes more it would sink again, and the stimulant must be renewed, or it would sink lower than before. By careful watching and spurring I have kept up the heat and circulation till a little nourishment could be digested, and perhaps the patient saved. But this is all the use I have ever made of alcohol as a medicine.

To whip and spur poor human nature all the way down through consumption to the grave, increasing the stimulus at every step as nature flags, seems to me absurd, cruel, and unphilosophical in the extreme. If stimulants should be thus applied to a jaded horse, its owner would be tried for cruelty to his beast; and yet there are said to be hundreds and thousands of men, women, and even children, now subjected to a similar mode of treatment in Boston and vicinity.

In an essay which obtained the prize of two hundred dollars, and which, Dr. Churchill says, displays great research upon the subject of the effects of alcohol, Dr. Bell comes to the following conclusions: —

1. The opinion so largely prevailing as to the effects of the use of alcoholic liquors, viz., that they have a marked influence in preventing the deposition of tubercle, is destitute of any foundation.

"2. On the contrary, their use predisposes to tubercular deposition.

"3. Where tubercle already exists, alcohol has no effect in modifying the course usually run by that substance.

4. Neither does it mitigate the morbid effects of tubercle upon the system in any stage of the disease.'

Professor Wood, in his Dispensatory, says the habitual use of alcoholic drinks produces deplorable consequences. Carpenter's Physiology says the physiological objection to the habitual use of even quite small quantities of alcoholic drinks rests upon the following grounds: "They are universally admitted to possess a poisonous character." "They tend to produce a morbid condition of the body at large." "The capacity for enduring the extremes of heat or cold, or mental or bodily labor, is diminished rather than increased by their habitual employment."

In a lecture of Professor Jacob Bigelow, in 1825, he used the following words, which I recorded at the time: —

Alcohol is highly stimulating, heating, and intoxicating, and its effects are so fascinating that, when once experienced, the danger is that the desire for them may be perpetuated." "Many patients have become gradually and imperceptibly intemperate under the sanction and guidance of a physician."

How often has my heart been saddened by witnessing illustrations of Professor Jacob Bigelow's statement concerning patients being led to intemperance by the guidance of their physician. Not long since an interesting lady, not thirty years old, came to me for advice. She had been subject, for two or three years, to terrible internal cramps from indigestion, and was advised by her physician to take gin. At first she only took it when the cramps occurred, and it relieved her, but soon she took it to prevent their recurrence, and it seemed for a time to succeed; but as she never knew when the pains were coming, she never knew when to stop the gin: and after two years her system had become so accustomed to the stimulus that no quantity short of that which produced actual inebriation would either prevent or relieve the distress. In that condition I found her, and of course advised to break off the habit at once, and take appropriate remedies. In two days she returned, and said she had had no return of the cramps, but felt as if she should die unless I allowed her gin, or a substitute. I put the case as it plainly stood. She must break away from gin then, or be a slave to it for life. She braced herself up to the resolution — "I will die now, sober, rather than live to be a drunkard;" and many a time since has she thanked me for assisting her in that resolution. And many a similar case has come under my observation, only differing in this, they never were able to break away from the snare that had caught them.

Is alcohol useful by preserving the tissues, and thus increasing the term of life?

There may be a sense in which this question may be answered in the affirmative, but it seems to me difficult to conceive a case in which tissues thus preserved would be of value sufficient to pay the expense of the process; but this idea having been recently advanced by a learned professor, deserves a passing, though not a serious notice.

Professor Yeomans, of New York, says, "It has been demonstrated that alcoholic drinks prevent the natural changes going on in the blood, and obstruct the nutritive and reparative functions."

Carpenter's Physiology says, "Alcoholic drinks diminish the waste of the tissues." That is, alcohol suspends the action of the whole system, brain and muscle, and tends to bring us down to a state of torpidity, like snakes and toads, who have wonderful powers of preserving their tissues by masterly inactivity. The professor did not prescribe the form in which alcohol should be taken, nor the regime to accompany it in order best to succeed in preserving the tissues; but, "holding the mirror up to nature,' I think I can see and supply the deficiency.

In the first place, you should sit perfectly still, for every motion tends against the preservation of the tissues; then you should live in the most impure air possible, for every breath of air containing oxygen burns up the waste of the tissues, and counteracts the desired influence; and then you should keep the tissues well preserved in lager beer, this form of alcoholic drink being best adapted to bring us into a state of torpidity.

You have seen, perhaps, a toad, a motley-faced, blubber-lipped toad, sitting in the corner of the garden, in one spot, hour after hour, and day after day, with just energy enough to wink, and to catch a fly if he comes within an inch of his nose; — a perfect personification of a bloated, beer-drinking, Pennsylvania Dutchman, who will sit, it is said, in the chimney-corner from morning till night, with just energy sufficient to raise the beer to his lips, and to call for more when his mug is empty. How long he can succeed in preserving his tissues has not been fully ascertained; but his prototype, the toad, sometimes succeeds wonderfully. Before a rain, a toad will sometimes muster up energy sufficient to crawl up into the fork of a tree, and there fill his big mouth with air, and blowing it through his lips, will utter a kind of trumpet sound, to notify us that a rain is coming; and when it comes, he crawls under the rough bark in the fork of the tree, and there waits and winks till the rain is over. Now it is said to have happened that, waiting too long, and the old bark becoming dry, he is bound in and can never get out. Year after year he stays there, winking in summer and suspending his work in the winter. Meantime the tree grows over him, and after many years, perhaps, is cut down, and there the toad is, still alive and winking.

Now this is not exactly an illustration of the power of alcohol to preserve the tissues, unless the toad has the power of manufacturing his own alcohol out of the carbon and hydrogen with which he was all the time surrounded, but it does illustrate the condition towards which all tissues must be brought to be preserved by alcohol. And the question comes up, What is the use of such tissues? What is a Dutchman good for who does nothing but drink lager beer? Professor Jackson's cabinet of morbid tissues is too small to accommodate him, and that is the only place for morbid tissues preserved in alcohol.

The professor's predecessor used to teach us that it was not desirable to preserve the tissues; that the more we exercised and wore out the tissues, and the purer the air we lived in, and the more we avoided the stupefying influence of alcohol, the oftener the tissues would be renewed, and the more healthy and useful we might become.

The only argument now depended on to prove that alcohol in any beverage is useful to the system, is founded on experience, and experience in this case, as in all others in which there is no careful observation, is merely "the *post hoc ergo propter hoc* error" which imputes the cause of everything to that which comes just before it. This was the reliance in the recent struggle in the Massachusetts legislature to establish the character of alcohol for usefulness as nutriment, and the eminent counsel referred to the extraordinary case of Carnaro, who lived fifty-eight years on twelve ounces of solid food and fourteen ounces of light wine each day, and he quotes Professor Lewes as saying, "he wonders that intelligent men, in view of such facts, can doubt that alcohol is nutritious.' The wine which Carnaro drank, as indeed all other sugared alcoholic beverages, contained excellent aromatic nourishment. Why then impute the results to alcohol, of which in light wine there is but very little? All we can say in favor of the little alcohol in light wines is, that it would probably do no harm, as the stomach may become accustomed by habit to the presence not only of alcohol in moderate quantities, but other poisons, as opium, tobacco, and even arsenic, so as to digest food and perform its functions in spite of them, and those who take these poisons may live perhaps as long as Carnaro; but does that prove that opium and arsenic are nutritious? I once heard of a farmer who claimed that sawdust and Indian meal would fatten hogs, for he had tried the mixture; but when asked what proportions were best adapted to the fattening process, he said he thought the less sawdust and the more meal the better.

Let two starving men have nothing but alcohol and water, and let one drink the pure water and the other a mixture of alcohol and water, and the water drinker will live the longest — the experiment has been tried many a time, accidentally on man, and for the sake of experiment on other animals.

The opinion of Liebig, that "alcohol is burnt in the lungs, giving off carbonic acid and water, and serving to support the temperature of the body," is proved to a demonstration to be wrong. All arctic explorers concur in the opinion that alcohol has a decidedly injurious effect on men exposed to the cold.

Sir John Ross testifies that he experienced in his own person the beneficial effects of abstaining wholly from spirituous drinks, and he proposed to his men that they should try the same experiment, which was done with very gratifying results. He says, "When men under hard and steady labor are given their usual allowance or draught of grog, or a dram, they become languid and faint, losing their strength in reality, while they attribute that to the continuance of their fatiguing exertions. He who will make the corresponding experiments on two equal boats' crews, rowing in a heavy sea, will soon be convinced that water-drinkers will far outdo the others."

Rev. W. Scoresby, before a committee of the House of Commons, testified as follows: "My experience has been in severely cold climates, and there it is observable that there is a very pernicious effect in the reaction after the use of ardent spirits. I did not use them myself, and I was better, I conceive, without the use of them. I am well assured that such beverages as tea and coffee, or, I doubt not, milk and water, are in every way superior, both for comfort and health, for persons exposed to the weather, or other severity. Spirits are decidedly injurious in cold climates. The men who have been assisted by such stimulants, have been the first who were rendered incapable of duty. They became perfectly stupid, skulked into different parts of the ship to get out of the way, and were generally found asleep. In case of a storm, or other sudden difficulty, I should most decidedly prefer the water-drinkers to those who were under the influence of any stimulant.'

Dr. Rush says, in his "Medical Inquirer," "There cannot be a greater error than to suppose that spirituous liquors lessen the effects of cold on the body. On the contrary, they always render the body more liable to be affected and injured by cold. The temporary warmth they produce is always succeeded by chilliness.'

Backus gives some striking facts illustrating this point, which I will quote. "In the winter of 1796, a vessel was wrecked on an island off the coast of Massachusetts. There were seven persons on board. Five of them resolved to quit the ship during the night, and seek shelter on the shore. To prepare for the attempt, four of them drank a quantity of spirits, and the fifth drank none. They all leaped into the water: one was drowned before reaching the shore; the other four came to land, and, in deep snow and piercing cold, directed their course to a distant light. All that drank spirits failed, and stopped, and froze, one after another; the man that drank none reached the house, and about two years ago was still alive."

"A few years ago a brig from Russia, laden with iron, ran aground upon a sand bank near Newport, Rhode Island. The master was desirous to unload and get her off. The weather, however, was extremely cold, and none could be found to undertake the task, as the vessel was at a distance from the shore, covered with ice, and exposed to the full effects of the wind and cold. A packet-master of Newport, who abstained from the use of spirituous liquors, at length engaged to unload the brig, and procure his men to do the work. Six men were employed in the hold, which was full of water. They began to work with the free but temperate use of ardent spirits, supposing they would need it then if ever; but after two hours' labor they began to give out, chilled through. After having warmed and refreshed themselves, they proceeded to make another attempt, using cider only through the day. They now succeeded better, but still suffered much from the effects of the cold. On the second day the men consented to follow the direction of their employer, and drank nothing but milk porridge, made rich, and taken as hot as the stomach would bear it. Although the weather was equally as severe as before, they were, after this change in their diet, enabled to continue their work from four to seven hours at a time, and then come up from it not at all chilled. With this same beverage, handed round every half hour, they continued their work from day to day, with not one drop of intoxicating liquor, until the iron was all handed out and brought on shore. Not one of them had a finger frozen."

"In the winter of 1825 two vessels were coming into the harbor of New York during an extremely inclement night, the temperature being several degrees below the freezing point. The captain of one of these vessels supplied his crew with warm alcoholic drinks during their exposure, while that of the other dealt out nothing but hot coffee to his men. The result was, that on arriving next morning, a large proportion of the crew of the former vessel were severely frost-bitten, while that of the other wholly escaped, not a single man having suffered any injury from the cold." These facts were published in the New York papers at the time, and are within the recollection of many of our readers. (See Appendix to American edition of J. Pereira's Treatise on Food and Diet. Appendix by C. S. Lee.)

That alcohol *per se* is not nourishing, but poisonous, I have never known questioned except where some point is to be made, as in the late struggle for a license law in the Massachusetts legislature.

Professor Yeomans, of New York, in a very able paper on Alcohol and the Constitution of Man, says, "Chemical experiments have demonstrated that the action of alcohol on the digestive fluid is to destroy its active principle, the pepsin, thus confirming the observations of physiologists, that its use gives rise to the most serious disorders of the stomach, and the most malignant aberrations of the entire economy."

"It is evident that, so far from being the conservator of health, alcohol is an active and powerful cause of disease, interfering as it does with the respiration, the circulation, and the nutrition; nor is any other result possible." "Nothing can be more certain than that it is a powerful antagonist of the digestive process." "It prevents the natural changes going on in the blood." "It impedes the liberation of carbonic acid, a deadly poison." "It obstructs the nutritive and reparative functions." "It produces disease of the liver." "It has a powerful affinity for the substance of the brain, being, indeed, essentially a brain poison." If these effects do not prove alcohol poisonous, where shall we look for proof that any substance is poisonous? But experiment can never settle this question, nor any other question pertaining to vital chemistry. He who made man and knows how to keep him in repair, has plainly given us laws of nutrition, and, as in all other important matters, has fixed a penalty for the breach of His laws.

If alcoholic drinks are useful then, they are useful not on account of, but in spite of, the alcohol contained in them, and are useful in proportion as sugar, starch, and other nutritious principles, together with osmazome, predominate over alcohol; and thus we have a standard by which to test the value of alcoholic drinks. That article is best which contains the most agreeable osmazome and the least alcohol, the elements of nutriment being of little consequence, unless, as sometimes happens, the stomach will receive nutriment through the medium of aromatic beverages better than in any other combination. This, however, in my experience and observation in a practice of forty years, is never only a temporary expedient, and in cases of extreme debility, which give place to more substantial nutriment, containing no alcohol, the moment the digestive powers so react as to be able to bear them. It may therefore be desirable to have an analysis of the wines and other beverages in common use.

Wines.

European wines, in one imperial pint, contain, according to Lankester, —

	Water.	Alcohol.	Sugar.	Tartaric Acid.
Port,	16 oz.	4 oz.	1 oz. 2 grs.	80 grs.
Brown Sherry,	15½ oz.	4½ oz.	360 grs.	90 grs.
Pale Sherry,	16 oz.	4 oz.	80 grs.	70 grs.
Claret,	18 oz.	2 oz.	—	161 grs.
Burgundy,	17½ oz.	2½ oz.	—	160 grs.
Hock,	17¾ oz.	2¼ oz.	—	127 grs.
Moselle,	18¼ oz.	1¾ oz.	—	140 grs.
Champagne,.	17 oz.	3 oz.	1 oz. 133 grs.	90 grs.
Madeira, .	16 oz.	4 oz.	400 grs.	100 grs.

These wines are prepared from the juice of the grape by direct fermentation. The juice before fermenting is called "must.' Wines vary according to the flavor of the grape from which they are made, the sugar and acid they contain, and the degree of fermentation by which the sugar is changed into alcohol. Those with much sugar are called "sweet" wines; those with little, dry wines. To some wines sugar is added to correct their acidity; others are sweet because fermentation has not exhausted the natural sugar. On the degree of fermentation also depends the amount of alcohol. To Port Wine, Sherry, and Madeira, alcohol is added to give them strength; but not to Claret, Hock, and the light wines from Europe. The acid in grape wines is the tartaric, which forms an insoluble salt that collects on the wine-casks; and is the source of our cream of tartar and tartaric acid. Wines from apples are called cider, and those from pears are called perry; each having its distinctive taste from the osmazome of its own fruit.

Analysis of Distilled Spirituous Beverages.

	Water.	Alcohol.	Sugar.
Brandy,	9½ oz.	10½ oz.	80 grs.
Gin, best,	12 oz.	8 oz.	—
Gin, retail,	16 oz.	4 oz.	½ oz.
Rum,	5 oz.	15 oz.	—

Distilled spirits are made by applying heat to fermented liquors, and collecting the alcohol as it condenses in cold pipes and runs back into a receiver. Alcohol is thus obtained from molasses, from malt, from all the grains and fruits, and also from potatoes; and anything, indeed, which contains either starch or sugar, can be converted by fermentation into alcohol.

As it is employed in the arts in its concentrated form, it has no special flavor, and is then called "Spirits of Wine."

Gin is obtained from fermented grain, to which is added the berries of juniper, which give its characteristic flavor. It is sometimes flavored also with cinnamon, cloves, &c., and is then called "Cordial" or "Cordial Gin."

Whiskey is distilled from grain, mostly in this country from corn, and obtains its flavor from fusil oil, which gives it a peculiar smoky taste.

Rum is distilled from fermented sugar and molasses, which, very frequently, is flavored with pine apples. In New England it has been extensively made without the flavor of pine apples, and is known all over the world as New England Rum.

Brandy is distilled from wine, and its peculiar taste is imparted by the essential oil of the fruit from which it is distilled. This taste is, however, imitated by the use of sorrel and other vegetables that contain prussic acid.

Arrack is obtained from fermented rice, butternuts, and the sap of various species of palm.

Analysis of Beers and Ales.

	Water.	Alcohol.	Sugar.	Acetic Acid.
London Stout,	$18\frac{1}{2}$ oz.	$1\frac{1}{2}$ oz.	281 grs.	54 grs.
London Porter,	$19\frac{1}{2}$ oz.	$\frac{3}{4}$ oz.	267 grs.	45 grs.
Pale Ale,	$17\frac{1}{4}$ oz.	$2\frac{1}{2}$ oz.	240 grs.	40 grs.
Mild Ale,	$18\frac{3}{4}$ oz.	$1\frac{1}{4}$ oz.	280 grs.	38 grs.
Strong Ale, .	18 oz.	2 oz.	2 oz., 136 grs.	54 grs.

The above analysis of beers and ales is made from beverages containing no elements but those which are derived from malt, hops, and water, the alcohol being obtained from starch, which, in the process of malting, is changed into sugar, and then, in the process of fermentation, changed into alcohol, the sugar also coming mostly from starch, but partly from the barley, as it is found there, and is not all changed to alcohol by fermentation. The color and flavor of the different beers and ales is obtained by roasting, more or less, the malt.

Acidulous Drinks and Fruits.

That vegetable acids perform important services in the human system is evident from various considerations. They are found in almost all fruits and vegetables, and all nations, savage and civilized, make constant use of them in some form, and this has been true in ancient as well as modern times. Moses speaks of vinegar as being in common use in his day, and Boaz, smitten by the charms of "the Moabitish damsel that came back with Naomi out of the country of Moab," and desirous of expressing his appreciation of her kindness to her mother-in-law, said to her, "at meal time come thou hither and eat of the bread, and dip thy morsel in the *vinegar*." (Ruth ii. 14.) This universal appetite, however, only goes to show a demand of the system for some acid, but it does not prove the wholesomeness of vinegar as produced by the process of fermentation, as we shall see on further investigation.

It has been clearly proved by repeated experiments that some vegetable acid is necessary for the preservation of health, or, at least, that the complete abstinence from succulent vegetables or fruits, or their preserved juices, is the cause of scurvy — a disease which nothing will cure but the vegetable acids.

It is also proved that acids that are organized in fruits and vegetables are much more efficient in preventing or curing scurvy than acetic acid (vinegar,) or any other acid not thus naturally combined with esculent principles; indeed, it is certain that some such organized combinations are necessary either to prevent or to cure scurvy; and I think it is evident further that an abundance of these acids are furnished in organized food, so that if we took every day apples or other fruits, either green or preserved by desiccation, or exclusion from the air as in canned fruits, or ate with our meats every day plenty of potatoes, squashes, or other vegetables, we should need no vinegar, or any disorganized or concentrated acids. But with a diet deficient in these subacid and succulent principles, vinegar is, to some extent, beneficial.

Vinegar, like alcohol, is the product of fermentation, and, like alcohol, comes also from the same element. Sugar and starch, and everything that contains sugar or starch, will, by a fermentation called the vinous fermentation, produce alcohol, and by a second or acetous fermentation the same material will produce vinegar. At first sight we seem to have here an exception to the law, which I have elsewhere described, which makes all substances which are disorganized poisonous, in order to protect the system from their deleterious influences; but the exception is only apparent, and goes to illustrate still further the design of nature in making such elements only poisonous as are injurious if they could be admitted into the system. Vinegar is not admitted into the system as a principle to supply any organ with nutrition, or to furnish heat; but only as a chemical agent, to combine with the alkalies evolved from the liver and other excretory organs, to eliminate these effete elements from the system, and thus purify the blood and cleanse the system from the impurities which would otherwise remain in it. Vinegar, therefore, is merely a chemical agent, and, as such, useful in the absence of natural, organized acids, and not a nutritive principle; but alcohol is neither a chemical agent in the system nor a nutritive principle — the one being useful is received, if taken in proper quantities, without exciting the system to reject it, while the other, having no useful purpose to subserve, produces an excitement, and is expelled as an intruder. Still, vinegar is not an organized element, and not harmless.

Vinegar, therefore, is not necessary, and not useful as a beverage or a condiment, except in cases where the organized acids are not to be obtained, and cannot take the place of them either as a preventive or curer of disease. The liberal use of lemon juice, or tomatoes, or any other organized acid fruits will prevent the scurvy for an indefinite period, as has been proved on sailors in very long voyages; but we have abundant testimony that on similar voyages the liberal use of vinegar will not prevent this terrible disease. These experiments show that vinegar is not the form of acid naturally adapted to the requirements of the system, and that it should only be used when the acid fruits and succulent vegetables cannot be obtained.

The best vinegar in this country is obtained from the cider of apples, and in farming communities each householder makes his own vinegar by exposing a barrel partly filled with cider to the sun and open air; fermentation is started by a little of the mucilaginous coat or skin which forms on the surface of vinegar, called "mother," and which consists of myriads of exceeding minute vegetables, in which are generated the microscopic animalcules called eels, which may be the cause of some of our obscure diseases; at least, there is no evidence that the heat of the stomach or the gastric juice is capable of destroying them; and no heat short of boiling water will kill any animalcule, and we seldom use vinegar except on cold food. There is evidence that some animalcules are capable of resisting the gastric juice, and of living, and growing, and producing many troublesome diseases in the stomach and intestine canal. It is at least safest, therefore, to depend for our necessary acids on the fruits and vegetables, of which we can always procure an abundance at an expense vastly less than that of the superabundant carbonates which we waste in using flour, sugar, and butter, which are not only wasted, but which produce a state of the system *that makes these acids necessary*. If we should give up all superfluous carbonates, therefore, we should need no vinegar, as all necessary acids would be furnished in the food that would naturally take the place of these articles. In England, vinegar is mostly made from malt or new barley subjected to acetous fermentation, which produces the same acid, the acetic, as that of the cider vinegar; but to give it life and character a little sulphuric acid is allowed in England, by law, to be added. This is much more injurious than acetic acid, having a stronger affinity for many elements in the system, especially for the lime in the teeth, than acetic acid.

Vinegar in large quantities is known to be injurious, and in the long-continued use of small quantities; by disturbing the functions of digestion and preventing the proper formation of chyme, it stops the supply of nutriment, and produces paleness and wasting. On this account it is in repute among such silly young ladies as prefer to be pale and sickly, rather than rosy and plump, and many such, by its constant use, succeed most lamentably in reducing themselves to their own foolish standard of beauty.

The following case is quoted from Portal by Pereira: "A few years ago a young lady, in easy circumstances, enjoyed good health; she was very plump, had a good appetite, and a complexion blooming with roses and lilies. She began to look upon her plumpness with suspicion; for her mother was very fat, and she was afraid of becoming like her; accordingly she consulted a woman, who advised her to drink a small glass of vinegar daily. The young lady followed her advice, and her plumpness diminished. She was delighted with the success of the remedy, and continued it for more than a month. She began to have a cough; but it was dry at its commencement, and was considered as a slight cold, which would go off. Meantime, from dry it became moist; a slow fever came on, and a difficulty of breathing; her body became lean and wasted away; night sweats, swelling of the feet and legs succeeded, and a diarrhœa terminated her life. On examination all the lobes of the lungs were found filled with tubercles, and somewhat resembled a bunch of grapes.'

Now that fruits can be so well kept by simply canning them and excluding the air, and such abundance and such a variety of fruits are now produced, we can have, at an expense very trifling compared with their value, all the acids the system requires, at all times of year, in a form at the same time agreeable and wholesome; and have, therefore, no necessity for using acid in the form of vinegar, which certainly has no advantages over fruits and vegetables, and which has, to say the least, some very suspicious characteristics as a sanitary agent. The expense of one of the half dozen barrels of flour which almost every family wastes in the year would do much towards supplying the necessary acids of any family, if judiciously expended in pleasant sour apples or good ripe tomatoes, with cans or bottles to keep them in, and dried apples from carefully selected fruit. Let every family have these agreeable acids on their table every day, morning and noon, during the whole season in which the summer fruits are absent, and let every member, young and old, eat all they will, and there would be no necessity for vinegar, or any other objectionable acid, which a morbid appetite only will crave.

Inquire into the habits of the school-girls who flock to the grocers at every recess, for lemons, pickled limes, and cucumbers, and you shall find every one of them living on fine flour, butter, sweet cakes, and confectionery, with no natural acids to eliminate these carbonaceous principles from the system; or if they do have any of these acid fruits, they are taken with the last meal at night, when the powers of digestion are exhausted, and not able to get from them their appropriate elements; and taken then, perhaps, in the shape of some jelly, between two layers of rich cake, the carbonaceous elements of which are more than sufficient to counteract any benefits that might be derived from the acid.

Fruit, as I have elsewhere explained (see page 211), and in fact every other class of food, is most wholesome in the condition in which it has the richest and most agreeable flavor. Fruits have the best flavor uncooked. There may be some exceptions, in which the osmazome is best developed by cooking, of which, to my taste, the tomato is an example; but apples, peaches, pears, and almost all the fruits and berries, have their richest flavor developed by Nature's own culinary process; and science has now devised so many means of preserving fruits, and all other articles of food, that no good reason can be given why we may not, at all times of year, have a constant supply of natural acids in a variety sufficient to satisfy the most fastidious tastes. And it is to be hoped the time will speedily come when all fruits, vegetables, or meats preserved in vinegar, salt, sugar, smoke, or alcohol, will be discarded as being unnatural and unwholesome articles, either as necessaries or luxuries of life, either imparting, as they all do, injurious elements, or chemically changing or withdrawing the nutritive elements, or at least changing their relative proportions, so as to be unfit for digestion.

Elements of Food Lost in Cooking.

In another chapter (page 16) it is shown that food must contain three classes of elements, those which will feed the brain and nerves, those which feed muscles and tissues, and those which furnish heat and fat. These elements may be found combined so as to be soluble in water, cold or hot, or both, and therefore, if cooked in water, are lost. The muscle-feeding elements of all meats and fish consist in fibrin and albumen (see tables, page 77), and in the flesh of all young animals, as veal and lamb, and in all kinds of fish albumen predominates.

Albumen is soluble in cold water, but coagulates and becomes solid in hot water. For example, the white of an egg, which is albumen, may be dissolved and lost in cold water, but on being dropped into hot water immediately coagulates and becomes insoluble. All meats, therefore, lose a portion of their nutrition, and some a very large portion, by being soaked in water, or by being put into cold water to boil, and if boiled at all, should be put into boiling water, unless the water in which they are boiled is to be saved as soup. In that case, the flavor and nutritive properties of the soup are much better by being first soaked in cold water and boiled in the same water.

Besides albumen, other valuable elements are lost in water, whether hot or cold, as is shown by chemical analysis. If the flesh of animals or fish be cut up fine, and washed and filtered, the water is found to contain not only the albumen, but the osmazome which gives the flavor, the phosphates which feed the brains and the nerves, and all the soluble salts of the blood, while there remains nothing nutritious but fibrin and the insoluble salts, which constitute the basis of bones. By boiling, instead of roasting or frying meats or fish, we lose therefore that which gives them relish, much of the true nourishment, and some other valuable elements.

On the other hand, by soaking in cold water, and boiling gradually, and retaining the liquid, we get all the valuable properties of meat. The liquid contains all the soluble properties, and indeed all the important properties necessary for sickly or sedentary persons; and the solids contain the fibrin and lime which are wanted for muscular power and strength of sinew and bone. Another practical error in regard to soups, relates to the nutrition in the gelatinous portions of soup obtained from the cartilages and tendons of the joints of meat, which are usually selected under the impression that the more gelatinous the more nutritious the soup, whereas it is found to be true that gelatine is in no sense nutritious. Its only use in the living system seems to be mechanical, forming protection to the joints as a kind of cushion, and attaching the muscles to the bones, and, as food, answering as waste material to keep the bowels in action. This is true of all animal jellies, as calf's foot, isinglass, &c.

Portable Soup, or Extract of Beef.

Thirty-two pounds of beef, without bone or fat, if put into cold water, gradually heated and boiled for a long time, and finally strained, and the liquid boiled down to dryness, will make one pound of true extract of beef, containing all the nutritive properties necessary for one who is sickly or sedentary. One ounce of this extract, with a little salt, will make a quart of soup or beef tea, which is rich and palatable, retaining the natural flavor of well-cooked beef, and which may be otherwise seasoned to suit the taste. This extract will keep, in a dry place, for an indefinite time, and if made, as it may be and is in the Western States where beef is cheap, need not be very expensive; and by the saving in expense of transportion, might be made a profitable way of disposing of beef.

It is kept by almost all apothecaries, and if it could be depended on as genuine, might be the best, surest, quickest, and most economical mode of supplying wholesome animal food to the sick and feeble; but uufortunately a cheaper and far inferior article is sold under the same name, which contains only enough of the genuine extract to give it flavor, all the rest being gelatine, which contains no nourishment.

The genuine may be known from the spurious article by the following test: Of the pure extract about eighty per cent. is soluble in eighty-five per cent. alcohol, while that made from gelatine will yield to that menstruum only from four to five per cent.

Portable soup might be used, and to some extent is used, for provisioning ships on long voyages, where fresh meat and vegetables cannot be had. This idea was first suggested by Professor Liebig, who ascertained by chemical analysis that the brine in which beef is salted contains the soluble constituents of the beef, even to a greater extent than concentrated soups. Salted beef, therefore, especially after it is boiled, contains nothing but fibrin, which is not much wanted in sedentary life, as that of a sailor on a long voyage. With such meat and hard bread let us see what he gets and what he loses of necessary elements.

He gets in the meat fibrin, which is but little wanted while inactive, and some insoluble salts, as phosphate of lime, which are needed also only in proportion to active exercise, and in the hard-tack he gets little but starch, which contains carbonates for breathing, but almost no food for the brain and nervous system, and none of the acids and alkalies that are necessary to eliminate the impurities from the blood and give life and activity. The system, consequently, becomes dormant and inactive, and filled with scorbutic sores, and other diseases, such as are induced by food destitute of the principles found in fresh meats and vegetables, especially if used without taking much muscular exercise.

Another excellent substitute for fresh food is found in desiccated vegetables, which saved many a life from diarrhœa and other scorbutic diseases in the late Southern rebellion, and which are still more useful at sea, where fresh food cannot be obtained. Of these, potatoes are best, but carrots, turnips, pumpkins, and squash are all good, and many families dry them for use in that season of the year in which green vegetables are not easily kept fresh.

Beef Tea.

The best and quickest mode of preparing nourishing beef tea is to chop up lean beef into fine pieces, first broiling it lightly to develop the osmazome, add to it an equal weight of cold water, slowly heat to boiling, and after boiling three minutes strain and season to taste. In this manner the elements are retained and the natural flavor, and a soup is obtained of as much strength and better flavor than by boiling the same piece of meat for hours.

Acidulous Drinks.

The juices of all fruits, and some vegetables, contain acids which are useful in eliminating from the system various alkaline impurities, by combining them and making them soluble, and they may have some other uses in the system which are not perfectly understood; but they never enter the system as an element of nutrition, but seem to act on chemical, or perhaps chemico-vital principles. Different fruits contain different acids, as malic, oxalic, tartaric, citric, &c., but so far as is known they are all alike useful.

Oxalic acid exists in a number of plants, as common sorrel, wood sorrel, &c., but the only plant employed at the table containing this acid is garden rhubarb, or pie-plant, whose leaf-stalks are used for tarts, puddings, sauce, &c., which are perfectly wholesome, notwithstanding the fact that oxalic acid in a disorganized state is very poisonous; which is another example of the principle I have endeavored to bring out, that an element may be wholesome or poisonous as it is or is not organized in some vegetable. The oxalic acid of the shops is obtained by the chemical action of nitric acid on sugar or molasses, changing them from nutriment to poison.

Citric acid.—This acid is a constituent of the juice of the lemon, the orange, the lime, the citron, the shaddock, and other fruits, which owe their sourness to this acid. The cranberry, the red currant, the strawberry, the raspberry, the cherry, the bilberry, and the tamarind also contain it, mixed with an equal quantity of malic acid.

Tartaric acid.—This is the acid of grapes, tamarinds, and pine-apples. It also exists, in combination with potash, as bitartrate of potash, or cream of tartar, in grapes, tamarinds, and mulberries, which, collecting on the sides of the cask during the fermentation of wine, is termed crude tartar, or argol. This cream of tartar, and tartaric acid, as it is called when purified and separated from the potash, is much used as a substitute for the juice of the lemon, and if it be not disorganized in the process of purification, may not be objectionable.

Malic acid, or acid of apples, is very extensively distributed in the vegetable kingdom, being found in apples, pears, quinces, plums, apricots, peaches, cherries, gooseberries, currants, strawberries, raspberries, blackberries, pine-apples, barberries, elderberries, grapes, tomatoes, tamarinds, and other fruits, and is frequently accompanied with citric acid; and of course it is the acid of wine, cider, and beer in an unfermented state.

These acids exist in most of the fruits, in connection with a principle called pectine, which means coagulum, which gives them the property of becoming gelatinous, or of making jellies. Jellies may be made of currants (red, white, and black), apples (both sweet and sour), pears, quinces, plums, apricots, the cucurbitaceous fruits (as melons and cucumbers), gooseberries, tomatoes, oranges, lemons, guava, and tamarinds. The carrots, turnips, beets, onions, and other vegetables, also contain pectine and pectic acid. By boiling with malic acid pectine is changed into an acid that is soluble in water, and the vegetable albumen contained in fruits assists also in making the change; and this explains why the juice of a fruit, by prolonged ebullition, often loses its property of gelatinizing (or, as the cooks say, *why* it will not come). Another reason why jelly will not come is, that fruit is used before it is perfectly ripe. Unripe fruit contains very little pectine, but it is formed by the action of the acids on the pulpy matter while in the process of ripening; and if the fruit be gathered early, this process goes on afterwards till it becomes soft. Currants, for example, will not make jelly when they first turn red. It is then that the pectine begins to form, and this formation continues till decomposition commences. Vegetable jellies afford the means of making agreeable acidulous drinks, and are useful in sickness. They afford but little nourishment, but are not objectionable.

Animal jellies, as calf's-foot, &c., are nearly worthless, containing no nourishment, and no flavor except what is imparted to them while being made.

Acetic acid, as I have explained, is the product of fermentation. It is not found in any sound fruit, and not in the juices of any of them, as wine, cider, &c., till they have first undergone the process of vinous fermentation, which produces alcohol, and the acetous fermentation, which changes the alcohol to vinegar or acetic acid. Whenever, therefore, fermentation is prevented, as it can be in preserving houses such as have recently come into use, we might have in the juices of the grape, apple, pear, and indeed of any fruits or berries, the most delicious beverages, containing acids in their natural state, and other elements, refreshing and useful both in health and sickness, without the disorganized and unhealthy principles of alcohol and vinegar.

This thought has not before suggested itself to my mind; but it impresses me as very important in connection with the use of the preserving house. Let us examine this subject, and see what is in it.

Fermentation.

All matter is under the control of vital or chemical laws. While life continues, either in animal or vegetable matters, vital law is supreme, but when life ceases, chemical law assumes control; and in all matter that has had life chemical law manifests itself in fermentation, either vinous, acetous, or putrefactive, and the conditions in which these chemical changes take place are the same in each. There must be present, and in contact with, or a part of, the substance to be fermented, oxygen, hydrogen, carbon or nitrogen, or both. And these must be in an atmosphere above a temperature of 32°, and to have the process go on with any degree of rapidity the temperature must be above 60°.

A well-constructed preservator prevents the presence of oxygen and hydrogen, and keeps down the temperature almost to 32°, and thus three of the conditions on which fermentation depends are wanting; and experiment has shown that it effectually prevents the putrefactive fermentation. The inference, therefore, is irresistible, that it will prevent the vinous and acetous fermentations. Why not, then, every man have his cask of Catawba or Isabella wine, or his cider, from the most fragrant and delicious apples, or pears, or the juices of currants, cherries, gooseberries, strawberries, raspberries, blackberries, pine-apples, peaches, quinces, or any other fruits? and, placing each in his preservator, with an arrangement to draw them through the side, have, the year round, his choice of fifty different beverages, all of which would be delicious and wholesome, containing in their natural condition the acids which the system requires, without the addition of alcohol, or vinegar, or any other disorganized or deleterious elements?

DIET IN SICKNESS.

Having examined the laws that are to guide us in the selection of food in health, for the different conditions, employments, and temperatures in which it is our lot to live, let us now see if there may be considerations which will be of service in sickness.

The first hint in regard to food in sickness, we have in the fact that the appetite is taken away, which is a clear intimation that food will no longer be beneficial, but injurious; and if sudden sickness occur while the stomach contains food, or if a serious accident occur, which would be followed by inflammation, Nature guards against the evil by causing the stomach to throw off the food, and thus stop the supply of nourishment that would keep up the inflammation.

A man falls on his head, or accidentally receives a blow that jars the brain, or a wheel runs over his foot and crushes it, or any other serious accident occurs, that would naturally result in inflammation, and the first efforts of Nature for protection and cure are seen in vomiting, which relieves the stomach of all food, and thus cuts off the supply of blood from the affected organ. Can we have a clearer intimation that in such cases all food should be withheld?

In the first stage of any serious disease we have, therefore, no question of duty, and can see the absurdity of urging sick friends to eat, when food is not only not desired, but absolutely loathed, as it generally is in all serious illness; and we find that such advice, if followed, is always succeeded by evil consequences.

In the mean time there is generally strong thirst, that is best satisfied with pure cold water; and this also is a clear intimation that pure cold water is the best thing, and the only thing, that Nature in such cases requires; and I have never seen a case in which the slightest harm came from gratifying this demand to the fullest extent, — not by filling the stomach at once, especially with very cold water, but by gratifying the desire in a more effectual way: by constantly sipping it, however cold it may be. And I have indulged many a patient, and have found great advantage in keeping up, without five minutes' cessation, the cooling influence of cold water on the tongue and in the stomach.

After a time, longer or shorter, according to the violence of the fever, Nature becoming exhausted, demands a little nutriment; but the stomach cannot digest food for want of gastric juice.

Dr. Beaumont had for many years a young man who had the stomach opened by a musket shot, which carried away the surrounding integuments and left it open for inspection, by simply raising a kind of trap-door made by folds of the integuments that remained. This gave him an opportunity, which no other physiologist ever had, of witnessing the processes of digestion under all circumstances, in sickness or health, and noting many phenomena not before known in regard to the use of the gastric juice, and its effects on different substances, liquids and solids, the time required for digesting different articles, the first process of digesting liquid nourishment, &c.

Dr. Beaumont says, "In febrile diseases very little or no gastric juice is secreted. Hence the importance of withholding food from the stomach in febrile complaints. It can afford no nourishment, but is actually a source of irritation to the organ, and consequently to the whole system." In another place he says, "The drinks received are immediately absorbed, or otherwise disposed of, none remaining in the stomach ten minutes after being swallowed. Food taken in this condition of the stomach remains undigested for twenty-four or forty-eight hours, or more, increasing the derangement of the whole alimentary canal, and aggravating the general symptoms of the disease.' The first process of digesting liquid food is to absorb the liquid and leave the solid in the stomach; indeed, both liquid and solid food is digested by first being brought into a semi-fluid state. If too liquid, by the process just described of carrying off the liquid; if too solid, by bringing into the stomach from the system, unless they are supplied from without, the liquids necessary. But there are some forms of nourishment which are absorbed without digestion, and go directly into the system to supply the demands of nature. Of this class of nutritive articles in common use, are barley-water, toast-water, beef-tea, and infusions of any of the grains.

In all of these articles the elements abstracted and ap propriated are evidently the nitrates and soluble phos phates, the carbonaceous elements not being soluble, and the only carbonaceous or heat-producing element that seems capable of being directly appropriated to the supply of heat without digestion is sugar.

Here, then, we have a clear indication of the diet which nature requires in febrile diseases — and these indications are corroborated by the natural appetite. At first, there is a loathing of everything but pure cold water; and anything but cold water, even barley-water, is disagreeable to the stomach. Then, after a while, a little barley or toast-water is agreeable and refreshing; and then, after a little longer time, the luscious fruits are relished, and the sugar in them is appropriated, without taxing the digestive powers, to sustaining the necessary heat, and checking the absorption of fat. At first the heat is supplied from the absorption of fat from the system, and the patient rapidly loses fat and becomes emaciated, the adipose matter of the body being absolutely burned up to keep up the heat while the digestive powers are prostrated, and unable to digest the farinaceous food on which the system generally depends. After a while the gastric juice is secreted sufficient to digest starch, which next to sugar is the most digestible carbonaceous food, having only to undergo the process of being converted by the saliva and gastric juices into sugar, as it always must be to be prepared to supply the lungs with fuel; and then the appetite will demand gruel made from some of the farinaceous grains, and thus we shall find, by watching the appetite, that it will call for the right thing at the right time, as long as its calls are heeded; but if physicians or nurses act on their own judgment, and give farinaceous food before the system is ready for it, the disturbance and flatulence produced will prevent the natural calls, and we lose all the advantage of the natural appetite. Adopting these ideas more than twenty-five years ago, I have never since refused a patient a little of anything which the appetite really demanded, even to the most indigestible substances, as cucumber, dandelion greens, cheese, &c., and have never seen a case in which they were injurious even temporarily. A careful discrimination must, however, be made between the fitful whims by which a perverted appetite will by turns desire a thousand things, and lose it again before they can be obtained, and the steady desire by which it craves the same thing hour after hour and day after day if not obtained, and judgment must always be used in regard to the quantity given at first; at least I have always feared the consequences of indulging the appetite to the fullest extent after long abstinence, but have been astonished at the impunity with which it may be indulged for any particular article of food, however inappropriate it might seem to be.

I had at one time the care of an old nurse sick with pneumonia, and so sick that for weeks she would take scarcely a particle of nutriment, and for a long time was reduced so low as not to be expected to live from one day to another. I told her, as I had frequently told patients of whom she had the care, to take a little of anything the appetite demanded, but gave no particular directions. One day, after an abstinence from food for nearly four weeks, I found her decidedly better, and for the first time able to talk and exhibit her usual vivacity. She told me that soon after my visit, twenty-four hours before, she felt a strong desire for a cucumber with salt and vinegar, and ordered her daughter to get a good large one, which she ate with a feeling that it was just the thing required; and, not being satisfied with one, she obtained another, and another, till she had eaten three or four, and she assured me she felt not a pain or any inconvenience from the repast, and from that day she took other food and rapidly recovered. There was less danger, indeed, from that indigestible article, which contained very little nourishment, than would have been from eating immoderately of more concentrated nourishment, though it might have been much more digestible.

This statement is illustrated by another case: —

A young man, recovering from a fever, seventeen miles from home, was urged by his parents to go home before he had been able to take but very little nourishment. Contrary to advice, while stopping to rest seven miles from home, being overcome by the demands of his appetite, and having no one to restrain him, he obtained and ate heartily of beefsteak, potatoes, bread and butter, &c., and in one hour was dead. A restoration so suddenly of the natural elements of the blood probably produced apoplexy. These cases forcibly illustrate the statement on page 128, that any article of food may be wholesome or poisonous according to the circumstances under which it is taken. The cucumber was wholesome — the beefsteak a deadly poison.

These cases also show that while the appetite may be trusted in regard to the article to be eaten, it cannot be trusted in regard to the quantity, especially after the system has been exhausted by disease; so that though the unperverted appetite may in health be trusted with natural food to the extent of its demands, in sickness it can only be trusted in relation to the appropriate article to be eaten, and not in regard to the quantity required.

We therefore need some dietetic rules by which to regulate the diet of the sick. In almost all hospitals patients are divided into classes, and have a diet for each under different names.

In St. Thomas's Hospital of London

They have

	Full diet.	Milk diet.
Breakfast.	2 pints beer, 14 oz. bread, water gruel.	12 oz. bread, 1 pint of milk.
	Dry diet.	**Fever diet.**
	14 oz. bread, 2 pints of beer, water gruel.	12 oz. bread, 2 pints of beer.

Dinner.	Full diet. ½ lb. beef, when dressed, twice a week; 4 oz. butter, or 6 oz. cheese, thrice a week; 1½ lb. mutton, when boiled, twice a week.*	Milk diet. 1 pint of milk four times a week; rice puddings thrice a week.
	Dry Diet. 4 oz. butter four times a week; rice pudding and 4 oz. butter thrice a week.	Fever diet. ¾ lb. beef for tea.
Supper.	Full diet. 1 pint of broth, four times a week.	Milk diet. 1 pint milk.

In London Hospital

They have per day

Breakfast.	Common diet. 12 oz. bread, 1 pint porter men, ½ pint porter women; gruel.	Middle diet. Same as common.
	Low diet. 8 oz. bread; gruel.	Milk diet. 12 oz. bread; gruel
Dinner.	Common diet. 8 oz. mutton, with potatoes, five times a week; 8 oz. potatoes and soup, with vegetables, twice a week.	Middle diet. The same, except 4 oz. meat instead of 8 oz.
	Low diet. Broth.	Milk diet. 1 pint milk.

* All the London hospitals have, when ordered by the physician, in addition, chops, steaks, fish, wine, spirits, porter, &c.

	Common diet.	Middle diet.
Supper.	1 pint of broth.	–
	Low diet.	**Milk diet.**
	Gruel or broth.	1 pint milk.

In St. Bartholomew's Hospital

They have

	Common diet.	Broth diet.
Daily.	Milk porridge, 12 oz. bread, 6 oz. mutton or beef, 1 pint broth with peas or potatoes, four times a week; 2 pints beer for men, 1 pint for women; 1 oz butter thrice a week.	Milk porridge, 12 oz. bread, 2 pints broth, 1 pint beer, 1 oz. butter.
	Thin, or fever diet.	**Milk diet.**
	Milk porridge, 12 oz. bread, 1 pint milk, with tapioca, arrow root, sago, or rice, as may be prescribed; barley water.	Milk porridge, 12 oz. bread, 2 pints milk, with tapioca, arrow root, sago, or rice; barley water; 1 oz. butter; bread pudding 3 times a week when ordered.

In Guy's Hospital

They have

	Full diet.	Middle diet.	Low diet.	Milk diet.	Fever diet.
Daily.	14 oz. bread, $1\frac{1}{2}$ oz. butter, 1 qt. table beer, 8 oz. meat when it is dressed.	12 oz. bread, $1\frac{1}{2}$ oz. butter, 1 pint table beer, 4 oz. meat, and $\frac{1}{2}$ pint broth.	12 ounces bread, 1 oz. butter, tea and sugar.	12 ounces bread, 1 oz. butter, 2 pints of milk.	6 ounces bread, 1 oz. butter, tea and sugar.

For each diet, gruel or barley water, as required.

$\frac{1}{2}$ lb. beef for beef tea, or arrow root, or sugar when ordered.

At St. George's Hospital

They have

	Extra diet.	Ord'y Diet.	Fish diet.	Fever diet.	Broth diet.	Milk diet.
Daily. . .	12 oz. bread, 2 pints beer for men; 1 pint of beer for women.	12 ounces bread, 1 pt. beer.	12 ounces bread.	12 ounces bread, barley water ad libitum.	12 ounces bread.	12 ounces bread.
Breakfast.	1 pint tea, 1½ pints milk.	1 pt. tea, ¼ pt. milk.	1 pt. tea, ¼ pt. milk.	1 pt. tea, ½ pt. milk.	1 pt. tea, ½ pint milk	1 pt. tea, ¼ pint milk
Dinner.	12 oz. meat, with bone, roasted, 4 days; boiled, 3 days; ½ lb. potatoes.	6 ounces meat, ½ lb. potatoes.	4 oz. plain boiled white fish, as plaice, haddock, flounders	Arrow root, &c., as directed.	1 pt. br'th, 6 ounces light pudding.	1½ pints rice, milk 4 days, ½ lb. bread or rice pudding 3 days.
Supper. . .	1 pint gruel, ¼ pint milk.	1 pt. gruel, ¼ pint milk.	1 pt. gruel, ¼ pt. milk.	1 pt. tea, ¼ pint milk.	1 pt. gruel, ¼ pint milk.	½ pt. milk.

In Westminster Hospital

They have

	Full diet.	Middle diet.	Low diet. Fixed.	Low diet. Casual.	Spoon, or fever diet.	Incurables diet.
Daily. . .	12 oz. bread.	10 ounces bread.	½ pound bread.		¼ pound bread.	¾ lb. bread, ½ lb. meat, ½ lb. potatoes, ¼ pt. milk, 1 pt. porter.
Breakfast.	1 pint milk porridge, or rice gruel.	1 pt. milk porridge, or thin gruel.	1 pt. tea, with sugar and milk.		1 pt. tea, with sugar and milk.	
Dinner. . .	½ lb. meat, roasted, broiled, or chops; ¾ lb. potatoes.	¼ lb. meat, roasted or boiled, or chops; ¾ lb. potatoes.	No fixed diet.	1 pt. broth or ½ lb. bread, or rice puddings, or 1 pt. beef tea, or fish	Barley water.	
Supper. . .	1 pint milk porridge, or rice gruel.	1 pt. milk porridge or gruel.	1 pt. tea, with sugar and milk.		1 pt. tea, with sugar and milk.	

In the Middlesex Hospital

They have

	Meat diet.	Soup diet.	Milk diet.	Simple diet.	Cancer diet.
Daily. . . .	12 oz. bread.	12 ounces bread.	12 ounces bread.	6 oz. bread.	12 oz. bread, $\frac{1}{2}$ lb. meat, $\frac{1}{2}$ lb. potatoes, 1 pt. milk.
Breakfast.	1 pint milk.	1 pt. milk.	1 pt. milk.	1 pt. barley water.	
Dinner. . .	Physicians' Patients. $1\frac{1}{2}$ lbs. potatoes, 4 oz. dressed beef or mutton, roasted and boiled, alternately, 4 days; 4 oz. meat in soup 3 days. Surgeons' Patients. $\frac{3}{4}$ lb. potatoes, 4 oz. dressed beef or mutton, roasted and boiled alternately.	1 pt soup, made with 4 oz. beef, alternately with 1 pt. of broth. with barley water.	$\frac{1}{2}$ pint milk with rice puddings four days, and batter pudding three days.	1 pt. gruel.	
Supper. . .	1 pt. gruel alternately with 1 pt. barley water.	1 pt. gruel.	$\frac{1}{2}$ pt. milk, or 1 pint gruel.	1 pt. gruel or barley water.	

In King's College Hospital

They have

	Full diet.	Middle diet.	Milk diet.	Low diet.	Fever diet.
Daily. . . .	1 pint beer, or $\frac{1}{2}$ pt. porter; 14 oz. bread.	14 oz. bread.	1 lb. bread.	8 oz. bread.	
Breakfast.	1 pt. milk porridge.	1 pint milk porridge.	1 pt. milk.	1 pt. gruel.	1 pt. gruel
Dinner. . .	$\frac{1}{2}$ lb. meat, $\frac{1}{2}$ lb. potatoes.	$\frac{1}{4}$ lb. meat, $\frac{1}{2}$ lb. potatoes.	1 pt. milk.	1 pt. broth.	2 pts. barley water.
Supper. . .	1 pt. milk porridge.	1 pint milk porridge.	1 pt. gruel.	1 pt. milk porridge.	1 pint milk porridge.

In North London Hospital

They have

	Full diet.	Middle diet.	Low diet.	Milk diet.
Daily.	16 oz. bread, $\frac{1}{4}$ pt. milk, $\frac{1}{2}$ lb. meat, and $\frac{1}{2}$ lb. potatoes, four days; 1 pint of rice or soup three days.	16 oz. bread, $\frac{1}{4}$ pt. milk, 1 pint soup or rice.	8 oz. bread, $\frac{1}{4}$ pt. milk, oatmeal gruel.	17 oz. bread, 2 pints milk.

According to Pereira, from whose treatise on dietetics the above tables are taken, and who was connected with one of these hospitals, these several diets are employed for the following reasons : —

Full, Common; or Meat Diet. — "On many occasions where it is desirable to restore or support the powers of the system, patients are permitted to satisfy their appetite for plain vegetable and animal food. In many indolent diseases, in scrofula, in some affections of the nervous system, as chorea and epilepsy, and in the stage of convalescence after acute maladies, &c., this kind of diet is frequently directed. In these cases beer and sometimes wine are permitted, and spirit is occasionally required. In some diseases of, and accidents occurring in confirmed drunkards, it is frequently found injurious to withhold the stimulus to which the patient's system has been long accustomed, and thus wine, gin, rum, or brandy are ordered according to circumstances.'

This full or common diet is in general founded, I think, upon correct general principles, as understood at the time of its adoption ; but in the light of some new scientific revelations might be greatly improved.

For example, in each table of full diet for all the London hospitals is given from twelve to sixteen ounces of bread, and from the remark of Pereira, page 149, that "the fine bread, prepared from flour only, is the most nutritive and digestible," I conclude that fine white bread is the article prescribed, and this conclusion is favored by the remark on the same page, that "notwithstanding that bread is denominated the *staff of life*, alone it does not appear to be capable of supporting prolonged human existence. Boussingault came to this conclusion from observing the small quantity of nitrogen which it contains; and the reports of the inspectors of prisons, on the effects of diet of bread and water, favor this notion."

These remarks are true of flour bread, but not true of bread made from wheat in its natural state, as is seen by analysis, page 24. That a great improvement in this diet would be made by substituting unbolted wheaten bread, or cracked wheat in part, I think will not be disputed by any one who will consider the facts already referred to. (See pages 26 and 27.) It is difficult also for us in Boston, who have pure water, and have never seen beer or porter used with meals to any extent, in sickness or health, to understand the necessity or advantage of giving in sickness two pints of beer to men or one and a half pints to women habitually, especially as in almost all kinds of sickness patients desire to return to primitive food and drinks, whatever their habits when well, and prefer pure water; but with such water as the best that can be furnished with their best arrangements in any hospital in London, we should realize the necessity of some beverage which would at least cover up the taste and smell of the water. Considering, therefore, the advantages of pure water which Boston possesses, and the little excuse we have for giving any substitute, our use of alcoholic beverages is much more obnoxious to criticism than that of any hospital in London. By the diet list it will be seen that no alcoholic beverages are given out regularly; but by the superintendent's report of disbursements, we see that in the year 1866 the sum of seventeen hundred and forty-nine dollars and seventy-seven cents was paid out for liquors, and seven hundred and seventy-one dollars and eighty-one cents for ale and porter — twenty-five hundred and twenty-one dollars and fifty-eight cents. Nearly fifty dollars a week for one hundred and twenty-eight patients.

Now, considering the effects of alcoholic drinks on the human system, according to the views of Professor Carpenter, who is the standard authority in the college under whose auspices this hospital is conducted, I venture the assertion that less than one dollar a week would cover the expense of alcohol in all forms in which it would be of any essential service to the patients. Carpenter says, in his Physiology, page 77, "The operation of alcohol upon the living body is essentially that of a *stimulus*, increasing for a time, like other stimuli, the vital activity of the body, and especially that of the nervo-muscular apparatus, so that a greater effect may often be produced in a given time under its use than can be obtained without it, but being followed by a corresponding depression of power, which is the more prolonged and severe in proportion as the previous excitement has been greater. Nothing, therefore, is in the end gained by their use, which is only justifiable where some temporary emergency can only be met by a temporary augmentation of power, even at the expense of an increased amount of subsequent depression, or where (as in the case of some individuals whose digestive power is deficient) it affords aid in the introduction of aliment into the system which nothing else can so well supply. These exceptional cases, however, will be less numerous in proportion as *due attention is paid to those other means of promoting health which are more in accordance with nature.*"

Will any physician contend that from seventy to one hundred applications of stimuli are necessary daily to "goad" the flagging powers of nature in these one hundred and twenty-eight patients up to their duty? A stimulus is literally a goad, and, according to Carpenter, and every other sensible physiologist, alcohol is a stimulus, and is never to be used only as a discreet horseman would use a goad or a whip when other inducements fail to excite the necessary exertion; and will any one contend that "these exceptional cases" in a year are so numerous as to require an expense to meet them of twenty-five hundred and twenty-one dollars and fifty-eight cents?

But the expense, it seems to me, is a trifle too insignificant to be mentioned (except as a means of estimating the extent of the practice) compared with other evils resulting from such practice. Professor Jacob Bigelow, in a lecture to a class of young men in Harvard Medical School, in 1825, of which I was one, uttered words on this subject that have so influenced my practice, that in forty years I have never used or recommended as much alcohol to be taken internally as is prescribed in the Boston City Hospital in one week; and while I have the pleasure of knowing that I never made a drunkard by precept or example, I have equal assurance that no patient of mine has ever had an additional pain or an additional hour of sickness for the want of alcohol in any form.

To quote again Dr. Bigelow: "Alcohol is highly stimulating, heating, and intoxicating, and its effects are so fascinating, that, when once experienced, the danger is that the desire for them may be perpetuated. Many patients have become gradually and imperceptibly intemperate under the sanction and guidance of a physician.'

These assertions are denied only by those whose practice makes a denial necessary for justification, and they are as true in relation to hospital as to private practice; and being true, the inference is irresistible that scores of intemperate drinkers are made every year by the practice of giving convalescents alcoholic beverages.

They feel better for a while after a glass of wine, or ale, or whiskey, and, having "the sanction and guidance of a physician," they continue the habit after leaving the hospital, with a determination, perhaps, to discontinue it as soon as they recover their strength;

but, unfortunately, they never recover so as to be able to do without their beverage, or at least so as not to make ill health an excuse for continuing the habit, and it grows upon them till they go down to a drunkard's grave, cursing, perhaps, the doctor who first set them out on the road to destruction. Such cases I have frequently seen, and have heartily thanked God that such an awful responsibility never rested on me.

Boston City Hospital. Diet List.

Dinner.

Mondays.	Soup, potatoes, bread (wheat, Graham, and brown), and puddings.
Tuesdays.	Boiled corned beef and vegetables, bread (three kinds).
Wednesdays.	Fresh fish (fried and boiled), potatoes, bread (three kinds), and puddings.
Thursdays.	Roast beef, or mutton, vegetables, and bread as above.
Fridays.	Salt fish and potatoes, bread as above, and puddings.
Saturdays.	Stewed meat and vegetables, bread as above.
Sundays.	Roast beef or mutton, vegetables, bread as above.

Breakfast and Supper.

Each day of the week tea and coffee, at the discretion of the physician; shells, cocoa, bread (wheat, Graham, and brown), milk and sugar, butter, &c. Cold meat, steak or chop, if ordered.

Bread always in abundance; potatoes always; other vegetables in their season. In addition, broth, either of mutton or chicken, is made each day, that it may be in readiness for patients, if prescribed by the physicians.

The above is what is called the House Diet, which takes the place of the "Full Diet," "Ordinary Diet," or "Common Diet," of the London hospitals. But there are no tables of "Middle Diet," "First Diet," "Milk Diet," "Low Diet," "Fever Diet," or "Broth Diet," as in the London hospitals. But in every ward is a bill of fare, which is filled up every morning and evening by the nurse, under the direction of the physician, and generally according to the wishes of each patient, thus: —

Orders for Food for Patients. Ward —.

Date.	House Diet.	No. of Patients.	Date.		No. of Patients.
	Beefsteak.			Baked potatoes.	
	Mutton chop			Eggs.	
	Chicken.			Milk.	
	Oysters.			Boiled rice.	
	Broth.			Toast.	
	Mush.			Coffee.	
	Gruel.			Tea.	
	Farina.			Shells.	
				Cocoa.	

The foregoing diet list and bill of fare may be considered the best dietetic arrangement in this country, the City Hospital being the last great establishment finished in the country, and the trustees having taken great pains to examine the diet tables of all, and make improvements on them. Like every other hospital, its diet is modified by the habits of the community in which it is situated.

The great dietetic fault of Boston consists in using much too large a proportion of carbonaceous food, which is the result of the use of superfine flour, butter, and sugar, instead of the natural combinations of these elements, as found in the grains, and fruits, and milk, from which these principles are separated. On page 34, I have estimated the proportion of white bread to all other bread used in Boston to be ninety-five per cent. The cook in the hospital estimates the proportion of bread used by the patients to be ninety per cent. of flour bread, while the proportion used by the other members of the family is much greater, making the estimate nearly the same as that for the whole city. A great improvement would undoubtedly be made by substituting bread made from unbolted wheat, ground from selected wheat, — that which is denominated Graham bread being generally an inferior quality of flour, mixed with bran, which is a different and very inferior article. Of twenty-six hundred and forty-eight dollars and fifty cents paid for bread, probably two thousand dollars are lost in the excess of carbonaceous food, which does much harm by creating a tendency to inflammations and fevers, and by prolonging this class of diseases. Of the twenty-nine hundred and seventy-eight dollars and eighty-eight cents paid for butter, all that part of it used with flour bread is lost, and worse than lost, adding only to its redundant carbonates, and increasing its heating qualities; but any part that may be used with lean meats or vegetables, may be useful, being more digestible than the fat of meats, and being useful in supplying the carbonates, which are deficient both in lean meats and green vegetables. The amount of sugar used does not appear, being included with other groceries, but probably enough to add considerably to the superabundant carbonates.

The amount of milk used in this hospital is very great, being, in the whole year, thirty-nine thousand nine hundred and fifty-two quarts, at a cost of twenty-nine hundred and seventy-six dollars and seventy cents, or four and one half quarts a week for every inmate. This is an excellent investment; and if, with all this milk used, there were as much of unbolted wheat bread, or cracked wheat, or hominy from southern corn, as the appetite demanded, the improvement would be very great.

Adaptation of Food to different Diseases.

In order to make a general adaptation of food to different diseases, and different conditions of the sick, it will be useful to recur to the table of the representative articles of the four different classes of alimentary substances, which will be found on page 134. The leading articles of the first class (the carbonates or heat-producers) are, the fat of meats, butter, sugar, and fine flour, all of which, and the last especially, are used in Boston in excess sufficient to account, undoubtedly, for many of the inflammatory diseases to which we are so liable, keeping up the steam, and heating up the timbers constantly, to the point almost of ignition, and making it more difficult to quench the flames when once started (if I may be allowed again to recur to the figure already once employed to describe the condition of the system induced by a diet unnaturally heating). This figure is also suggestive of the diet adapted to inflammatory diseases. Remove the combustible material and use water. This treatment Nature strongly suggests also, by the loss of appetite for all carbonaceous food, and the demand for cold water in all fevers and inflammatory diseases. The first effect of following these intimations will be to cause emaciation, the adipose substance being used to supply the lungs with fuel, which they must have every moment; and at the beginning of sickness it is certainly not an evil to lose this fat, and thus prepare the system for fresh, clean, and new clothing whenever it returns to a condition to need it. We need not be anxious to retain our old clothes if we can be sure of new ones, without extra expense, whenever we are able to make good use of them.

One source of that delightful sensation which constitutes the luxury of convalescence, is that sense of freshness and newness of every part, as the body is being reclothed with newly-formed adiposea and muscle. This anxiety, therefore, which we so often see manifested lest we or our friends should lose flesh when sick, is at least unnecessary. Of this we can judge by adverting to our experience or observation of the difference between the luxury of convalescence from a fever, in which the flesh has been removed, to be again restored, and that from dropsy, or rheumatism, or gout, where the effete old body of flesh still clings to us. In all attacks of inflammatory disease, then, the first direction is to stop the supply of fuel, and let Nature supply the necessary heat, burning up the rubbish and cleansing the premises at the same time.

If we need no supply of carbonaceous food in the first attack of inflammatory diseases, we certainly need none of the nitrates or phosphates, for the muscles and mind both need absolute rest, and therefore need not be supplied with elements which are only necessary in muscular or mental activity. And here, too, we have but to follow the intimations of Nature, not only in regard to the supply of nutriment, but also in regard to the rest which is demanded, both for mind and muscle.

In regard to the exercise of muscles in sickness we are not much inclined to err, as we seldom use the muscles, or urge our friends to do so, in that state of lassitude which accompanies inflammatory diseases; but forgetting or not knowing that the mind is subject to the same laws as the muscles, the mind is not left to enjoy that absolute rest which it requires, and nurses, and mothers, and friends tire patients with talk on all sorts of subjects, if they do not insist on answers from them to all sorts of questions; but, by reference to pages

87, 88, and 89, it will be seen that the brain requires nourishment as well as the muscles, and is as much exhausted by efforts of the mind as the muscles are by active exercise. While, therefore, phosphatic food cannot be borne, the mind should be permitted to have absolute rest, being exercised only in making known the necessary requirements of the system. That friend is, therefore, kindest who keeps out of the sick chamber till her services are required.

Nor is it right to consult the patient on the subject of seeing friends or neighbors. The very efforts necessary to decide the question are injurious, and until after decided convalescence, and both mind and body have been recuperated by appropriate nourishment, the world, and everything pertaining to it, mentally or physically, should be absolutely shut out of the sick chamber, and when again admitted, should be admitted very carefully and gradually. Another important consideration is to CONSULT THE FEELINGS, WISHES, AND TASTES OF PATIENTS IN EVERYTHING.

Mind is the motive power of the world, and everything in it, mental or physical. And the human system, sick or well, is more dependent on the harmonious action of the mental faculties than all other influences combined beside, not only for its health and efficiency, but for its comfort when sick, and for its recovery to health.

First, then, put the mind of patients at ease in regard to everything in which they are interested, — the doctor, the nurse, the room, and everything in it, — allowing nothing in it disagreeable. Then allow them to take a little of anything they desire to take, and to taste of nothing disagreeable, of food, drink, or medicine. I have already alluded to the fact that in health the appetite and sense of taste are placed as guardians to protect the system from injurious substances (page 12); and can we believe it to be duty, when suffering from pain and sickness, to add to our suffering by taking disgusting drugs, making no effort to render them palatable and innoxious? But the argument in favor of this practice is, that Nature has furnished drugs which, in their crude state, are disagreeable, but which, nevertheless, do sometimes relieve suffering and cure disease. Does this argument prove that we should take drugs in the crude, disagreeable state in which they are naturally provided? If so, it proves too much, and, therefore, nothing.

Our food is furnished us mostly in a crude, unpalatable condition, but we were provided with intellects to show us how to cook it and adapt it to our tastes and requirements; and when we rightly use our intellects, and rightly prepare our food, we both relish it and are conscious of its adaptation to our wants. So God evidently intended we should use our brains in preparing medicines, and in adapting them to our taste and requirements, and when we do so we are rewarded by the same evidence of its adaptation to our requirements. If instead of relief we find the system disturbed, we may be sure we have mistaken the remedy, or have given it in an improper condition or quantity, just as we are always sure we have taken improper food, if, instead of gratified appetite we get disturbance from it.

Other animals are furnished both with food and medicine in a state adapted to their wants, because they have not sense to prepare them. The sick cat takes with relish the simple catnip provided for it, and it does good and not harm; but the sick child must swallow drugs which it shudders to think of, and which disturbs all its functions for days and weeks, and sometimes for life. All animals, in their natural state, take with impunity whatever they desire, sick or well, and nothing else; and until our appetites are perverted by unnatural food, we also can take and give our children everything, in a natural state, which they desire, sick or well; and when prostrate with sickness, however perverted our tastes may have been, we return to our primitive appetites and desires. The drunkard loses his desire for alcohol, the smoker for his cigar, and the gormand for his rich food. All come down to the same simple demands of nature, and all can be trusted to eat and drink what they choose, and will all be benefited by rejecting everything offensive to their tastes.

Is it reasonable that our heavenly Father should be at such infinite pains to adapt the world to the comfort and happiness of man, and give him a natural relish for everything that is best for him to have in health, but when sick and in pain, should intend to add to his suffering by consigning him to the torments of blisters, hot irons, cataplasms, and disgusting drugs?

Our reason, therefore, as well as our humanity, experience, and common sense, accords with plain deductions from Nature's common laws, and demands that everything offensive to the patient, whether of diet, regimen, or medicine, should be excluded from the sick chamber.

Following these intimations, we shall find that articles of the second and third class (page 134) will not be demanded till there is decided convalescence, and then the soluble portions. These sustain life without furnishing fibre for the muscles or solid phosphates for bones, and are, therefore, called for before the muscles can be used. Beef tea, or broth from lean meat or chicken, for example, in which are infused the albumen and soluble phosphates, the one furnishing food for the dormant tissues, and the other nervous or vital power; while the appetite for solid meat or fish will be reserved till the muscles shall require fibre for use, and the bones the solid phosphates. Liquid food, therefore, is all that is needed in severe sickness of any kind, and such food is generally all that the appetite craves or the stomach will receive. Sometimes, however, the appetite, having been blunted by some interference in giving nutriment in spite of her remonstrances, ceases to demand the right food at the right time, and we are obliged to use judgment in adapting the nutriment to circumstances. In that case great assistance may be obtained from the Dietetic Tables; when there is too much heat, abstaining from the carbonates, except as nature has combined them with cooling acid, as in the succulent fruits, and when cold and lifeless, giving some easily-digested carbonate, as starch, or some of the life-giving nitrates and phosphates, as in the broth of meats, or the phosphatic flesh of the active fishes or birds.

The fourth class of representative articles of food, being in its characteristic effects rather mechanical than vital, is to be selected with reference to the condition of the digestive organs. If there is inactivity of the stomach, or bowels, or liver, and constipation is the consequence, then this class of food should be freely used; but if, on the other hand, there is irritability of these organs, and diarrhœa, dysentery, or cholera, then these organs should be permitted to rest from the natural influences of waste, which are necessary in health, and nutriment be taken, like the juice of beef, flour porridge, &c., which contain no waste; just as in inflammation of the eye, we shut out the light, and give it rest and time to recover, or in inflammation of the brain, we prohibit all exciting influences, and abstain from all phosphatic food, using only common sense in the application of the laws of our being to our particular circumstances, as the farmer uses it in supplying the necessary elements for the crop to be produced, and allowing the land to rest when overworked and sick.

The Development and Preservation of our Faculties

Demand appropriate food and drink, taken at proper times and in suitable quantities; appropriate sleep and rest for all the faculties, alternated with regular and appropriate exercise; suitable protection from the cold, purity of the air night and day, personal cleanliness, avoiding sudden changes of habits or temperature, keeping out of the stomach everything injurious, and the right use of the means which God has provided for restoring to health the organs and faculties which may become diseased.

On each of these subjects might be written an elaborate treatise, but I propose to write a chapter only, to show as clearly and familiarly as possible the indications of Nature as to the principles which are to guide us in these important matters. First,

The Laws of Nutrition.

Every living thing requires nourishment, and every living thing is provided with food within its own reach, just adapted to its own peculiar wants; and every living thing but man is provided with instinctive powers to appropriate to its use just the elements that are needed, and, under ordinary circumstances, to reject every element that is not needed or is hurtful, as I have already explained. It is interesting to notice the wonderful provision of Nature, by which every creature, from the elephant to the minutest animalcule, comes into life just where and when its natural food is ready for it.

See the *paterfamilias* of the canker-worm family, tugging up the trunk of the apple-tree with his helpless wife on his back, to place her where she can deposit her eggs beside the buds out of which is to come the tender leaf by the influence of the same degree of heat that will hatch its eggs, so that the young worm will have food fitted for it at just the right time! And the provision by which a similar result is effected with other creatures is still more remarkable.

The larva of a species of gad-fly can live and grow only in the intestines of the horse, and the whole life of the fly after it has obtained wings, which is only a few days, is devoted to the task of depositing on the legs of the horse its eggs. These eggs are covered with gluten, by which they adhere to the hairs, and binding them together produce an irritation, and, trying to relieve that tickling with the teeth, some of the eggs adhere to the teeth and are swallowed, and thus arrive at their destination; and it is remarkable that the eggs are never deposited on any parts of the horse except those which can be reached and relieved of irritation by the teeth, otherwise they would lose all chances of arriving at their destination.

Another species of fly can be produced only in capsicum (Cayenne pepper). The fly is, of course, not very often seen in this country; but I have seen, in a neglected pepper-box, a flourishing family luxuriating and developing into perfect flies on their natural elements.

But the most remarkable example of complicated and far-seeing provision of nature to bring a living creature into the situation where its natural food is provided, which has yet been brought out from Nature's great storehouse of wonderful things, is found in the tapeworm. The facts on which this statement rests were developed by a learned and persevering German, whose name is Küchenmeister.

It has long been known that small sacks, or cysts, containing, together with serum, a rudimentary form of animal life, are sometimes found in the liver and other organs, and sometimes in the flesh of the hog and other animals; and hogs thus infested are said to be "*measly*." If this pork is eaten uncooked, as it frequently is in Germany, in Bologna sausages, and in ham made into sandwiches, and sometimes in this country in uncooked fat pork, and one of these cysts enters the stomach, the sack is broken, and the young tape-worm, having arrived at its natural home, commences life in its own peculiar way. At first it has only a head and four suckers, through which it draws its nutriment from the coats of the stomach, and a double circle of hooks, with which it attaches itself firmly to the side of the stomach on the mucous membrane. Here it remains during its lifetime; but its body, consisting of joints like pieces of tape, from one quarter to one half inch in length, grows, one joint after another, from the head extending itself in the stomach and among the intestines, till it reaches the length of ten, twenty, thirty, and sometimes forty or fifty feet, new joints being constantly formed from the head, and pushing the old ones away, and thus the joints farthest from the head are oldest and most mature. These joints, after a while, break off in pieces, sometimes of fifteen or twenty feet long; each joint containing numerous eggs or germs, are cast off, and if they find a lodgment on the grass or in water, where they may be taken into the stomach of another animal, are hatched in their stomach, and in their first form have the power of crawling through the integuments into the liver or flesh, forming new cysts or sacks, and thus are prepared again to be taken into the human stomach, to go again their rounds. The eggs will not hatch except in the stomach of a quadruped; and the developed animal cannot live except in the human stomach. The only chance, therefore, of perpetuating itself is, first, the chance that some animal which is eaten by man shall get an egg into its stomach, and that some man shall get it after the first process of development into his stomach, which chance would seem to be very small in this country, where so little raw meat is eaten, and where so few animals have access to the means of obtaining the eggs.

While, therefore, every tape-worm may, in the course of its life (sometimes of many years), cast off as many eggs as there are inhabitants on the face of the earth, the chances of the conditions being fulfilled, on which their perpetuation depends, are so small that, in this country, it is very rarely found. When once it gets hold, however, it is very difficult to dislodge it. I once gave two ounces of spirits of turpentine, which brought away twenty-five feet of the worm; but the head remained, and the creature still lived and flourished.

To prove that the tape-worm is developed from the cysts taken from measly pork, Küchenmeister performed the following experiment on a criminal condemned to death: He administered, during three days, seventy-five of these cysts, giving them time to develop before execution. After execution he found ten young tape-worms in the intestines, six of which were destitute of hooks; but the remaining four were attached by their hooks to the mucous membrane.

And to prove the other part of the theory, some pigs were fed with segments of tape-worm, and subsequently killed. The flesh was filled with the cysts in different stages of development, from the first commencement to the perfect formation, in proportion to the amount eaten and the time which had elapsed, while a pig of the same litter, not so fed, was entirely free from this formation.*

And that interesting parasite, called *louse*, can live only on its own animal or plant, and if transferred to any other species will soon starve; and thus every living thing is provided with its appropriate food, and with means of getting it in its own limited sphere.

But man has no limits to his range of enterprise, and no limit to the variety of food on which he can subsist; and yet no animal has such a struggle with difficulties, not only in selecting food suitable for his powers of digestion, but in adapting it to his varied circumstances.

What is the Natural Food for Man?

When God created man, he gave him for meat "every herb bearing seed which is upon the face of the earth, and every tree in the which is the fruit of a tree yielding seed;" and when, afterwards, he blessed Noah

* See Küchenmeister's Manual of Animal and Vegetable Parasites.

for his faithfulness, he gave him, in addition to his bill of fare, "every beast of the earth and every fowl of the air,' "and all the fishes of the sea,' and told him that "every moving thing that liveth shall be meat for him, even as the green herb.'

This would enable him to fulfil his destiny, and have dominion over all other creatures, and to live with the polar bear almost at the north pole, or with the monkey at the equator, having in each of these extremes of temperature food adapted to his wants. Wherever he chooses to live, in a cold, or hot, or temperate climate, he finds prepared at his hand the kind of food best adapted to his wants, and has a relish for just the article best fitted to supply his wants. If he lives in Greenland, he desires and has the heat-producing fat of whales and seals, the very thought of which would disgust him in Africa; and if in Africa, he desires and has the cooling fruits and vegetables which would freeze him to death in Greenland; and in the climate where cold and heat alternate, he has all the variety best adapted to his changing circumstances.

To comprehend the necessity of this variety of food, and to understand the principle on which we can adapt our food to the different conditions and employments of life, it will be necessary first to understand the physiological necessity for food. Besides the necessity of providing for the growth of the young, food is necessary, principally, for three essential purposes: —

1. To supply the waste which is constantly going on in the tissues, especially in the muscular or moving part of the system.

2. To supply the fat and the animal heat of the system.

3. To supply food for the brain and nervous system, the bones and solid tissues, and some essential elements in pure red blood.

Now, if we examine any one article in its natural state in the whole bill of fare which God has given us, either of the vegetable or animal kingdom, we shall find these three classes of elements, but find them combined in different proportions, and find them mostly, also, in a condition to require some cooking to fit them for digestion, and thus find exercise for our mental faculties, both in selecting food and cooking it, so as to adapt it to our varying circumstances.

In this respect man, and all other animals, are placed in very different circumstances. All animals but man are endowed with instincts to direct them to the right food which is prepared for them, and which requires no cooking and no preparation; but the destiny of man was, that he should use his intellect to study Nature's laws, and to use them in the selection of appropriate food, and in preparing it for digestion.

What his condition in regard to food was before the fall, is not clearly revealed; but even in the garden of Eden he had something to do, for it is said, "And the Lord God took the man and put him into the garden of Eden, to dress it and keep it."

But after the fall, his condition is clearly revealed to Adam in these awful sentences: "Cursed is the ground for thy sake. In sorrow shalt thou eat of it all the days of thy life." "Thorns also, and thistles shall it bring forth to thee, and thou shalt eat of the herb of the field.' "In the sweat of thy face shalt thou eat bread till thou return unto the ground.'

After that sentence, whatever his variety of fruits and vegetables might have been before, he seems to have been almost literally driven to the herb of the field, including, perhaps, some farinaceous seeds of the grasses, and some wild fruits and berries, that out of them, by the use of his wits and by the sweat of his face, he should cultivate the grains, and fruits, and vegetables, and to the end of time increase their variety, improve their taste, and fit them, not only to become the necessaries, but also the choicest luxuries of life. And it is interesting to trace, as far as we may, our grains, delicious fruits, and succulent vegetables, to their original wild fruits and green herbs.

Many of our grains and vegetables were so early changed by cultivation that their history has not been preserved, and their original grass, or tree, or herb cannot now be found or recognized; but enough have been traced to their origin, and the wonderful changes noticed which have been wrought by cultivation, to warrant the belief that farinaceous grains, and our valuable vegetables and fruits, which cannot be found wild in any part of the world, are so changed by cultivation that their original grasses or plants are not recognized.

Cabbage, in all its varieties, cauliflower, broccoli, &c., have all been traced to, and cultivated from the kale, colwort, &c., which grew in a natural branching way, without forming a head at all.

Celery is cultivated from a very disagreeable herb, called *apium*. All the delicious varieties of apples came originally from the crab apple, which grows wild in every part of England, and in many parts of this country, — a bitter, sour, disagreeable fruit.

And the peach is a still more remarkable example of the effects of cultivation and change of climate.

When first introduced into Europe from Persia its pulp was hard, disagreeable, bitter, and sour, resembling the pulp of a walnut in a green state; and it is generally supposed that by some change of climate or culture the green pulp of the fruit, or nut of the almond, the pit or kernel of which it almost exactly resembles in appearance and taste, and the botanical character of which it also very nearly resembles, was prevented from drying into a shell or nut, and by continued culture has come to be a delicious fruit. At any rate, since its history was first known it has changed from a disagreeable substance, which afforded no nutriment, to a very valuable and delicious fruit.

Rye, barley, wheat, oats, &c., have all the characteristics of the grasses, and the seeds of all our common grasses, as well as all the grains, contain alike the nitrates, the carbonates, and the phosphates, and these elements of food are found in all in nearly the same proportions, and in nearly the right proportions, to supply all the wants of the human system in ordinary temperatures and circumstances. But neither of these grains is found wild in any part of the world, and the inference is fair that they were changed from their original grasses so early and so radically that their identity has not been transmitted to us.

Our maize, or Indian corn, has also the characteristics of the gigantic grasses, and must have come from the same source as the sugar-cane, the sorghum, and broom-corn. And this suppostion, I think, is corroborated by a very curious circumstance which came under my own observation. More than twenty-five years ago some officers in the United States service brought from Egypt a mummy, in the integuments of which were found some peculiar grains of maize. It had not probably been exposed to the air for three thousand years, and on being planted it grew; but the season proved too short, and it was not so perfected as to be capable of being perpetuated. Some which was planted in my own garden grew like common Indian corn, tasselled out, and grains of corn were formed, not on a cob, but on a bundle of small stalks, as if the stalks of the top of broom-corn had been firmly tied together, and had adhered, and the grains of corn grew around this bundle of sticks in a conical form. The inference to my mind was, that at the period at which this corn grew, the ear of corn was undergoing a process of change from the large seeded umbelliferous plant, like the broom-corn, to the solid, cylindrical ear, on a cob, as we now find it.

The potato is a still more recent and interesting illustration of the power of climate and cultivation to transform a useless tuberous root into a valuable article of diet.

The plant from which the potato is cultivated is now found growing wild in Chili and Montevideo, and is a useless, gnarly root; but within the last two or three centuries it has been changed into a standard article of diet in all Europe and North America, supporting, to a great extent, in some places, thousands of working people.

Thus, if we will build on Nature's own foundations, we can improve almost every living thing, animal or vegetable, and add to our bill of fare indefinitely, not only the necessaries but the luxuries of life, still retaining all the elements needed by the system; but when we attempt to improve our natural food, by abstracting what we call the best parts of any article, we make sad mistakes, and have to suffer the consequences, as we have before explained.

Besides the appropriate supply of the elements required for all the organs, functions, and faculties, other considerations demand our attention in regard to the selection of articles of food.

Some articles of food contain more nourishment and less waste than others. Some require more and some less powers of digestion than others, &c.

Is that article most wholesome which contains most nourishment? Certainly not in this country, where we all get too much nourishment. Food containing waste is absolutely necessary every day, not only to produce the necessary distention of the stomach and intestines, but to produce the natural stimulant for which this waste was intended; and one of the prominent evils, and perhaps the greatest next to the evils produced by the want of essential elements, in the use of our fine flour, sugar, and butter, in their various combinations, is the evil of constipation, which is the natural consequence of the too constant and too exclusive use of these articles, which contain no waste materials.

Are those articles which are most easily digested the most wholesome? Certainly not, for the stomach, like every other organ and faculty, needs exercise to acquire or keep up its energy and healthy action; and therefore, on the contrary, that article of food is best, other things being equal, which most fully exercises the powers of digestion; but that article is not wholesome which overtaxes these powers; just as that muscular exercise is best which most fully develops the powers of the muscles, but does not overtax them.

Beans and rice, for illustration, contain nearly equal amounts of nutrition, each containing from eighty to ninety per cent., and each containing some of all the elements of nutrition required, but in different proportions, as we see by the tables; but the power and time required for digesting these articles differ materially, beans being one of the hardest and rice one of the easiest articles to be digested.

Now who can say, abstractly, which is most wholesome, beans or rice? To the laboring man, who has powers of digestion sufficient for beans, they are more wholesome than rice, which is too soon disposed of, and too soon leaves a desire for other food, and gives too little strength of muscle: but to the sedentary invalid, whose powers of digestion are feeble, rice would be wholesome, while beans might be distressingly unwholesome, and for a permanent article of diet, to be eaten alone, both would be unwholesome, as one contains too little waste for the healthy action of the bowels, and the other too much.

Osmazome.

The taste and appetite are placed as sentinels to guard the portals of the stomach, and, through the stomach, the whole system; and, under the direction of instinct, in all animals in their natural condition, are absolutely or very nearly infallible, both as to admissions and rejections. Offer an elephant a piece of tobacco or a glass of whiskey, and he will not only reject it, but reject you with disdain for the insult; but give him his natural food, and he will take all that his appetite demands, and all that would be good for him, and no more.

The same thing is true of man till his taste is perverted. The little child always relishes its natural food, and may be safely trusted to take of it all he wants; but offer him unnatural food, or unnatural drugs or medicine, and he rejects it. A perverted appetite, however, cannot be trusted, as it demands and relishes articles which are positively hurtful.

It is interesting to notice the great variety and exquisite delicacy with which Nature has flavored the different articles of food, no two articles having the same flavor, although in other respects almost exactly alike. Beef and mutton, for example, contain the same elements, and are almost exactly alike except in regard to the osmazome, which constitutes their distinctive flavor; but this difference is of very considerable importance practically, when we consider that that which relishes best always digests best. We should therefore never allow ourselves to eat that which is disagreeable to our own taste, whatever others may think of it. And this is true of every article of food in the animal or vegetable kingdom, and other things being equal, and they generally are equal, that which we love best *in its natural state* is best for us.

Another noticeable fact is, that this osmazome is in its perfection only when the food is in a perfect condition for digestion. Those articles which require cooking have their flavor most perfectly developed just at the time when they are properly cooked, and ready to be eaten and easily to be digested, and any considerable delay, or a second cooking, always diminishes the flavor. Beefsteak, for example, is much more palatable and much more digestible when first cooked, than when it has been exposed, and its osmazome evaporated, or when warmed over; indeed, all meats are better when once well cooked, to be eaten cold, than to be warmed or cooked over, and this is understood by all cooks, who always add some spices to make meats palatable on a second cooking.

Soups from meats and vegetables have a much more delicious flavor when made from raw meat and vegetables than when made from meat and vegetables previously cooked, and the most delicious soups are made without other spices than are found in vegetables and meats. Most meats and vegetables become, by frequent cooking, so insipid as to be unpalatable and unwholesome, as I have elsewhere explained, merely from the loss of the osmazome; and this natural stimulant of digestion can be only very imperfectly supplied by aromatic condiments. On the other hand berries, and the rich fruits which need no cooking, have their most delicious flavor already developed, and any attempt at improving them by cooking only makes them less palatable and less digestible.

We have, therefore, a clear intimation that we should consult our appetite and taste, both in regard to the kind of food and to the manner of preparing it.

No one can realize till he tries it, what an amount of real enjoyment can be added to life by simply studying Nature's laws in regard to food, and by applying them to every-day life, in the mere enjoyment of meals, as well as in the freedom from sickness and pain, and in the increased value of all our faculties. And these laws are very simple and easily understood.

In every variety of food furnished for man on the face of the earth, every article contains in its natural state, with all other essential elements, that peculiar element called osmazome, which is in correspondence with the wants of the system at all times, and induces an appetite and relish for just the article most needed. The osmazome of whale oil, for example, would be very disgusting to a man living under the equator, while to a man exposed to the cold of Lapland nothing could be more agreeable; and the orange, which is so delicious in warm climates, would have no attractions for one living in cold climates.

Condiments.

In view of the fact, so clearly revealed, that food, to be well digested, must be made to relish, condiments are of no small importance in the philosophy of cooking; for, though Nature has furnished to all suitable food in its natural state, when properly cooked, all that is needed, except salt, to make it palatable and digestible, still it is quite impossible always to get our food in just the right condition, and to eat it while the osmazome remains. We often need a substitute for the natural flavor, and Nature seems to have furnished that substitute in the aromatic herbs, and seeds, and flowers. Certain it is, that mixed food, or re-cooked food, as minced meat, or sausages, or soups from re-cooked meats and vegetables, are made more digestible by being made palatable with condiments; but in this, as in everything else, that cooking is best which best imitates Nature. The flavors of all natural and valuable food are delicate, not strong or pungent, except in the onion, and other worthless articles; and to all but perverted tastes food is most agreeable which is only delicately flavored, and nothing can be more certain than that the pungent spices, as horse-radish, mustard, cloves, red pepper, &c., any one of which, if applied to the skin, would produce inflammation, must be injurious to the delicate stomach, as they are generally used. This, indeed, has been proved beyond all doubt. All condiments, indeed, must be used as a choice of evils. If we could at all times get the requsite elements of food, either from the beasts of the field, or the fowl of the air, or the grains, and vegetables, and fruits, just when they have their natural osmazome fully developed, we should need no condiments; but if we cannot get appropriate food till after its natural flavor has evaporated, or has been dissipated by re-cooking, then some delicate condiments are useful to make it palatable and digestible. When obliged to dine on food that is not relished, the stomach is oppressed, and the food remains undigested till we take a bit of cheese, or a few nuts or raisins, or some agreeable condiment, which, though indigestible in themselves, will arouse the stomach to action, and the dinner will be digested.

Some part, at least, of every meal must have an agreeable flavor in order to be well digested. For this reason, a small cup of aromatic coffee will sometimes make amends for a very poor dinner; but a little is better than more.

Salt.

Salt has some characteristics peculiar to itself, differing from all other elements or compounds, organic or inorganic. It is not in any sense nutriment, as it does not furnish support to any organ or function, and does nothing towards sustaining life, as has been often proved in the shipwrecked and famishing sailor, who, instead of relieving his sufferings, has added to them by taking salt water, even in very small quantities. Neither is it a chemical agent, combining with some other element in the system to effect a necessary change, as the acids combine with alkaline bases and remove effete matter from the system in the excretions. It is chloride of sodium, wherever found, in the stomach, in the blood, or in the excretions, and what its office is in the system, is not known; but undoubtedly it has some beneficial influence besides its use as a condiment. This seems to be indicated by the fact that other animals seem to require salt, and have a natural desire for it, and seem to suffer if for a length of time they are deprived of it.

And this is not confined to domesticated animals, as the buffalo and the deer of the western prairies make paths to the salt licks by their frequent visits after salt.

Still it is not an absolute necessity in the animal economy, at least not farther than may be met by the chloride of sodium, which is found in almost all animal and vegetable food, as whole nations of men and their domestic animals live without salt, except as it is found in food; and this relieves us from the apparent exception which salt furnishes to the law which I have endeavored to develop, — that all elements to be incorporated into the human system, or any other animal system, must first be organized in some vegetable.

There is enough salt in common, natural food, to account for all the salt actually incorporated in the system; indeed, it is yet an unsettled physiological question whether any salt is actually incorporated in the blood or in any of the organs.

But whatever else is accomplished in the system by salt, its essential use is that of a condiment, exciting the secretory organs to do their duty. Certain it is that it does incite to action the salivary and other glands. Take in the mouth a bit of salt fish, or bacon, or any other savory article, and the mouth is immediately filled with saliva; and when it is received into the stomach, the gastric juice also immediately gushes out. Of these effects on the glands of the mouth and stomach we can have no doubt, as they are under the observation of our senses; but of the effects on the liver, the pancreas, and the other glands, we have only to judge by inference; but the inference is certainly fair if the glandular system, as far as we can know, is stimulated to action by salt; the other glands, whose action we cannot observe, but whose duties are also connected with the process of digestion, may also be affected by the same agent. My conclusion, therefore, is, that salt, like other condiments, promotes digestion by exciting the glands and inducing the production and flow of their secretions. And the principal value of the salt is in its savor; so that the question, "If the salt have lost its savor, wherewith shall it be salted?" like all other questions from the divine Master, contained a philosophical truth as well as an apt illustration.

Like all other condiments, salt is useful or injurious, according as it is taken in large or small quantities. A little gives a better relish than more, and therefore is more useful, while the larger the quantity the more injurious. The only rule, therefore, for the use of it is to use as little as will give to food a relish; and the amount necessary for that depends very much on habit, except in regard to that which is found in plants and the flesh of animals. Salt is an inorganic substance, and the only one demanded and extensively used as a condiment, and the only one so universally and so abundantly furnished; and this fact alone would indicate its importance in the animal economy; but some nations of men, and some animals in every nation, do not require salt; and to some, as the birds, it is a poison, in quite small quantities; and this fact, on the other hand, would indicate that it is not, like the nutritive elements, necessary for the support of animal life.

Other condiments are from the vegetable kingdom, and mostly from tropical climates; and, from the very narrow range of temperature to which the most aromatic are limited, we may infer that they were not intended for universal use; but each probably possesses some medicinal quality adapted to some peculiarity of the diseases of its own locality.

The *cinnamon* is said to be indigenous only to the Island of Ceylon, and even there is confined to a small district in the south-western part of that island.

The *clove* is a native of the Molucca Islands, and the *nutmeg* of the same islands. *Ginger* is a native of the south-east coast of Asia and the adjacent islands. The *pimento* or *allspice* grows spontaneously in Jamaica, and one writer says, "it is purely a child of Nature, and seems to mock all the labors of man in his endeavors to extend or improve its growth: not one attempt in fifty to propagate the young plants, or to raise their seeds, in parts of the country where it is not found growing spontaneously, having succeeded." These spices, therefore, were evidently not intended for universal use; nevertheless, upon the principles which I have elsewhere explained, they may be useful in promoting the digestibility of food which is destitute of, or deficient in osmazome; not by any special virtue in them, but upon the general principle, that whatever agrees with the taste excites the glands to secrete the fluids necessary for digestion.

Sometimes a deficiency in these digestive fluids is the cause of a want of appetite, and the appetite craves something savory; and, taking a hint from this instinctive demand of Nature, I have, for the last twenty-five years, practised giving a sick patient, especially after passing the crisis of disease, a little of anything which the appetite demanded. Salt fish, smoked ham, pickles, anything else savory and agreeable at the time to the patient, by only being chewed and held in the mouth will excite the secretions, and then the stomach will be prepared for simple and natural nourishment, and will call for it, as before stated.

This practice may be carried too far, and is frequently, in warm weather and warm climates, where carbonaceous food is not needed. The appetite is then stimulated by the pungent spices, which do harm not only by their own exciting influence, but by inducing the taking of unnatural and stimulating food. In this way the people of our Southern States prepare themselves for the bilious fevers and other diseases which carry off so many; and this has been proved by the fact that those among them who have sense enough to abstain from alcohol, spices, and pork, and live on the cooling fruits, and vegetables, and grains of their own climate, are exempt from these diseases.

Those spices are best which are best relished, as their value consists in gratifying the taste, and thus exciting the secretions. Of course no one can judge for another in regard to the spice to be used; and cooks must not consult their own taste, but the taste of the family for whom they cook; for a spice that may be highly relished by one, and therefore wholesome, may for another be disagreeable and unwholesome. The rules, therefore, for selecting and using spices are very simple: First, use none at all with food that can be relished without it. Second, use that which best agrees with the natural taste. Third, use the smallest quantity that will be satisfactory to the unperverted taste, and never allow the quantity to be increased. Our gustatory pleasures, like all other pleasures of life, are best enjoyed by the moderate use of the good things that are kindly provided for us. And the greatest sufferings which come from them, come, as do most of our physical sufferings, from deceiving ourselves with the idea that if a little of any good thing will give us pleasure, the pleasure may be increased by increasing the quantity. Instead, therefore, of being contented with the delicate and wholesome flavor which may be imparted by a very little pepper or any other spice, we are inclined to increase the amount, till we take into the delicate stomach these spices of strength sufficient to draw a blister on the skin if applied to it, — and can they fail to be injurious?

Cinnamon.

Cinnamon is the bark of twigs or young shoots of a tree which grows in Ceylon to the height of twenty or thirty feet. It has been the source of a great trade for more than three hundred years, and its fragrance has been admired from time immemorial. By a report of the Royal Asiatic Society, made some years since, it is stated that the number of people engaged in the cinnamon department of trade was from twenty-five to twenty-six thousand persons, and that the amount exported was two hundred thousand tons.

At one time, when under Dutch government and monopoly, the degree of rigor with which this monopoly was maintained was so great that "the selling or giving away the smallest quantity of cinnamon (even were it but the single stick), the exporting of it, the peeling of the bark, extracting the oil either from that or the leaves, or the camphor from the roots, except by the servants of the government, and by their order, as well as the wilful injuring of a cinnamon plant, were all made crimes punishable with *death*, both on the persons committing them, and upon every servant of government who should connive at it." *

Bertolacci's Ceylon, p. 241.

And in order to keep up the price when the supply was greater than the demand, the government ordered the destruction of all the surplus. "M. Beaumere relates that on the 10th of June, 1760, he beheld, near the admiralty at Amsterdam, a blazing pile of these aromatics, which were valued at eight millions of livres, and an equal quantity was burnt the next day. The air was perfumed with this incense; the essential oils, freed from their confinement, distilled over, mixing in one spicy stream, which flowed at the feet of the spectators; but no person was suffered to collect any of this, nor, on pain of heavy punishment, to rescue the smallest quantity of the spice from the wasting elements." *

Cassia.

Cassia is supposed to be an inferior quality of cinnamon, and to come from a variety of the same species of tree; but botanists consider it a distinct species. It is not brought from Ceylon, but principally from China, and both the bark and buds are used. They have the same kind of aroma as cinnamon, but inferior in degree of flavor.

Clove.

Europeans are said to have known this spice for more than two thousand years. It is a product of the Molucca Islands, and was for a long time under the

Lankester's Vegetable Substances used for the Food of Man, p. 202.

control of the Dutch government, who monopolized the trade in this as other spices, having driven off the Portuguese, who first discovered the source from which it came to Europe. It is the product of a beautiful tree, every part of which is fragrant; but the only part used is the calyx of the flower, which, while in the form of an elongated bud, is beaten from the tree and dried for the market. It has an exceedingly pungent flavor, and should therefore be used only in very small quantities.

Nutmeg.

The nutmeg is the kernel of the fruit of a beautiful tree, a native also of the Moluccas; but now cultivated in many islands, and in the southern part of the peninsula of India, the mountains, and some other places. The tree furnishes two spices, the nutmeg or kernel, and the mace, which is the membranous tunic or covering of the shell in which the nutmeg is contained.

The flavor of the nutmeg is much less pungent than that of the clove, and therefore is less stimulating and injurious.

Ginger.

Ginger came originally from Southern Asia, but at an early period was transplanted in South America and the West Indies, from which places it was exported to Europe as early as 1547. (Edwards' West Indies, vol. ii.) It comes from the tuberous joints or roots of the ginger plant, and in commerce is distinguished as black and white ginger; both kinds, however, come from the same plant, the difference of color depending on the mode of preparatiou.

Pepper.

There are said to be at least sixty varieties of pepper, some of which are found in every part of the world. The black pepper of commerce, which is the most extensively used, is found native on the mountains on the coast of Malabar, and is cultivated to a great extent in Sumatra and Java, and forms the principal article of export in these places. It grows on a creeping or climbing plant, and resembles, when the leaves are off, very closely the grape vine.

Pimento, or Allspice.

This spice is the unripe fruit of a large and beautiful tree. The berries are gathered just after the flower has fallen off, as they lose their fragrance and become valueless if suffered to ripen. The crop, in a favorable season, is sometimes enormous, a single tree yielding one hundred weight of dried fruit after losing one third in curing. The allspice has a flavor which seems to combine the properties of many other spices, and that fact is the origin of its proper name.

Capsicum

Is a native of India, but has been acclimated in this country and England, of which there are three kinds, the cherry pepper, the guinea pepper, and the bell pepper. The green pods of all these varieties are used for pickles, and the ripe ones for seasoning pickles, &c.

Vanilla.

Vanilla is a native of Mexico and some parts of India. It is a parasitical plant, with lanceolate leaves, eighteen inches long and three inches wide, and bears slender pods, containing, besides numerous seeds, a substance which is black, oily, and balsamic when recently gathered, and its odor, when strongly inhaled, produces a kind of temporary intoxication. These pods are gathered and dried, and constitute the vanilla which is used for making chocolate, and for flavoring ice-creams, cakes, blanc-mange, &c.

These foreign spices, together with many seasoning herbs, which grow spontaneously or are acclimated in this country, such as parsley, fennel, purslain, horse-radish, mint, spearmint, thyme, sage, marjoram, &c., are used for seasoning meats, cakes, soups, broths, &c. They owe their fragrant and spicy qualities to volatile or essential oil, each having its own, which may, by distillation, be collected, and, being dissolved in alcohol, are called essences. In that form they are generally kept and used instead of the crude spices and herbs from which they were taken.

GOUT: ITS CAUSE AND CURE.

In the chapters on general inflammations and neuralgia, we have seen that the predisposing cause of inflammations and pains is carbonaceous food, heating, as it does, the blood, the internal organs, and the nerves, as the fire of a steamboat heats the combustible materials around the boiler, and renders them more susceptible to ignition. This illustration is particularly applicable to the gout, which is eminently painful and inflammatory; and it is corroborated by the fact that subjects for the gout are generally fat, and live *high*, which, according to the English and American acceptation of that term, means that their food is greatly composed of butter, fat, starch, and sugar, which are only the heat-producing elements, without either strength-giving principles for the muscles, or food for the brain and nerves. But there are some peculiarities of the gout which distinguish it from all other inflammatory diseases.

One exciting cause of gout is violent, exciting, or long-continued mental action — an exciting cause of no other inflammatory disease; at least the effects are peculiar to gout, and the disease is accompanied with peculiar irritability of mind, irascibility of temper, and frequently with deposits of certain effete matter as it passes from the system. Let us see if these peculiarities are not susceptible of explanation.

What physical effect on the system is produced by violent, exciting, or long-continued mental action, such as induces gout?

It has been already shown that one twelfth of the solid matter of the brain is phosphorus, which is combined with other mineral principles, the most important of which is soda; and that the amount of phosphorus varies in different brains according to mental capacity, children and idiots having less than half as much as men of common intellects.

It is also shown that this phosphorus is used up in thinking, and in any mental exercise, and thrown from the system as effete matter, just as nitrogen is used up and thrown off in working the muscles — clergymen excreting more phosphorus on Monday than any other day of the week, and lawyers excreting more after court days than at any other time.

The Want of Phosphorus the Cause of Gout.

Assuming, then, that the want of phosphorus in the system is the cause of the characteristic symptoms which distinguish gout from other inflammatory diseases, we have a rational explanation of all their phenomena, and a theory of prevention and cure, corroborated by the experience and observation of those who are best acquainted with the disease.

Phosphorus not only promotes the action of the brain, and produces mental activity and power, but it promotes the action of the muscles, and is the source of all nervous or vital power and physical health and activity. This is proved by analyses, which show that the most active animals, birds, or fishes have most phosphorus in the composition of their flesh, and require most phosphatic food to sustain their activity. This principle is also fully explained in the first chapter of this book, on Food for Thinking Men.

I have also explained, in another chapter, the well-known fact that nursing and expectant mothers who live on carbonaceous food suffer from excruciating neuralgia, toothache, &c., because, not taking phosphorus enough in food to keep the nerves of the mother and child both in a healthy condition, Nature favors the child at the expense of the mother.

And here we have a hint of the cause of the excruciating pain accompanying gout, and the reason why not only gouty people, but all other fat people who eat too much carbonaceous food, suffer toothache and all other painful diseases more severely than those who live on natural food.

The Rationale of the Gout, and its Treatment.

Gouty people are always such as eat too large a proportion of carbonaceous food, either butter, or the fat of meats, or fine flour, which is mostly starch, or sugar, or all combined — and sometimes all at a single meal. Of course they get too little phosphorus, not a particle of that element being found in fat, starch, or sugar, and are strongly predisposed to inflammations — always keeping the timber hot, especially if to these carbonaceous and heating articles of food are added the unnatural stimulus of alcoholic drinks.

Still, having wonderful powers of conforming to circumstances, Nature keeps the machine running comparatively well, till some excitement of mind or muscle exhausts the phosphorus below the point of endurance, and Nature cries out in agony for more vitality and less heat. The fuel being stopped the heat subsides, and after a few days, by heating up gradually, the machine will work again, till it is again overheated, and the exciting cause again renewed, to go through the same agony and the same process of temporary cure.

If the excitement which exhausts the phosphorus, and causes the fit of gout, be mental, the soda which is combined with phosphorus in the brain is set free, and, uniting with uric acid, forms the urate of soda, which constitutes the urinary calculi and the chalky deposits peculiar to gout. And it will probably be found that these deposits occur in gouty men of mental activity, and in fits of gout produced by mental excitement or mental exhaustion.

Again: gouty people are always sedentary in their habits; and here we get also a corroboration of the theory that want of phosphorus is the cause of gout. By reference to the tables of analyses, pages 120–123, it will be seen that the phosphates and nitrates are always united, these articles containing the most muscle-making food, which contain the most phosphorus; and it will be seen also that those who exercise the muscles most require most nitrogenous food. Active men, therefore, require and will have more nitrogenous food than sedentary men, and with it get, of course, more phosphorus. And this explains the fact that laboring men never have the gout.

The only other peculiarity of gout usually mentioned is, that gentlemen, and not ladies, are most subject to it. But this, I think, is equally true of all inflammatory diseases, which are induced, not only by carbonaceous food, but by alcoholic drinks. And the explanation is this: gentlemen "tarry long at the wine" after the cloth is removed and the ladies are dismissed.

Dyspepsia, derangements of the stomach, bowels, &c., are all accounted for on the same principles, as is explained in the chapter on Dyspepsia, &c. My belief, therefore, is, that living according to the laws of life, as explained in Philosophy of Eating, no one, however predisposed to it, will ever have the gout. And if living otherwise he gets into its screws, the quickest way to get out of them is first to let off the steam, not by exhausting medicine, but by stopping the supply of fuel, and then restoring the nervous and vital equilibrium, by taking, in a form to be relished, food prepared from active fishes, birds, or animals, with bread or plain puddings from wheat, barley, or oatmeal, with cheese, as it can be well digested, and enough of butter, or other agreeable carbonates, to supply any deficiency of fat in the fish or lean meat, and to give relish to the food, and enough of some agreeable fruits or vegetables to furnish the necessary acids and waste which is wanting in cheese.

FOOD FOR THINKING MEN.

THAT one set of principles in food enables us to use the muscles, that another set enables us to keep up the animal heat, and another promotes the action of the brain and nerves, and enables us to think, I have endeavored to show.

That phosphorus is used up in thinking, as nitrogen is used in working the muscles, and carbon in furnishing animal heat and fat, I think has also been clearly demonstrated.

This idea, though not new to physiologists, has never been made practical, and, indeed, I have seen no attempt to develop it either for philosophical or practical purposes.

Vauqualin and L'Harittee, two celebrated French chemists, laid the foundation of its development in their analyses of the human brain, proving, as they did, that the brains of infants and idiots contain less than half the phosphorus that is found in the brains of men of common intellect, and that the proportion of phosphorus found was in proportion to the intellect; but for more than a quarter of a century it has remained without development or practical application.

Meantime it has also been proved by analysis of the secretions, that the more active the brain, the more phosphorus is used up and thrown off by the system, clergymen using up more on Sunday, and lawyers on court days, than at other times. And yet our professional men have lived as other men live, — eating what has come before them, without considering whether the elements they take are adapted to develop stupidity or mental vigor; eating, perchance, such stupefying articles as ham, or fat pork, and white bread and butter, while making or preaching a sermon, and such phosphatic food as trouts and other fish, with unbolted bread, vegetables, and fruits, when idle and rusticating. But a little observation would show a vast difference in the quality of sermons whether made and preached on carbonaceous or phosphatic diet; and the estimate of the old divine, "of the number of tons of beans and pork preached to in New England every Sunday, while the owners were asleep," might be offset by an estimate of the number of congregations, not only in New England, but in Old England, and all the rest of the fat and starch eating world, who are put asleep by sermons made from stupefying principles extracted from fat pork, fat beef, and superfine flour.

The principle that mental activity depends on phosphatic food, I have been gratified to notice, has been recently endorsed by Professor Agassiz, in his address before the committee of the legislature of Massachusetts on the propagation and preservation of fishes.

He said, as reported in the Boston Journal, "The fish enters largely into the requisition of the human system. It is a kind of food which refreshes the system, especially after intellectual fatigue. There is no other article of food that supplies the waste of the head so thoroughly as fish diet; and the evidence of it is in the fact that all the inhabitants of the sea shores, the world over, are the brighter population of the country. Fish contains phosphorus to a large extent, — a chemical element which the brain requires for growth and health. He would not say that an exclusive use of fish would make a blockhead a wise man; but that the brain should not be wanting in one of its essential elements."

But man cannot live on fish alone, that food being generally deficient in carbonaceous elements to furnish animal heat; and we need a variety of food, one article being adapted to supply the deficiencies of others; and everywhere in the habitable world nature has furnished this variety, adapting it to different climates, tastes, constitutions, employments, and habits of life. For every animal but man appropriate food is placed, already cooked and prepared for digestion, within the reach of every species, in its own limited sphere, and its instincts direct with unerring certainty to the food best adapted to its development and health; but man, having intellect, is expected to use it in studying the wants of the system, and in analyzing food to ascertain its adaptedness to supply those wants, in the destitute condition in which he is placed, as implied in the sentence, "Cursed is the ground for thy sake: in sorrow shalt thou eat of it all the days of thy life; thorns also and thistles shall it bring forth to thee; and thou shalt eat the herb of the field. In the sweat of thy face shalt thou eat bread till thou return unto the ground.'

Differ as we may in regard to the meaning of this passage, we find man in a condition in regard to food very different from that of other animals. Instead of having everything ready at his hand, he must cultivate the herbs, and the grasses, and tuberous roots, the grains, and vegetables, and fruits, and every luxury must be obtained by dint of his wits and his industry. All he finds growing spontaneously are a few berries and small imperfect fruits, and perhaps the juices of some plants and vegetables; everything else must be cooked and prepared to be capable of digestion and of furnishing nourishment, — all our delicious apples, and peaches, and grapes, and other fruit, are brought to the perfection in which we now find them by cultivation from these berries and small imperfect natural fruits. And all our grains and succulent plants and vegetables, which are our main dependence for food, are cultivated from the seeds of grasses, and from plants so unlike these excellent articles, that the origin of many of them, though doubtless still growing wild, is not recognized. For interesting examples of this change, wrought in many common articles of food, see pages 287–289.

To assist in selecting articles of food with suitable proportions of elements for muscles and brains, under different conditions and occupations in life, you will find analyses of about fifty articles, embracing most if not all articles of food in common use in the civilized world, see pages 120–123.

They are selected with great care, from English, French, German, and American analyses, but cannot in the nature of the case be positively, but only proximately correct; for no two specimens of any article, growing on different soils and in different climates, are found to contain precisely the same elements in the same proportions. For example: Of the four hundred different varieties of wheat, described and analyzed by the French Academy of Arts and Sciences, no two are found to contain the same elements in precisely the same proportions. Still, as a means of comparing one kind of grain and food with others, and of adapting them to our particular conditions and circumstances in life, these tables cannot fail to be practically valuable to any one who shall give attention to them.

It will be seen that in ordinary circumstances of temperature, muscular and mental exercise, &c., the proportions required are about fifteen per cent. of the nitrates, or muscle-making elements, to sixty-five to seventy of carbonates, or heat-producing elements, and two or three per cent. of phosphates, or food for brains and nerves, or a little more than four times as much carbonaceous food as nitrogenous, while the proportion of phosphates vary much, and are to be used more or less according to mental and physical activity, and that the proportions of these different elements are various in different articles, giving a wide field for selection and adaptation.

And in the selection of animal food, it is of great practical use also to recur to the principles explained. See pages 82–90.

The amount of phosphatic food contained in the flesh of any animal, and the physical and mental activity imparted by it, is in exact proportion to the activity of that animal, the flesh of the trout, pickerel, or salmon imparting much more mental and physical vigor than that of the dormant pout, eel, or flounder, and the flesh of the wild bison or hog more than that of the domestic ox or hog of the same species, and of the active working ox more than that of the dormant hog or calf, which are fed and fattened in a pen, without exercise. And the same remark holds true in relation to the flesh of wild and domestic fowls.

Without going to tables of analysis, therefore, much assistance can be had in selecting food for the brain by reference to this principle.

In comparing these various articles of food, with a view to determine their adaptation to our particular circumstances, the considerations mentioned heretofore in table on page 120, and elsewhere must be noticed.

On page 16, it is intimated that the phosphates should be subdivided into soluble and insoluble, and this for thinking men is an important distinction, both as it relates to the selection of food, and its preservation and preparation. Take, for example, beef or fish, which contain both soluble phosphates for the brain and insoluble phosphates for the bones. In pickling in brine, or in boiling, the soluble phosphates and much of the albumen are lost in the water, and of course boiled or salted beef or fish is not suitable food for the thinking man, although, retaining as it does the insoluble phosphates and fibrin, it may be good food for the laboring man. And the same considerations enter into the question of cooking or preparing all meats and vegetables.

The nitrates and phosphates of all meats and vegetables are partly soluble and partly insoluble, and therefore in soaking in cold water, all lose much that is important, especially to the thinking man. In cold water, albumen is dissolved or lost, but in hot water the albumen is coagulated, and mostly retained; but in hot water as well as cold the soluble phosphates are lost. Neither fish, nor meats, nor vegetables should therefore ever be pickled in brine, nor should they be boiled, unless in a little water, as in the admirable arrangement of Zimmermann or Duncklee, where all the soluble materials, as well as all the flavor, are retained in the water that is necessary to keep up the steam, and being used as gravy or soup, all the elements are saved, as nature intended.

In roasting also, or broiling, or indeed in any manner of cooking, care must be taken not to burn up or otherwise destroy or lose any of the juices of either vegetable or animal food; especially is this important for thinking men and for those whose digestion is feeble, the power of the stomach as well as the power of the brain being dependent on soluble phosphorus. And especially is the power of the stomach dependent on the flavor of food, as elsewhere shown. Let any one try the experiment of cooking meats, fish, potatoes, carrots, turnips, or any other food, animal or vegetable, in a steamer in which the flavor and all the steam are distilled back and saved, and compare the taste of them with that of the same food cooked so that all these elements are lost, and he will be astonished at the difference in flavor, digestibility, and mental and physical energy imparted by it.

Other articles of food may be wholesome to the laboring man, that are not wholesome to the thinking man. Cheese, for example, is very strengthening to bones and muscles, containing not only the concentrated nitrates of the milk, but also a large share of its phosphates; but the phosphates are mostly insoluble, the soluble phosphates having gone off in the whey. Cheese, therefore, while it may be excellent food for the laboring man, and for children whose bones are feeble, is too indigestible, and contains too little food for the brain, to be very valuable to the sedentary thinking man, especially as it tends to constipation, containing as it does almost no waste material. But with this exception, all articles of common food, cooked so as to retain their natural elements, are useful to thinking men in proportion to the phosphates indicated by analyses, containing, as they all do in their natural condition, soluble as well as insoluble phosphorus.

Of the amount of soluble phosphorus in animal food, we can judge, as I have before mentioned, without an analysis, by the degree of activity of the animal, as only soluble phosphorus gives either activity of brain or muscle; but of the soluble phosphorus in vegetable food we have to judge by a different estimate. The phosphates of succulent vegetables and fruits, when nourishment is mostly in their juices, are of course mostly soluble, and as their solid material is mostly woody fibre, and indigestible, they also furnish waste, which is very important to sedentary men, inclined as they are to constipation. They also contain the acids which are needed every day, especially in sedentary men, the action of whose liver is sluggish, to eliminate effete matters, which, if retained in the system, produce inaction of the brain, and indeed of the whole system, causing jaundice, sleepiness, scurvy, and troublesome diseases of the skin. Acid fruits and succulent vegetables are needed therefore every day of the year, especially in summer, and in winter by those who live in warm rooms, without much exercise; and the amount of refreshing nourishment in them is much greater than would at first appear as the result of analysis. As they contain from seventy-five to ninety-seven per cent. of water, and only from three to twenty-five per cent. of solid matter, the per cent. of nitrogenous and phosphatic nourishment is greater than in more solid food in proportion to the amount of water.

For example: In wheat there is eighty-six per cent. of solid matter, of which fifteen per cent. is nitrogenous and about two per cent. is phosphatic. In apples there is but sixteen per cent. of solid matter, of which five per cent. is nitrogenous and one per cent. is phosphatic, so that in apples there is nearly twice the food for muscles; and, considering that in wheat the phosphates are partly insoluble, there is more than four times the food for the brain in apples than in wheat. And this estimate is not unfair, because there is as much water used in the digestion of wheat as in that of apples, all that is needed in the wheat being demanded and taken as drink. In other fruits and vegetables the proportionate amount of nitrates and phosphates is still greater, and it can readily be understood why, in warm weather, when carbonaceous food is not much needed, fruits and vegetables are so plentifully provided, and why they furnish such healthful action of the system and such vigor of mind.

FOOD FOR LABORING MEN.

THAT muscular power and activity is greater under the use of some kinds of food than others has been known and recorded for more than two thousand years. Before the Christian era the gladiators were so constantly trained on barley bread that they were called *hordearii*, hordeum being the Greek name for barley. And if we look at the analysis of barley (refer to table on page 121), we shall see that it contains more nitrogenous, as well as more phosphatic elements, than wheat, or any other grain adapted to bread-making. Prize-fighters and professional pedestrians prepare themselves and sustain their extraordinary powers of action and endurance on the muscles of the ox or sheep and on unbolted bread. Horses, also, are trained for the race on food containing a large proportion of nitrogenous and phosphatic elements, as oats, barley, the bran of wheat, or Southern corn — never on Northern corn or fine wheat flour, which tend to fatness, but not to strength and activity. Indeed, the experience of practical men the world over corroborates the important truths developed by analyses of different articles of food, and the scientific inferences deduced from them; and the tables, pages 120–123, are therefore confidently referred to, for the purpose of assisting laboring men to determine what kind of food will give most muscular strength, and what, in the common way of living, is lost.

It will be seen that most of the kinds of natural food, as the meats of our domestic animals, fat and lean together, with unbolted wheat, potatoes, vegetables, milk, corn, rye, barley, &c., contain a due proportion of food for the muscles, nerves, and for animal heat, without the addition of such heating materials as fine flour, bread, butter, fat pork, or lard. And as neither of these last-named articles contain any, or but little of any, strength or life-giving elements, it follows, that, used with the food containing the natural mixture and proportions of all the elements required, these heating elements, not being wanted, are either thrown off and wasted, or, by increasing the amount of heat and by embarrassing the system, tend to produce inflammations and disease. But it will also be seen that other valuable articles, as beans and peas, and many fruits and vegetables, not containing enough of these carbonaceous materials, do require with them, or at the same meal, some butter, or other fat, or starch, or sugar, to give them the requisite heating power, especially in cold weather. A little attention to these tables, and the principles upon which they are made, would be of great service, not only for the preservation of health and strength, but for economy.

It will be noticed that the kinds of food most wasted, because eaten when not wanted by the system, are the most expensive. The article most used when not wanted, in Boston, is superfine flour, out of which has been bolted a large portion of its nitrates and phosphates. This being used with butter and sugar, furnishes very little but heating materials. The next article on which most money is expended and wasted, because most used with other articles containing enough of carbonaceous elements, is butter, which contains not a particle of strength or life-giving material, and therefore is never useful, except with food deficient in carbon.

And another article most extensively used, and, for the same reason, wasted, is sugar, which, though useful with too acid fruits, and as a part of a meal in which is too large a proportion of nitrogenous food, is worse than useless in confectionery, cakes, &c., especially if eaten between meals, and when food is not wanted, as it not only adds to the superfluous heat, but causes fermentation in the stomach and bowels, and causes, or tends to cause, flatulence, colic, dyspepsia, and the thousand and one troubles of the digestive organs, which we are apt to impute to green vegetables and fruit, when the fact is, these extra carbonaceous substances, in their passage out of the system, embarrass the digestion of natural food, and cause it to give us these troubles; and this is proved by the fact that those who avoid these expensive and useless articles may eat as much as they choose of green vegetables and fruits, and it gives them no flatulence, and produces no irritation.

Our puritanic forefathers, who lived on beans, peas, unbolted grains, and the meats, vegetables, and fruits as they came from their fields and gardens, cooked in the simple manner best calculated to develop their natural flavor and prepare them for digestion, were not troubled with flatulence, colic, indigestion, &c. And our foremothers were not the pale-faced, flabby-muscled, toothless, chlorotic, consumptive, and sentimental race, as are their degenerate daughters of the present generation. Having plenty of nitrogen for the muscles, lime and silex for the teeth, iron for the blood, and all strength-giving articles of food for the lungs and digestive organs, and phosphorus for the brain, in natural food as God had furnished it, and their systems not being heated up and embarrassed by the extra carbonaceous food furnished in superfine flour, butter, and sugar, on which our daughters try, but fail, to live, they had all the elements necessary to promote the vigorous health of every organ and faculty, and none of the extra carbon which heats up the system, embarrasses the digestive organs, and renders us more liable to disease and less able to resist it.

Even our farmers, and their wives and daughters, have become terribly degenerated. Instead of the robust and healthy men, and the full-chested, healthy, rosy-cheeked, beautiful women, of former generations, we see a people almost as feeble and sickly as city people. And the reason is apparent. The outer crust of the wheat, and the buttermilk, which contain the nitrogen, phosphorus, and iron on which strength and energy, mental and physical, and beauty of complexion, depend, is given to the cattle and pigs, while they take themselves, instead, the butter, fine flour and sugar, which contain only the heating and disease-producing carbonates.

The robust Irishmen and Scotchmen, also, who come here with strong, energetic muscles, and sound teeth, from their oatmeal, wheat, and barley cakes, with their potatoes, buttermilk, and cheese, soon fall into our starch and grease eating habits, and become, or at least their children become, as pale, puny, and toothless as pure-blooded Yankees. Indeed, bringing with them, as they do, especially the laboring Irish, their clannish and unclean habits, and therefore breathing air impregnated with impurities, they suffer much more and die much faster than Yankees, whose habits of life, in this respect, are better. (See statements and statistics, in another chapter, relating to length of life, &c.)

Articles of Food best adapted to impart Muscular Power.

Cheese.

By the tables of analysis, so often referred to, it will be seen that cheese contains more elements of strength to the muscles and bones than any other article in common use in this country or in England. It contains from sixty to seventy per cent. of nitrogenous matter, and seven per cent. of phosphatic, to only nineteen of carbonaceous; and the phosphates being of the insoluble or bone-making class, it imparts strength to the bones and working power, in a more concentrated form than any other known article of food; and, being hard of digestion, it has also the good quality of staying by, or holding on, or, as the farmers say of salt beef and beans, "it is a good prop to lean over when at work." But it is not natural food, being only a part of the natural food, milk. It therefore needs additional elements to make it wholesome for a single meal. By a calculation made elsewhere, it will be seen that to eat three times a day we should require, at one meal, less than two ounces of food for the muscles. And we find that two ounces would be contained in three ounces of cheese, whereas, to produce the natural distention, nearly eight times as much bulk of food is required; and, therefore, on a meal of cheese sufficient to supply muscular power, the stomach would collapse into a condition in which the gastric juice could not be properly produced, and the digestive process could not go on. Then, again, in three ounces of cheese only one ounce of carbonaceous food would be produced, whereas there should be at least twelve ounces, to give its natural proportions. Then, again, in cheese there is almost no waste, and therefore cheese alone would produce fatal constipation in a very short time. Cheese, therefore, to be wholesome, must be eaten in small quantities, and, to get appropriate carbonaceous food, must be eaten with bread; and for this purpose white bread would not be objectionable, if it contained the requisite waste. If, therefore, we ate three ounces of cheese and three fourths of a pound of wheat bread, we should get nearly half the nitrates and carbonates needed for twenty-four hours, and in about the right proportions. But still we should get no waste, and only a part of the phosphatic elements needed; but with the addition of apples, or other fruits, or coarse bread, to supply the deficient elements, cheese would be excellent and cheap food for the laboring man.

Southern Corn.

Next to cheese, the long, tooth-shaped Southern corn, such as is delineated in figure 3, page 25, contains most nitrogen and phosphorus, compared with its carbon; and its phosphates being partly soluble, and its nitrogen in the form of albumen and gluten instead of casein, it is more easily digested, and it imparts more vigor and activity than cheese, and is therefore better adapted to work requiring rapidity of motion, but less continuous action than that to which cheese is adapted. It requires some addition of carbon, having but one part of nitrogenous to three of carbonaceous elements, whereas there is need of one to four in warm weather, and one to five in cold. It is, therefore, appropriately eaten with molasses, or meats, fat and lean; and even the negro diet of "hog and hominy" is not a bad one, especially in cool weather.

Beans and Peas.

Next come beans and peas, which, being very nearly alike in their proportions of necessary elements, will be considered together. They also contain too large a proportion of muscle-making principles, having twenty-four per cent. of nitrates to seventy of carbonates, and three to four per cent. of phosphates, partly soluble and partly insoluble, so that if we retain the liquor in which they are cooked, as in bean porridge or pea soup, they are good articles not only for laboring men but for thinking men, if they have good digestive powers. These also require additional carbon, and are appropriately eaten with butter, or fat pork and potatoes, with more of the vegetable carbonates in summer and of the animal in winter.

Lean Flesh of Meats.

Lean meats, or muscles of animals, contain about the same proportion of nitrates and phosphates as beans and peas, but they contain no carbonates at all, or at least the gelatine in them, which is carbonaceous, is not digestible, but is used as waste, to keep the bowels in action, gelatine in meats answering the same purpose as woody fibre answers in vegetable food. It is gelatine which gives consistence to soups, especially those made of joints of meat, and many people are deceived by the idea that the more gelatinous the more nourishing the soup; but nourishment comes from other elements. Still, to old people, and sedentary people who are inclined to costiveness, they are wholesome and valuable, and the gelatine performs an important office in the promotion of health.

The lean of beef contains twenty-five per cent. of food for muscles, seventy-five per cent. being water and waste. It is, if tender, very easily digested while fresh, and hard-working men prefer that which has been salted, as it "stays by" better; and as all the insoluble phosphates and all the fibrine is retained, it is good food for them, although the soluble phosphates and the albumen are lost in the brine. Lean meat can never, of course, be eaten alone, not having in it the necessary carbon to keep up steam to run the machine, but requires either fat or starch to supply the lungs with fuel, more or less according to temperature, &c., fat being best adapted to supply its carbonates in winter and starch in summer; and if fruits are eaten with meat, sugar also may be eaten without injury. Sugar seems to accord with vegetable diet rather than animal. There seems, however, to be required, to keep the system in good order, some variety, containing some fat, some starch, and some sugar; but it is always better to get these principles combined with food in Nature's own way, rather than in the concentrated form in which we find them in lard, butter, fine flour, and sugar; and the more nearly we conform to Nature's arrangements in this respect, as in all others, the better every way.

Fish.

The only other article of food in common use, in which the nitrates and phosphates are in excess of the carbonates, are the common varieties of fish in our climate. The only available carbon in fish is in the fat, of which, in most species, indeed in all species used as food in this country or England, there is but little, the gelatine, of which in many species there is a large proportion, being used for the same purpose as gelatine in red meat. It is carbonaceous, but not digestible, but serves the valuable purpose of keeping the bowels in order. The carbonates necessary to keep up the steam must, in a fish diet, be furnished either in butter, the fat of other animals, or in the starch of vegetables and grains, of which, perhaps, the potato furnishes the most valuable supply. Fish is more easily digested than red meat, but it gives less muscular power. It is not, therefore, satisfactory to those whose labor consists in lifting or steady muscular exertion; but, having a larger share of phosphates, it gives activity of muscle, especially the flesh of such fish as are themselves active, and may be adapted therefore to those whose labor requires great activity of muscle, and it is certainly good diet for work which requires study and judgment. To enable us to judge of the amount and proportions of carbonaceous and nitrogenous elements necessary, I would refer to some practical experiments collated. See pages 97–111.

The English government has for many years carefully experimented on food for soldiers, and it is found that to keep them in good fighting trim, five ounces of nitrogenous and twenty ounces of carbonaceous food are required daily, and while in active service their rations always contain this amount of nourishment. The Dutch soldier has twenty-one ounces carbonates and five ounces nitrates while fighting, or preparing to fight; but in garrison, twenty ounces carbonates and three and one half ounces nitrates.

But our American commissaries seem not to have given sufficient attention to the subject, even to learn the difference between fat pork and lean beef. Accordingly, at one time our soldiers were obliged to march a whole day on twelve ounces of fat pork, which contains not a particle of food for muscles, and hard tack, which, being made of flour out of which is bolted a large part of its nitrates, could not in all that could be eaten contain one quarter of the nitrates necessary; while at another time the rations might consist of lean beef, which has in it little else than muscle-making food.

By all the facts that can be gathered from bills of fare of soldiers, sailors, prisoners, and other working men whose diet is accurately observed, it is ascertained that at the average temperature in which men work, and with the average activity, five ounces of nitrates and twenty-one ounces of carbonates are required; and in the staple articles of natural food, such as the meats, fat and lean together, and bread from unbolted grain, milk, eggs, &c., these necessary principles are found mixed in about the right proportions; and in eating them the appetite will be satisfied with the amount of food necessary to furnish these twenty-six ounces; but if he has set before him unnatural food, that is, food from which has been taken some of its principles, as butter, cheese, or beefsteak, fine flour, or sugar, his appetite will not direct him as to quantity. For example: He may eat of white bread and butter all the stomach will contain, and not be satisfied, because nature demands and the appetite craves more nutriment for the muscles and brain; or, on the other hand, he may eat of cheese, or beefsteak alone, twice as much as is needed for the muscles, while there is still a demand for carbon, which will not be satisfied till bread, or potatoes, or some other carbonaceous food is supplied. In either case he will eat too much; but if he have before him a variety of natural food, such as meats or grains or fish, and vegetables and fruits, he may indulge his appetite, especially in the early part of the day, to the fullest extent, without harm. Eating too much, then, comes of eating unnatural food. Why should not other animals, who have unrestrained access to their natural food, eat too much?

But how shall we guard against eating too much, while indulging in food not all in its natural condition? We have seen that some articles of food in common use, both in its natural and unnatural condition, contain too much of the carbonaceous and some too much of the nitrogenous elements, and we have seen by the tables of analysis, so often referred to, that it is easy to learn which articles contain the right proportions, and which contain an excess of either principle, and bearing in mind the proportions of each principle consumed, it is easy to adjust a dinner so as to supply the principles in right proportions.

If the meal consists of meats of average fatness, — more or less fat according to the temperature of the weather, — cooked by itself, and its juices saved, unbolted wheat bread, potatoes and other vegetables, with milk, and plain puddings from any grain in its natural state, and any good ripe fruits, we might eat as much as we desired of any or all the articles before us, without varying essentially the proportions of nitrates and carbonates, and without eating too much; or, if we have articles too nitrogenous — as beefsteak, or cheese, or beans, or peas — for dinner, it is only necessary to use with them articles like butter, fat meats, and starch or sugar, and vegetables, to supply the deficiency.

The difficulty is, that not knowing the constituents of food, we use together articles which are deficient in the same elements, as white bread and butter, pork and hard tack, sugar, butter, and flour, as in cake and pastry. (Refer to tables of analysis, pages 120–123.) Assistance may also be obtained from the following table, which shows what quantity of articles of food in common use is required to get the five ounces of nitrates needed daily, and how much of carbonaceous food is had at the same time.

To get the requisite five ounces of nitrates requires, of

	Lbs. Total.	Oz. Total.	Oz. Nitr.	Oz. Carb.	Pr. ct. Waste.	Pr. ct. Water.
Cheese,	0	8	5	3	0	0
Southern corn,	1	2	5	6½	8	14
Beans,	1	8	5	10⅓	17	15
Peas,	1	9	5	10½	19	14
Barley,	2	5	5	22	16	14
Wheat,	2	7	5	21	3½	14
Oats,	2	0	5	19	15	13
Northern corn,	2	9	5	24	5	14
Rye,	2	8	5	23	15	13
Rice,	5	0	5	50	4	13½
Buckwheat,	4	0	5	35	3	14
Potatoes,	15	0	5	51	3	75
Sweet potato,	20	0	5	65	1½	67
Carrots,	50	0	5	51	4½	87
Cabbage,	10	0	5	2	4	90
Turnips,	28	0	5	2	4	90
Parsnips,	25	0	5	25	9	82
Apples, &c.,	5 to 10		5	5 to 10	5	86
Milk,	6	0	5	20	4	86
Beef,	4	0	5	45	5	44
Mutton,	4	0	5	64	4	44
Lamb,	4	0	5	35	3½	50
Veal,	4	0	5	28	4½	62

	Lbs. Oz. Total.		Oz. Nitr.	Oz. Carb.	Pr. ct. Waste.	Pr. ct. Water.
Pork,	5	8	5	110	$1\frac{1}{2}$	38
Lean beef,	1	4	5	0	7	70
Lean mutton,	1	4	5	0	$6\frac{1}{2}$	70
Lean veal,	1	4	5	0	6	75
Lean pork,	1	5	5	10	3	60
Lean fish,	1	4	5	0	10	75
Butter,	–		0	all	0	0
Lard,	–		0	"	0	0
Fat of all meats,	–		0	"	0	0
Starch,	–		0	"	0	75
Sugar,	–		0	"	0	75

Why is a Variety of Food necessary?

Besides the three staple principles for the supply of muscles, and animal heat, and the brain and nerves, included under the terms Nitrates, Carbonates, and Phosphates, other principles are needed and other conditions required to keep the digestive organs in perfect condition and the system in perfect working order.

1. We need food in amount or bulk sufficient to produce a proper degree of distention, else the digestive process cannot go on properly. The vegetarian eats on an average, perhaps, six pounds in a day, while of mixed food, of meat, unbolted bread, and vegetables, and fruits, the average may be four pounds. If, then, we should undertake to live on cheese alone, the stomach would col-

lapse into one eighth of its natural size, and could not secrete the necessary juices, or digest at all. With cheese, then, we must have vegetables or fruits, or other less concentrated food, for the purpose of distention; and the same remark applies to meats, beans, peas, &c., but to a less extent.

2. We must have also waste, which is the natural stimulant to produce the healthy action of all the digestive organs. If, then, we ate only cheese, or white bread and butter, or confectionery, or pastry, we should soon die of constipation.

3. The acids and juices provided in fruits and succulent vegetables are needed also every day, but more in warm weather than in cold, to eliminate from the system effete matter; and all nations, civilized or savage, make use of them: and if they are not had, the liver becomes engorged, the brain and the whole system becomes inactive, and, after a while, the skin breaks out in sores, and that degenerate condition or disease supervenes which is denominated scurvy, to which soldiers and sailors who are deprived of them are subject, and of which so many are known to die.

4. Food, to be well digested and assimilated, must be adapted to the taste of each individual; and a dinner made up of the necessary elements, but of articles against which we have an antipathy, or so cooked as to offend the taste, will not be digested at all, but will be rejected by the stomach, even while the system requires nourishment.

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With these considerations in mind, let us examine the foregoing table with a view to a more practical application to the every-day wants of the laboring man.

What Combination of Food will meet the daily Requirements of the Laboring Man?

The daily requirements are five ounces of solid nitrates for the muscles, twenty to twenty-two ounces of carbonates for animal heat, two or three per cent. of phosphates for bones and for nervous power, with waste and water to give it bulk, and acids to eliminate effete matter from the blood through the liver; and this food must be so prepared and cooked as to be eaten with a relish, and not be too easily digested.

By the foregoing table we see where we can get the five ounces of nitrogenous food, which is the first daily requisite for the laboring man, and we see that in the articles of food which come unchanged from Nature's storehouse, we have at the same time a part of all the other requisites, some containing too many for the ordinary demands of the system, and some not sufficient, making a variety of food necessary; and we have seen also that the natural appetite and taste directs to the use of such articles of natural food at the same meal as will supply all the demands of the system.

If, then, we had before us every variety of natural food, and nothing else, we might follow our inclinations to the fullest extent of our capacity without suffering evil consequences; but perverted as are our tastes and appetites by the constant use of butter, sugar, starch, and lard, which are separated from their food for muscles, nerves, and brains, our appetites and tastes are not a true guide, and we form a habit of taking too much carbonaceous food, with consequences such as are elsewhere described.

Under these circumstances, it becomes us to put our appetites under the guardianship of reason and common sense. And after all the mystery and darkness in which, in our ignorance, we have permitted this subject to be enshrouded, it is not a complicated question involving great mental power to comprehend, or memory to retain its principles. On the other hand, it is very simple, easily understood, and easily remembered.

Articles of Food in common Use containing an Excess of Nitrogenous Matter.

These are very few, and may all be embraced in the following articles: Cheese, southern corn, beans, peas, lean meats, fish, green vegetables, and fruits; and these require more or less food containing carbon in excess, as may be seen by the degree of deficiency noted in the preceding table; and all we have to do is to supply the deficiency with the articles containing an excess of carbon, as shown also in the table — only remembering that we require about twenty ounces carbonaceous food to five ounces nitrogenous.

Articles of Food in common Use containing an Excess of Carbonaceous Matter.

These consist of fats and oils, including butter, and of starch and sugar; and the articles of natural food in common use containing an excess of either of these principles are rice, buckwheat, potatoes, sweet potatoes, carrots, beets, and the meats of all domestic animals, as they are usually fattened for the market, and some species of fish used in northern regions. But the articles from which we derive most of our excess of heating food are the unnatural articles, — butter, sugar, lard, superfine flour (flour only containing anything but heating food, and that only a little), and in some places fat pork.

With these data before us, it requires but little study to understand what articles of food are to be used at the same meal, and what combination of articles should be avoided. It would be folly to undertake to live on cheese, or beans, or peas, or lean meat, or fish alone, or all of them combined. We should lose our fat, and become cold and die, for want of natural warmth of blood. It is equal folly to try to live on butter, sugar, fine flour, or lard, or all combined, as in pastry, cake, &c. Animals submitted to the experiment of such a combination alone, have died in from thirty to forty days; and probably three fourths of all the deaths recorded in our bills of mortality are the results of over-heated blood, and consequent inflammations and diseases induced by the excess of carbonaceous food on the organs and functions, rendered weak, and their recuperative power lost or greatly impaired, for want of the strength-giving nitrates and phosphates required, as has been elsewhere explained.

How few and simple, then, are the requirements necessary so to combine the principles of food that are within the reach of all industrious families in this country at least, as to insure at the same time economy, the pleasures of eating, health, long life, and usefulness; and to all but the most perverse and ungrateful, cheerfulness, and domestic peace and happiness! I venture the assertion that with one quarter of the time, and without any of the expense that is devoted to the silly and ridiculous foibles made necessary by the demand of fashion, these blessings might be secured to all intelligent families; and instead of losing, as they now do, one half of their children before they come to maturity, and finding most of the other half feeble, sickly, and worthless, except, perhaps, a very few who might die from casualties and from diseases inherited from a degenerate ancestry, their sons would "be as plants grown up in their youth,' and their daughters "as corner-stones, polished after the similitude of a palace.'

THE ECONOMY OF TAKING FOOD IN NATURAL PROPORTIONS.

By something like a telegraphic arrangement the stomach is kept informed of the wants of every organ and function; and, through the appetite, a demand is made for nitrates for muscular strength, or carbonates for animal heat, or phosphates for bones, and nerves, and brain, until all are supplied. And if we take food in its natural state, so as to supply all these demands at the same time, the appetite is satisfied without waste material. For example, take unbolted wheat bread and milk, containing, as they both do, a due proportion of elements for muscle, animal heat, and brains. The appetite is satisfied when just enough food is taken to supply the ten ounces of carbonates and two and a half ounces of nitrates, for twelve hours' supply. But suppose we take, instead, white flour bread and butter. When we have taken the ten ounces of carbonates which the system requires for the meal, we have received less than one quarter of the necessary nitrates and phosphates, and until these principles are supplied the appetite demands more food; and if we attempt to satisfy these demands by the same food, we must take four times as much of carbonates as are needed, and the surplus, not being wanted, after embarrassing the system for a time, is finally thrown off into the vault. And thus, by our daily habit of using, with articles already having their natural proportion of carbonates, butter, sugar, and fine flour, as we do in cakes, pastry, confectionery, sweet sauces, &c., we waste three quarters of all these expensive articles.

With less than half the expense that is thus wasted on these articles, to say nothing of the doctor's bills, and loss of time occasioned by inflammatory diseases, we might purchase all the choice fruits, and vegetables, and meats necessary to give us the highest gustatory pleasures of which we are capable ; and, at the same time, save doctor's bills and loss of time from sickness. On natural food, therefore, judiciously selected, a family can be raised, in the full enjoyment of robust health, and substantial, enduring happiness, for less than half the cost of trying to keep alive our feeble, pale-faced, sickly children on white bread and butter, pies, cakes, and candy.

NATURAL FOOD AFFORDS THE HIGHEST GUSTATORY ENJOYMENT.

THAT is certainly a beautiful provision of our heavenly Father, by which perfect happiness is made to consist in perfect obedience to his laws; and this pertains to every department of our nature, moral and physical. Indeed, there can be no real, unalloyed enjoyment but in perfect obedience to moral, mental, physiological, or physical law. It may be true in dietetics, as it is in morals, that "no man liveth and sinneth not,' and therefore no man enjoys perfect, unalloyed pleasures in eating; but in the one case, as in the other, he enjoys most who most nearly obeys the laws of his nature.

Every article of natural food is provided with its own particular flavor, or *osmazome*, which distinguishes it from every other article; and this *osmazome* is most perfectly developed just when it is so prepared as to be best adapted to furnish us wholesome nourishment. Beefsteak has its most agreeable flavor developed with just the amount of cooking that best fits it for digestion. And this is true of all meats and vegetables; while the peach, and other fruits which need no cooking, have their most agreeable flavor developed without cooking, and, when fully ripe, the slightest amount of cooking diminishes their flavor, as any extra cooking or re-cooking of meats and vegetables diminishes their flavor, and renders them less wholesome.

This principle, *osmazome*, seems to be imparted for no other purpose than to make food agreeable, and give us gustatory pleasure. And of course our natural tastes are made to harmonize with these natural flavors, so as to enable us to appreciate and enjoy them; and, until they are perverted, we do enjoy them — just as all other pleasures of the senses afford pleasure unalloyed till perverted.

A child who has never tasted of pies, cakes, candy, or any other unnatural food, will much prefer wheat bread and milk, or fruit, to any of them. This I have seen in a grandson four years old, who had eaten nothing but milk, unbolted meal bread, fruits, and other natural food, and who, in a large party of little ones, all eating cakes and confectionery, could not be induced to eat a thing, till he found an apple, which he recognized as natural food. The inference, then, that butter and sugar must be good, because children love them, is fallacious. Their natural love is for butter and sugar as they are found in milk and fruits, in their natural combinations with other necessary elements.

The first time sugar or butter is given to a child the sensation is such as to produce a shudder, and the little victim clearly indicates a disapprobation of such concentrated sapidity; but he so soon yields to his fate that parents come to think his love for these things is natural. The taste is generally tampered with in the first hour of life, by the sugar and water which its thoughtful nurse administers lest the poor thing might starve before Nature gets ready to provide for it; and then, for the hiccups which this unnatural feeding is sure to produce, it must have pure sugar; and thus the taste is perverted in the first week of its life, and then the first solid food that is put into its mouth is, probably, white bread, spread, perhaps, with butter.

No, no; Nature is not so inconsistent as to give us a natural taste for unnatural food. Nothing, to my mind, can be clearer than that the responsibility of the love of concentrated carbonaceous food, which undoubtedly causes, directly or indirectly, three fourths of all the sickness, suffering, and death of our children, rests on parents. And yet how hard it is to convince them that what their mothers did for them, and what they lived through, can be wrong.

In vain you remind them of their less hardy brothers and sisters, who have long since been laid in the grave from inflammations and other diseases induced by heating food. In vain you show them the reasonableness of obeying Nature's laws, and the fact that animals who do obey them enjoy health, and lose none of their offspring. Their only answer is, "I feed my child as my mother fed me. I did very well. I guess the little sugar, and cake, and white bread and butter which I give won't hurt them." But, I thank God, there are those who have sense enough to see the folly of such persistence in wrong, and who, giving reason and common sense control over silly prejudices, pursue the right as soon as they learn it. Such will have the happiness to see their brains transmitted to healthy and useful children, while those whose only rule is to do as their mothers did before them will transmit a race more silly, feeble, and degenerate than themselves (for the evil effects of disobedience accumulate from generation to generation), and will see them living a life of struggle with disease and suffering, or will prematurely bury them, murmuring, perhaps, at the cruelty of their fate.

Suppose a mother, in ordinary health, having a healthy husband, should always live on natural food, or, at least, should commence, seven or eight months before her child is born, and allow nothing to pass her lips but food containing all the elements that nature has furnished in it, and should take no elements in liquids but such as Nature furnishes in the juices of fruits, vegetables, milk, and pure water, and continue that course, without exception, till the child is old enough to be weaned; — having all the materials for making a perfect child, just as they are naturally provided, will Nature fail to use these materials, so as to leave any organ or function defective? Having lime, silex, potash, and insoluble phosphates for the bones and teeth, with no foreign elements to interfere with the process of forming them, perfect teeth will surely be formed. Having nitrogenous elements for muscles and solid tissues, soluble phosphates and other materials for the brain and nerves, carbon and hydrogen for adipose matter and to furnish animal heat, and all these elements and principles in the combinations and proportions which she herself has adjusted, Nature cannot fail to furnish a child perfect in all its parts and functions.

Then, supposing it continues to be furnished with natural food and drinks, allowing no foreign elements to enter the system, and conforming to other necessary requirements as to pure air, cleanliness, exercise, comfortable temperature, protection, &c., when can the organs or functions begin to be imperfect, or to become diseased? Indeed, if he should not, in all respects, conform to laws of his being, his constitution, being kept in order by natural food, will have recuperative power to ward off or overcome the evil effects, and health, nevertheless, be continued or restored. Then, again, with recuperative powers, derived from conforming to Nature's laws, and living on natural food, diseases from external causes, as small-pox, measles, &c., could all be controlled, and made harmless. Surely, then, it is a sin and a shame, as well as a misfortune, to have feeble, half-developed, sickly children; and, instead of murmuring at the Providence that removes them from us, we should repent, in dust and ashes, that, by our neglect of the clearly-revealed laws of Nature, it becomes a merciful necessity to remove them from the evil to come; and if too late, for benefit to ourselves and our children, to do works meet for repentance, we should cease not to teach the young the laws of life and health, and "to warn every one, night and day, with tears,' to escape the punishment which has been inflicted on us for our transgressions. But we shall meet a class of cases harder to reach than those who have suffered the loss of health and the loss of children.

Those who live and seem to enjoy Health in spite of wrong Habits of living.

An old toper, who has kept his copper hot with whiskey or rum for half a century, and who has outlived all his drinking companions by scores of years, cannot see that he lives because he is too tough to be killed by that which has killed all his old toper friends, but very likely thinks he should have been dead long ago but for the preserving power of alcohol.

An excellent old lady of seventy-five years, who had taken green tea from her youth, till by the tannin it contained her skin had been dried and tanned into the resemblance of what indeed it really was, dark-brown leather, said to a friend, in sober earnest, "There will probably be very few more old people in Boston, for everybody is leaving off drinking green tea."

After Carnaro lived fifty-eight years on twelve ounces of solid food and fourteen ounces of light wines each day, containing a mere trifle of alcohol, Professor Lewes (himself a drinker of alcohol), "wonders that intelligent men, in view of such a fact, can doubt that alcohol is nutritious.'

I have tried in vain to persuade a young mother, who has inherited a good constitution, and who is one of six children, all but two of whom lived to maturity, the remaining four, however, being subject to dyspepsia, neuralgia, colics, and all the other sufferings induced by too heating food, to bring up her child in obedience to Nature's laws, trying to show her that the chances of its living to grow up will be doubled, and her exemption from suffering vastly greater, as it will be less liable to sickness, and have greater recuperative power to overcome it; but she says she is willing to trust her child with the same treatment that she herself had, and lived through, and so in the first winter of life the top of its lungs are exposed by low-necked dresses, and it is fed with sugar, cakes, white bread and butter, &c., and now, as it has lived through the winter and spring without lung fever, — as I told her it might not, — she is fully confirmed that she is right, and will probably go on risking its life further and further till, unless it proves tougher than the majority of children, some inflammatory disease will take it from them; and even then it is hardly probable she will be convinced of her responsibility in the case. And thus it is now, as in the times of Ecclesiastes the Preacher, "Because sentence against an evil work is not executed speedily, therefore the heart of the sons of men is fully set in them to do evil.'

FOOD FOR SEDENTARY PEOPLE.

By experiments made on five hundred prisoners, in five jails in Scotland, it was found that the least amount of food that would keep men up to their standard weight while sitting still in a moderate temperature, was four ounces of solid nitrogenous food and thirteen ounces of carbonaceous. And we also see that soldiers in active service, and laboring men, require from twenty to twenty-three ounces of carbonates and five ounces of nitrates.

By these data we can estimate the amount of these principles required in different degrees of exercise, but we must also consider the difference in quality of food adapted to different conditions. Laboring men require more of such nitrogenous food as gives most fibre and strength of muscle, as the flesh of active animals, cheese, beans, peas, &c., which contain fibrine and casein, which make fibrine for the muscles; while sedentary men require more of gluten and albumen, which are found in fish, eggs, grain, &c. Then, again, the carbonates which are adapted to sedentary life are sugar and starch, rather than most of the fat of meats, and they need more of acids to eliminate effete matter from the liver, which accumulates for want of activity. They need, also, more waste material, to keep the bowels in action, and therefore require, besides the grains in their natural state, more vegetables and fruits, which furnish waste as well as acids; and these waste and acid principles are needed more in spring than at any other time, especially the acid fruits. Not that that is Nature's arrangement, or that these requirements would be needed if we lived in winter as we should; but sedentary people spend most of their time in winter in a warm atmosphere, and need, therefore, vegetables and fruits almost as much as in summer; but not having them, and eating more of the fatty materials which produce this state of things, the liver becomes engorged with effete matter, which vegetable food alone is adapted to remove.

This can be tolerated in winter, when the system has more physical energy, especially if a part of the time is spent in the open air. But when warm weather comes on, and the system becomes dormant, the liver, partaking of the general inactivity, cannot perform the extra duties of disgorging matter thus accumulated, and jaundice, and other bilious difficulties ensue. In such cases medicines which act directly on the liver may afford temporary relief; but Nature's sovereign remedy is found in the juices of fruits and vegetables.

Sedentary people not only need different kinds of food from active laborers, but they require it differently cooked. Active men can live and thrive on salted and boiled meats, as I have before explained, out of which have been taken the soluble phosphates and the albumen, because they retain the elements which give strength to bones and muscles; but these last elements are essential to sedentary men, as are also the sugar, albumen, and soluble phosphates of vegetables, which are lost in soaking and boiling in water, unless the water in which they are boiled or soaked is retained and used as gravy or soup.

Active men, having also good digestive powers, can dispose of food out of which is taken, by salting, or soaking or boiling, the osmazome, or flavor, which so essentially assists in the digestion of food; but those who have little out-of-door exercise, and require less food, having less powers of digestion, need the aid of all these flavors, and every other auxiliary to digestion. They should, therefore, have all their food so cooked as to retain every element and every quality which Nature has provided in it, so as to make it most agreeable to the taste, and most digestible.

Flavor, which is essential to good Digestion, is volatile, and may be lost in cooking.

That principle which gives relish to food, and which distinguishes one article from another, called *osmazome*, I have explained, and I propose here only to show how it can be preserved in cooking.

Go into any house where meats and vegetables are being cooked in the open air in the basement, and you find the air filled with the combined flavor of every article. Of course all the flavor thus diffused is lost for the purpose for which Nature intended it, and the food is rendered insipid to the extent to which it is thus diffused, and to the same extent it becomes indigestible. This is proved by the fact adverted to (page 214), where good meat was boiled in the open air till all its osmazome was removed, but which retained all other essential elements; and the stomach of the dog, which was allowed no other food, so rejected it that, rather than eat it, he would have died of starvation.

All meats and vegetables should therefore be cooked by a process which not only saves the soluble nitrates, phosphates, and carbonates, as before stated, but also the osmazome; and for that purpose, the steamer invented by Zimmermann, and improved by Duncklee, is an admirable arrangement, saving, as it does, all the flavor, and condensing it in the water at the bottom, so that the smell is not perceptible in the house or kitchen in which it is cooked, and so that it may all be returned to the meats or vegetables, vastly improving their flavor and digestibility.

The flavor of soups may also be greatly improved by putting together every article to be used, first soaking them in cold water, and using that water only in the steamer, then steaming them gently, so as not to allow the steam to escape, and serving all the liquid that remains, diluted more or less to suit the taste. Soup thus made, with a variety of vegetables, and one kind of meat not before cooked, is to an unperverted taste delicious, without the addition of a single condiment except a little salt, (and the taste may be trained to relish soup and other food without salt; but there is no evidence that a little is injurious. Cattle that have access to salt eat all they want without injury.) Of course its flavor may be varied to suit the tastes of the family, by using such vegetables as are most agreeable, and by avoiding any article known to be offensive to any.

Roast meats may also be greatly improved by first steaming them for a short time with the vegetables to be used, and saving the water, to be used with the drippings of the meat for gravy, instead of the vile stuff made of flour and butter and spices, which is usually served for gravy.

Only one kind of meat should ever be cooked in the same steamer or roaster at the same time; otherwise, by mixing the flavors, all meats taste alike, and we get no variety. For this reason, hotel life soon becomes tiresome, and the food loathsome. All the meats being cooked in the same oven, and served with the same gravy, you may call for beef, pork, veal, mutton, or chicken, but cannot tell by the taste which you get.

FOOD FOR WINTER.

THAT carbonaceous food furnishes animal heat is clearly proved, and that, therefore, we need more starch, or fat, to keep us warm in winter, just as we need more coal and wood to warm our apartments, there is no doubt. Some hypercritical professor, who rides theoretical physiology as a hobby, may again object to the comparison, unless I fully explain the difference between combustion of fuel and the vital process by which animal heat is produced; but if I am able so to explain to common-sense minds the use of carbonaceous food, as to enable them to obtain its benefits and avoid its evils, I care very little for cavilling criticism. I have already explained the fact that fats and oils, having in them no water, contain two and one half times more carbon than starch and sugar, that contain a large per cent. of water. Fats and oils, therefore, are adapted to cold weather, when large supplies of heat are needed; and accordingly Nature furnishes this principle in cold climates, in the adipose covering of the flesh of seals, whales, and other animals which need it for their own protection from the cold, and also in the corn and grains, which contain oil as well as starch in proportion to the cold of the climate in which it grows. (See plates on page 00.) So that the Greenlander may have his excessive demand for heat supplied by the excessive fatness of the seals and bears of that region, and the Canadian can be supplied by the oil and starch of his corn, either directly in his corn cakes, or indirectly in the fat which they furnish to his pigs and cattle.

People who live in the open air in cold climates are not in danger of eating too much carbonaceous food, even the gallon of whale oil, or twelve pounds of candles, which an Esquimaux woman is said to eat in a day, being only enough to keep up the necessary heat. But they who live in warm houses, and seldom go out in the cold, may and generally do eat too much carbonaceous food; and not having in winter so much of the counteracting influence of fruits and succulent vegetables, suffer even more from that cause than in summer.

Why is it that we suffer more from inflammatory diseases, especially of the throat, air passages and lungs, in winter than in summer? Eating, as we do in winter, more fat meat, buttered cakes, buckwheats, &c., with less of fruits and vegetables, and spending most of our time in warm rooms, we keep up that heated condition of the system which predisposes it to inflammations, and exposing, as we do, perhaps, for twenty-three out of the twenty-four hours, the nasal organs, air passages and lungs, to a warm and relaxing atmosphere, and then for one hour, perhaps, exposing them to air below the freezing point, and perhaps at zero, the vessels of the mucous membranes are first expanded and filled with blood, and then suddenly contracted and the blood expelled.

This naturally causes inflammation of the parts thus exposed, rather than other parts not thus exposed, and thus in winter we have catarrh, sore throat, bronchitis, lung fevers, &c., unless perchance we get a chill on some muscles or other organs by exposure to currents of air or damp clothing; then we may have, instead, rheumatism or gout, or some other disease to which we may be predisposed.

Nature evidently made provision in each climate for us to live mostly in the open air; for we find that the starch in grains and seeds, and the proportion of fat in all animals, compared with the muscle-making elements, are furnished in proportion to the average amount of cold for the year of the climate in which the animals or grains grow or live. For example: The weight of wheat is mostly made up of starch and gluten; and hundreds of analyses have been made to ascertain their relative proportions in different climates of Europe, and it is found to vary from the cold northern states of Scotland and Northern Russia, from ten per cent. of gluten in these northern climates to thirty-five per cent. in Italy and Turkey and the more southern climates, the remainder being mostly starch. And the same fact has been shown by comparing the wheat of Canada with that of Georgia and Alabama in this country. And to show that this is not an accidental circumstance, wheat from Canada has been sown and raised in Georgia, and the first year it will produce nearly the amount of starch as the same kind in Canada; but if the product be again raised in Georgia, the next crop will contain less starch, and it will thus continue to diminish, if continuously raised, till its proportions are the same as Georgia wheat; and the change will be reversed by raising Georgia wheat in Canada; and the same effect is produced by the same process on corn and other grain. For those, therefore, who in this climate live mostly in warm houses, and spend but little time in open air, and for warm weather, bread from Southern corn and Southern wheat is much more wholesome than from Northern corn or wheat.

CHRONIC DISEASES CURED BY DIET.

In another chapter I have shown that extra carbonaceous food, by keeping up the heat of the blood above its natural temperature, predisposes the whole system to fevers and inflammations, and renders these fevers and inflammations less easily cured, just as exposure of wood and other combustible substances to heat renders them liable to combustion, and makes it more difficult to subdue the flames if once commenced.

Extra carbonaceous food, then, is the predisposing cause of catarrhs, sore throats, lung fevers, and inflammations generally. The exciting cause is change of temperature, producing undue contraction and expansion of blood vessels; but if there is sufficient recuperative power in the system, these diseases will be prevented or immediately thrown off.

Accordingly we find that the same exposure which will produce disease in one person will be entirely harmless in another; and some facts have recently come to light which go to corroborate the idea that those who take no extra carbonaceous food have power not only to resist the encroachments of disease, but have recuperative powers that produce wonderful effects in the cure of disease: so that, living according to Nature's laws, we may not only hope to be exempt from new diseases, but may also get rid of chronic diseases and infirmities of even twenty-five years' standing.

My attention was first called to this fact by the statement of Banting, the fat Englishman, who reduced his weight by abstaining from carbonaceous, and eating freely of nitrogenous and phosphatic food, that while living on this diet, a hernia, for which he had worn a truss for many years, was almost entirely cured; and during the last year a case has come under my observation still more remarkable. A gentleman who has been obliged to wear a truss for inguinal hernia for nearly twenty-five years, and who is now sixty-four years old, having for the last two years eaten no extra carbonaceous food, has been gradually recovering from the hernia, and now for some months has left off his truss entirely. At first these cures seemed to me almost miraculous; at least I could see no connection between the cause and effect; but on reflection, I am convinced that the explanation is this: Hernia is caused by want of tone and consequent relaxation of the abdominal muscles, occasioned, perhaps, generally by want of sufficient nitrogenous food. The tendons are not drawn together sufficiently taut at the ring to retain perfectly the flowing and slippery intestines, and they pass through; but by leaving off extra carbonates, and taking instead the nitrogenous food, which gives strength to muscles, their tone is restored, the tendons are drawn taut, and the bowels are retained.

The following case of family idiosyncrasy I think gives some light on the influence of nitrogenous food on the muscular tissues: A few years since, a physician in Boston, in a good but not harassing practice, became so affected by disease of the heart that for a long time — I think a year — he could not attend to business, and at times was brought apparently to the point of death. He travelled from city to city, consulting all the most eminent physicians in the country, especially such as made heart disease a specialty. They all agreed that his case was anomalous; and inasmuch as his father and one brother had died of a similar disease, they naturally supposed his would prove fatal also. But he recovered, and is now enjoying good health and engaged in active practice.

Knowing that he was an extravagant eater of cheese, — the most concentrated nitrogenous food, — and also seeing the extraordinary effects of such food in the cases just referred to, and, therefore, suspecting that cheese might have had something to do with the case, I called on him, and obtained the following facts: —

His father and his brother, as well as himself, were all extravagant eaters of cheese; eating it at all times in the day, and in great quantities; and they had, of course, great powers of digestion: for a stomach that can digest cheese in half-pound quantities can digest anything. And the old gentleman died at eighty-four, of what was considered organic disease of the heart, retaining his digestive powers to the last. The brother died comparatively young, with similar symptoms; and the doctor, after struggling for a long time with similar symptoms, seemed to be approaching a similar end, when he gave up cheese for a time, and soon began to recover. Since then, for two or three years, having eaten less than half his former quantity of cheese, he seems perfectly well.

The doctor's case was not, of course, organic disease, and my diagnosis of the three cases is this: All eating probably two or three times more nitrogenous and phosphatic food than was necessary to supply the requisite muscular and nervous power, and, as in the cases referred to, where the right proportions of this kind of food gave new tone to the abdominal muscles, and enabled them to overcome a hernia and cure it, so in their cases, excess of the same food produced an excessive tone and tension to the muscular system, and the heart, being a muscular organ, the action of which must be regular and not excessive, to perform its functions properly, that was the organ on which this excess of tone and tension most clearly manifested itself, and the symptoms were precisely such as might have been expected under such circumstances.

The circulation was very rapid, and the pulse very full and irregular, and at times, for eighteen hours without ceasing, the heart would beat with such force as to jar the bed on which the doctor lay, and then suddenly, as if exhausted, would calm down as if to rest.

With recuperative powers such as is induced by such food and such powers of digestion, Nature holds out wonderfully, and for a whole year she was able to grapple with the difficulty, till relief finally came by removing the cause; and now, if he will allow himself to take no more nitrogenous food than is necessary, say five ounces in a day, his chances of life are as good as those of any other man in the same circumstances in other respects.

His brother, continuing his extra nitrogenous diet to the last, and, having less recuperative power, perhaps, succumbed to the first attack in two or three weeks. His father, having extraordinary vital energy, endured the strain of extra nervous and muscular power to a good old age, but, continuing his extraordinary diet to the last, he yielded also to the first attack.

But other cases show more directly the recuperative effect of natural food. A gentleman of scrofulous tendencies, who had had for eight or ten years an open abscess, was induced, for the improvement of his general health, to abstain from extra carbon, and take food rich in nitrogen and phosphorus, and almost immediately the abscess began to heal, and in a few weeks it ceased to discharge, and this without any local application to it.

Another gentleman had a kind of gouty enlargement of the great toe joints, which had become chronic, and which required boots of extra width to enable him to walk. For improvement in general health, he also adopted natural food exclusively, and in a few months could wear narrow, genteel boots, without the least pain or inconvenience.

These three very suggestive cases have come under my observation within the last year; and among the large number who have already adopted practically "the Philosophy of Eating" (even now reckoned by hundreds), there are probably other cases that have not been brought to my notice.

These cases, though not sufficient to establish an important theory, at least give us reason to hope for more benefit from living philosophically than I had dared to anticipate. They show at least that, to some extent, abstaining from extra carbonaceous food and using instead that which is nitrogenous and phosphatic, the system has increased power not only to resist the encroachments of diseases, but also to overcome and cure them.

NOTE TO THE SECOND EDITION.

DEC. 24, 1868.

In the four months since this chapter was written, I have seen cases, showing that by the combined influence of nitrogenous and phosphatic food and homœopathic medicines, scrofulous ulcers, tubercles, and ulceration of the lungs, scrofulous and fatty tumors, can be cured; and in one case, two ovarian tumors, producing enormous distension, were entirely removed in two months, leaving the patient in more vigorous health than she had been before for years.

FOOD FOR SUMMER.

In warm climates Nature provides starch and sugar for necessary animal heat, not fat; and gluten and albumen for muscular power; while in cold climates fat and starch are the carbonates. Ripe fruits and green vegetables have mostly sugar for their carbonates, and gluten and albumen for their nitrates. Grains and seeds have mostly starch for carbonates, and gluten and albumen for their nitrates; and it is worthy of notice that while grain, especially corn growing in the Northern States and Canada, has a large share of oil, the corn of Southern states has not a sixth as much.

Animals, also, of northern climates, eating the grain that contains fattening oil, have much more adipose covering to their flesh than the same species in southern climates. These are clear intimations that sugar and starch are appropriate principles for furnishing animal heat in warm weather, and fat and starch in cold weather.

We also find a larger proportion of starch in wheat and corn (Southern corn having but half the starch in proportion to gluten as Northern corn), and, indeed, in all grains in northern climates. We find, also, that the warmer the climate the greater the abundance of succulent vegetables and fruits, whose carbonates consist almost entirely of sugar. And from all these facts we are shown that vegetables, grains, and fruits are intended for warm weather, and that meats, especially fat meats, are better adapted to cold weather. Fish, however, of every climate, furnishes appropriate food for that climate; those of Northern waters being fatter than those of Southern.

A little reflection on these data will suggest a bill of fare for warm weather, consisting of the grains in their natural state, — avoiding Northern corn and wheat, — vegetables, fruits and berries, as they come along, the most succulent being furnished in the warmest part of the season, with lean meats and fish, and only enough of butter or fat to make them palatable, avoiding, especially, stimulating condiments and concentrated combinations of heating food, as pastry, cakes, flour puddings, white bread and butter, &c., these carbonaceous articles of food being undoubtedly a predisposing cause of the dysenteries, dyspepsias, liver and bowel complaints, that are so prevalent in warm weather.

And it is not an argument against this theory that nursing children are as liable to these diseases as others; for, according to the doctrine I have endeavored to establish, the influence of carbonaceous food is the same on the nursing child, through the mother, as on the weaned child directly. Nor is it an argument against the free use of fruits and vegetables, that, if taken only occasionally, and in excess, they produce or excite these very diseases; for it is true in this case, as in every other, that that which in regular use and appropriate quantities is wholesome, in irregular use and in excess is the source of suffering and disease. Besides, if children were constantly supplied with fresh and wholesome fruits and vegetables, they would never eat them in excess.

PREVENTION AND CURE OF DYSPEPSIA.

THE grand port of entry for the human system is the stomach, and the senses of taste and smell are placed, as sentinels, to guard its portals; and, if not tampered with and demoralized, they would not, under any pretence, allow a particle of matter, solid or liquid, to enter it, except food as organized and prepared in Nature's own laboratory, and drinks composed of milk, the juices of fruits and plants, and pure water; and these would only be admitted as they are needed to supply the necessary elements as fast as they are used up and cast off from the system.

All animals in their natural state range at large in the sphere assigned them, and have access to everything, good and bad; but their appetites and tastes, as sentinels and guardian angels, allow not a particle that would be injurious to enter the stomach. Though there might be found in the same field, and even in the same plant, the natural food and the deadly poison, they are directed, with unerring certainty, to take such food as contains the elements required to keep them in health, and to reject everything that would be injurious. Having, therefore, all that is requisite to keep the stomach and digestive organs in health, and nothing to disturb their secretions and functions, they never have dyspepsia, or any other disease, except such as are induced by accident.

Does any one doubt that man would be as perfectly exempt from dyspepsia, and, indeed, from all other diseases, if he lived as entirely on natural food, and obeyed as perfectly all the laws of his nature? To believe otherwise is to believe that our Maker has taken less care of his most perfect work than of his inferior productions. Do you say that man has less power to discriminate between the good and the bad because his senses of smell and taste are less acute? That may be true; but are not his intellect and reason more than an equivalent for any deficiency in his animal senses? Our senses of smell and taste are, however, sufficiently acute to guide us, if unperverted by the use of food out of which has been taken some of its essential elements, and by poisonous articles. And, as it is, they are faithful sentinels still, as far as they are allowed to be, and admit no food in its natural condition but at the right time and in right quantities; so that, in regard to the grains, meats, milk, vegetables, and fruits, in their natural state, if we ate nothing else, we might eat as much of them as the appetite demanded, without injury.

But a faithful sentinel might admit to the garrison one who might prove to be the vilest traitor or spy; and though, at first, he might be suspicious of him, might, after a while, come to like him, and treat him with kindness, if, at first, he had been ordered to admit him by a superior officer; — so these sentinels of the stomach admit, and come to have confidence in, and even ardently love, not only butter, sugar, starch, fat, and other articles which are injurious, in that unnatural, concentrated state in which we use them, but even the vilest weeds and compounds containing the most poisonous principles, as tobacco, alcoholic drinks, opium, hashish, &c. Under these circumstances, it may be questioned whether, with these perverted appetites and tastes, it is possible to return to natural food alone, so as to bring back the system to its normal condition, and make it exempt from the diseases and suffering to which it is thus made liable.

Whether or not it is possible to restore a degenerate and diseased body to a state of perfect health, one thing is encouraging: — we find, by the testimony of all who resolve to live as nearly right as possible, that they succeed in improving their condition far beyond their expectations, and that just in proportion as they approximate to Nature's standard is their approximation to health, as also to the enjoyments of eating; and in just the proportion as they eat natural food, properly cooked, and allow nothing else to enter the stomach, are they free from dyspepsia, and the thousand and one pains and ills that are connected with it.

Animals in their natural state never suffer from dyspepsia, because, from the day of their birth till the day of their death, being left free to follow their natural appetites and tastes, they never take into their stomachs a particle of matter, solid or liquid, but natural food and pure water; but the appetites and tastes of children are not left unperverted for a single day, — "they go astray as soon as they be born," — and that child is a lucky exception who escapes unnatural food for the first six hours of life: as if Nature was so at fault as not to provide nourishment as soon as it is needed. As a natural consequence, the symptoms of dyspepsia, such as flatulence, colic, &c., commence on the first day of life; and then come the catnip and camomile teas, to relieve the flatulence and pains induced by the sugar, which are sure to induce other pains worse and more enduring; and thus, on the first day of life is inaugurated, not only dyspepsia, but, at the same time, a system of treatment which perpetuates all manner of diseases and sufferings to the end of life, and which diminishes the average length of life from "threescore years and ten" to from thirty to thirty-three years. And the foundation for these evils is also laid during the period of nursing, and even before birth, as I have before explained, by the neglect of the mother to furnish elements for a perfect organization, and by furnishing, instead, elements which, not being needed, are injurious.

And having, in such culpable ignorance, laid the foundation, and inaugurated a system, and formed appetites for unnatural food, by which these diseases and sufferings are so early commenced, we, of course, follow on, thoughtlessly, in the way in which our parents have started us, in the use of heating food and deleterious drugs, till we inevitably fall a prey to the diseases which are thus induced and perpetuated. And, to every reflecting mind, the wonder is, not that so many are troubled with dyspepsia, but rather that any escape.

The Process of Digestion.

The most important agents in the process of digestion are the juices of the mouth, the stomach, the liver, and pancreas — the gastric juice being the most important, the others being only auxiliary. These juices are changed day by day, in certain qualities, so as to be adapted to the digestion of different kinds of food, and, like muscles which have regular duties to perform, have power given them according to the duties required. If we live on food requiring little power of digestion, like rice, fine flour, fresh fish, soups, &c., the powers of digestion will, after a while, become so enfeebled that, if suddenly we take solid meat, cheese, &c., suitable juices not being, at first, furnished, indigestion, or temporary dyspepsia, follows; but continue the use of these articles, and the appropriate juices will be furnished, and the powers of digestion will rally and perform the task assigned them. It is a mistake to suppose that the most digestible food is best for those who are predisposed to dyspepsia; on the other hand, the powers of the stomach are capable of cultivation, and become strong or weak according to the regular work imposed on them to do, just as the muscles become strong or weak as they are or are not actively used. But in the one case, as in the other, strength can be imparted only by regular and gradually increasing exercise. Perhaps, for example, there is not one stomach in twenty which, after a lengthy abstinence from it, could readily digest cheese; and yet there is not one stomach in a thousand that could not be made to digest it readily, by beginning its use in small quantities early in the day, and increasing the quantity daily; and thus we may teach the stomach, as we may teach the muscles, to perform any reasonable task regularly imposed on it. This is an important consideration, both as a means of preventing and curing dyspepsia.

Another important consideration relates to the principle which gives relish to food, called *osmazome* — a principle without which the digestive juices are not secreted, and without which digestion cannot go on at all. This is proved by the experiment already referred to, in which the dog, shut up with meat having all its elements preserved but the flavor, would not eat it, because it could not be digested, although he was starving. Our own experience also shows us how much our digestion depends on the relish with which it is taken. And we are thus taught that it is our bounden duty to enjoy eating as it is our duty to enjoy life. But we find in the one case, as in the other, that true enjoyment comes only in connection with obedience to the laws of our being; so that they enjoy most who only study to know what is duty, while they enjoy least who only seek after enjoyment in eating, and most assiduously inquire what can be had that is good to eat.

So also in the one case, as in the other, the pleasures which we do enjoy, in the unnatural excitements of excess, are fraught with evil consequences, and produce subsequent reaction, depression, exhaustion, or suffering — as, in the other case, the pleasures derived from the taste of sugar, butter, flour, and their combinations, give us, in just the proportion as their flavor is excessive and unnatural, subsequent gastric exhaustion, debility, disease, and pain.

To get, then, all the gustatory enjoyment we are capable of receiving, we have but to take, every day, the kind and variety of food best suited to the condition and duties of the body for that day — so kind is our heavenly Father, in providing that, in keeping his commandments, physical and moral, there is always great reward, and in thus making it promote our highest happiness to do right. But some one may say, "I am so wedded to my butter, and sugar, and pastry, and cakes, and they have so become second nature, that I cannot do without them." Well, if you cannot make the sacrifice of a radical reform, try a partial course, and you shall find a reward even in that. Take, for example, good, clear, light-colored wheat, and have it well ground, and kept in a close, tight cask, so that there shall be no need of sifting, and make from it unleavened bread, according to rule already given (page 45), or from good sweet yeast, and not eaten till it has been for some hours in pure air, to exchange its carbonic acid gas for oxygen, and use that, or rye and Indian, entirely, and a large majority will prefer it, at first, to fine white bread;

and though, at first, being harder of digestion, it may cause flatulence, yet, follow the rule for teaching the stomach to do its duty, and you will soon be rewarded in improved digestion and improved health. But in confirmed dyspepsia a more radical course will be needed; and in just the proportion as you return to natural food will be your enjoyment of digestion, your freedom from flatulence and colic pains, and you will find yourself able to do cheerfully all the duties of life. Hundreds have tried it, and this is their unanimous testimony; and if there are exceptions, they are only apparent, and are dependent on want of perseverance sufficient to overcome the effects of long-continued perversion of the digestive powers. At any time, before there is actual disorganization of some organs connected with digestion, which, from continued transgressions, will sometimes occur, a radical change, and conformity to Nature's laws, not only regarding food, but air, exercise, friction of the skin, &c., will effect a radical cure. (For other important considerations relating to digestion, see chapter on Leanness.)

IS ANIMAL FOOD ALWAYS INJURIOUS?

In the first place, it seems to me perfectly unreasonable that God, in blessing Noah after the flood for his faithfulness, should give him control of "every beast of the earth, and every fowl of the air, and all that moveth upon the earth, and the fishes of the sea;" and should tell him that "every moving thing that liveth shall be meat for you, even as the green herb;" and should cause to be deposited in all these living creatures the same elements, in the same combinations as are wanted in the human system, and as are found in the "green herb,' or vegetable food, and should, at the same time, make one class to be appropriate food and the other injurious.

That each class of food does contain the same elements, in the same combinations, and nearly the same proportions, has been seen. Take two articles — beef and wheat, for example. Beef contains of carbonaceous food thirty per cent., nitrogenous sixteen, phosphatic five, and water fifty. Wheat contains of carbonaceous food seventy per cent., nitrogenous fifteen, phosphatic two, and water fourteen. Now, considering that thirty per cent. of fat is equal to two and a half times as much starch, in heating power, or seventy-five to that of wheat at seventy, these two articles, the beef being of average fatness, in strengthening and heating qualities are nearly alike; but the beef has more than twice the nerve and brain food as the wheat.

In this last respect, however, beef and wheat differ less from each other than some other articles entirely vegetable. For example: Northern corn contains but one per cent. of nerve and brain food, while beans contain three and a half per cent., and Southern corn four. Where, then, is evidence, in chemical structure of animal, as compared with vegetable food, to show that the one is wholesome and the other injurious? And then as to the practical results of living exclusively on animal or vegetable food — where is found the proof of the advantages of the one over the other, either in the perfection and size of the body or in the vigor or length of life which they impart?

The Patagonian is the largest, and, perhaps, the most vigorous race of men, and they live almost exclusively on animal food, while the vegetable-eating Hindoo is a race among the most inferior. On the other hand, the vegetable, and milk and cheese-eating Bushmen are well formed, athletic, and vigorous, while the meat-eating Esquimaux are an inferior race of men.

And then statistics, while they prove, as I have shown in another chapter, that length of life, as well as health and happiness, depends on the free but temperate use of the good things that Nature has furnished, both of food and remedial agents, and on rejecting everything injurious in food, drink, medicine, or air, give not an item of proof that vegetarians live a day longer, or have less sickness or pain, than those who eat meat, but who live, in other respects, as temperately and carefully as their vegetarian friends. Nor has such proof been furnished from any other source.

CONSUMPTION OF THE BLOOD.

That peculiar greenish or ash-colored appearance which is seen in our feeble, undeveloped daughters, and which indicates the disease called chlorosis, from the color of the skin, — being a watery state of the blood, — is supposed to be caused by want of iron in the system; and hence such girls are always found taking iron, in pills, or drops, or in some other crude preparation, with the vain hope of thus restoring iron to the blood. And as, for a while, the appetite is improved, and the strength apparently increased, the remedy is continued; but the improvement is deceptive, and never, according to my experience and observation, effects a permanent cure. And this opinion is confirmed by the highest medical authority, as I have quoted before.

One sentence from Trousseau is so important in this connection, that I will repeat it here, there being no higher authority on this or any other medical subject. As quoted by J. Francis Churchill, a celebrated French physician, who confirms the statement, "M. Trousseau declares that iron, in any form, given in chlorotic affections, to patients in whom consumptive diathesis exists, invariably fixes the diathesis, and *hastens the development of tubercles*. The iron may induce a factitious return to health; the physician may flatter himself that he has corrected the chlorotic condition of his patient; but, to his surprise, he will find the patient soon after fall into a phthisical state, from which *there is no return*. This result, or at least its hastening, M. Trousseau attributes to the iron. The assertion is a most startling one. M. Trousseau is nevertheless so certain of what he says, that he denounces the administration of iron in chlorosis as *criminal in the highest degree*.'

No attempt has ever been made, to my knowledge, to refute the opinions of these two celebrated physicians, and it corroborates the doctrine that I have elsewhere endeavored to establish, that "no elements are allowed to be incorporated into and become a part of the blood, in any organ or tissue, that are not fitted for digestion in some vegetable," but that, on the other hand, they become poisonous or injurious to the system. And yet, if you ask the first ten green or ash-colored girls you shall meet, what they are taking as medicine, nine will probably tell you — iron.

And the most of them, if they have taken it but a short time, will declare they feel better for it. And this is accounted for on the same principle that alcohol, another article composed of disorganized elements, deceives the feeble patients who take it, by making them at first feel better, but afterwards, as the stimulus loses its power, depressing them in the same proportion as they had been stimulated. Iron, however, is a slower and more permanent stimulant, and therefore more deceptive. For a time, however, like alcohol, it increases the powers of digestion, and causes, perhaps, iron to be appropriated from the food; for sometimes the color of the cheeks and the blood return, and it apparently becomes thicker and better; but that the strength and color of the blood in that case are produced by the stimulant, and not from the iron directly, is proved by the fact that alcohol, and phosphorus, and some other stimulants, will do the same thing, and even quicker than iron. In all cases, however, these stimulants leave the system more depressed at last, and thus hasten the development of incurable consumption, either of the lungs or bowels.

What is the Cause of Chlorosis?

I have investigated scores of cases, and found their history to be uniformly the same. From the time of its birth, and months before, till the child was weaned, the mother had lived on food which contained very little iron, or any of the elements of which its tissues or blood is composed.

Butter contains not a particle of iron, sugar none, and superfine flour very little. I have found many a young mother whose principal food consisted mostly of white bread and butter, cakes, pastry, confectionery, and coffee and tea, neither of which, nor all together, would contain, in all she could eat, of iron, phosphorus, nitrogen, or lime, sufficient to make blood, bones, or muscles in good condition for the child alone, while her own system would be left unsupplied.

It is a curious physiological fact, that in such cases Nature provides first for the child, and if the expectant mother fails to supply elements sufficient for both herself and the child, the child will be first supplied at the expense of the mother; and we often see white bread and butter, and cake and pastry-eating mothers pale and feeble, and suffering intensely from defective teeth and neuralgia, for want of iron, phosphorus, nitrogen, and lime, while the infant may be born in a condition comparatively well developed and healthy.

And then in nursing, though the child gets the best of the elements furnished, still it can never get good blood from such food as does not contain the elements of good blood; and when it is weaned, its food will probably be of the same kind as that on which its mother lives. And thus if it lives at all, it will grow up feeble in muscle, for want of nitrogen; defective in teeth, for want of lime; neuralgic, nervous, and hysterical, or perhaps stupid, for want of phosphorus; and pale and ash-colored, for want of iron. Such are the girls who have a morbid, indefinite craving for something, they know not what, and therefore add to their troubles by eating such unnatural and abominable things as chalk, slate pencils, magnesia, pickled limes, &c., their systems being deficient in important health-giving elements.

I once made a post-mortem examination in case of a chlorotic young lady, who died after intense and long-continued sufferings, the cause of which could not be ascertained while living; and we found a ball of magnesia that weighed a pound, and other smaller ones, embedded in the intestines, obstructing the passage, and finally stopping it altogether. And there are numerous records of similar cases. And if they do not thus accumulate, all unnatural or undigested articles in passing off must produce irritation, and tend to develop tubercles of the bowels and other diseases. Having, then, the cause of this disease, or at least the foundation of what is called consumption of the blood or bowels, as well as consumption of the lungs, to which so many of our daughters are sacrificed, it is certainly an important inquiry, What will cure this terrible malady?

What is the rational Mode of curing Chlorosis?

If my position is true, that chlorosis is simply the want of iron and other necessary elements in the blood, and if it be also true, as I have elsewhere shown, that these elements are all furnished and at hand in "every herb bearing seed, which is upon the face of all the earth, and every tree in the which is the fruit of a tree yielding seed," and also in the flesh of "every beast of the earth, and every fowl of the air, and everything that creepeth upon the earth wherein there is life," which, having obtained in their flesh the elements as organized in the herb, and the seed, &c., and being thus fitted to be food for man, were given to Noah and his posterity as a blessing, for food, "even as the green herb;" and if it be also true, as I think I have shown, that neither iron, nor any other element not thus organized, can be assimilated as an element of the blood, but, on the other hand, is interdicted as poisonous, — then surely the rational mode of cure is clearly pointed out. We have but to take food freely which is known to contain iron and other elements as they are needed.

But how can we ascertain whether any Elements are wanted to make the Blood pure in any given Case, or, if so, what are the deficient Elements of the Blood?

Why not use common sense, as our mechanics and chemists use it in their every-day operations? Suppose an intelligent soap-maker should find that a lot of soap, which a blundering man had attempted to make, was good for nothing because the necessary elements were not mixed in the right proportions, — how would he ascertain what was wanted to make good soap of it? Knowing just how much alkali and how much oil or grease were necessary for the quantity before him, he would ascertain how much of each had been used; and if a pound of potash was wanting, would add it to the mixture; and if other necessary conditions were complied with, he would be sure of good soap. But suppose he should not know what was needed, and should add at hazard a pound of grease instead, would he get good soap?

Upon the same principle, if we see a feeble, sickly, undeveloped girl, without disease of any particular organ, we know that something must be wanting in the blood; and what that something is, we can know by ascertaining what she has omitted to supply. If she has lived principally on superfine flour bread and butter, or cakes and confectionery, or any other food of which starch, butter, or sugar is the predominant principle, we know that she has omitted to supply her blood with iron, nitrogen, phosphorus, lime, &c., as these articles of food do not contain these elements. What, then, does common sense dictate, in such a case, but to omit such articles of food, and take instead such food as is known to contain these deficient elements? Just as, in the supposed soap case, the intelligent soap-maker omitted the grease and added alkali.

A woman in the country once gave me an account of what she called her bad luck in attempting to make soft soap. She put together, as she thought according to rule, her grease and lye, and boiled them, and added the right quantity of water, and stirred it; but the soap "wouldn't come;" and not knowing what was the trouble, she asked a neighbor, who told her she had heard that salt was good, and advised her to add a pint of salt, and stir it all day. She followed the advice, and still it wouldn't come.

She consulted another neighbor, who told her the trouble was, that she stirred it a part of the time one way and a part of the time the other, and thus undid at one time what she did at another: she must stir it always with the sun, and that would certainly fetch it.

"She stirred it, and stirred it; but the more she stirred it the more it wouldn't come." Finally she consulted a very old and experienced housekeeper, who assured her it would come if she stirred it when the sign was right. She must get old Isaiah Thomas's Almanac, and look up the signs of the zodiac, and when the sign was right she must stir as before directed, vigorously, with the sun, and her trouble would soon be over. She followed advice, but after all lost her soap.

Now, absurd and ridiculous as were these whims of the grandmothers of the past generation in regard to the making of soap, they were not a whit more absurd or ridiculous than those of the mothers of the present in regard to the treatment of what are called humors, or impurities of the blood, especially of that condition of which we are now treating, and from which so many of our daughters are lost. Indeed, that mother is a rare exception who, after iron has failed, does not resort to beer, or wine, or oxygenated bitters, or some medical discoveries, or something else which some neighbor or quack doctor shall tell her is good for the blood, although not one of them all has more power to cure chlorosis, or to purify the blood, than the signs of the zodiac have power to make soap; but they have more power to do harm, and that harm is incalculably more important. And yet, to carry out the illustration, it is no more certain that good soap can be made without failure by using the right materials in the right way, than it is certain that pure blood can be made by the right use of the elements which constitute good blood.

But what kinds of food contain iron? Analyses of different articles have not yet been made to determine the proportion of iron which each article contains; but a general statement will be sufficient for all practical purposes. The flesh of all animals contains iron, and of course milk, grains, fruits, and vegetables, which make the muscle or flesh of animals, contain it.

Iron, phosphorus, lime, and all other mineral elements, are connected together with nitrogen, for making muscles and blood, but not one is found connected with carbon, which furnishes fat and heat, so that those articles of food which are found in the tables to contain the most nitrogenous and phosphatic elements generally contain most iron.

To prevent chlorosis, therefore, mothers have only to see that their daughters always live on food containing all its natural elements; and to cure it, they have but to select the articles of natural food which contain most phosphatic elements.

HOW TO PREVENT APOPLEXY, NEURALGIA, AND NERVOUS DISEASES.

By analysis the brain and nerves are found to be composed of albumen, a fatty substance called cerebral fat, phosphorus, mineral salts and water; and that the mature, healthy, adult brain contains more albumen, more phosphorus, and more mineral salts, but less cerebral fat, and less water than the brain of infants or idiots.

The elements that are thus shown to be needed are found in all natural food, combined with nitrogenous, or muscle-making principles, but not with the carbonaceous, or heating principles; in milk, and eggs, and fish, and the grains, &c., in their natural state, but not in starch, any fatty substance, or sugar. Those, therefore, who live mostly on white bread, butter, and confectionery, which contain none, or very little of these elements which keep the brain and nerves in a healthy condition, are those who suffer most from headaches, neuralgia, and nervous diseases, and those who, finally, die of apoplexy.

We have noticed, also, in another chapter, that nursing and expectant mothers, who live on carbonaceous food, are peculiarly liable to toothache, headache, neuralgia, and nervous disorders, because Nature favors the infant at the expense of the mother, and therefore, if the right elements are not furnished sufficient for child and mother, the mother suffers first. These hints clearly indicate the course of diet necessary to prevent headache, neuralgia, nervous excitements, apoplexy, and all other diseases dependent on the healthy action of the nerves or brain; and this on the simple principle, so often explained, that no organ or function can perform its appropriate duties, or keep in health, without a constant and regular supply of the elements composing or used in that organ or function.

For all these sufferings from headache, neuralgia, hysterics, &c., from which the young suffer so much, and many so intensely, the remedy is simple and certain. Avoid the heating, unnatural articles of food, out of which have been taken the elements before enumerated as necessary to keep the brain and nerves in order, — such as white bread, butter, fat, and sugar, and all the pastry and confectionery which are made up of those heating principles, — and take, instead, only natural food, in which are retained the elements needed, and the cure is certain.

Apoplexy, also, which seldom, I think never, occurs except in those who have been for a long time overfed with carbonaceous food, almost never occurring in persons under forty years of age, and not in persons so young as that, unless they have added to carbonaceous food the stimulus of alcoholic drinks or strong spices and condiments, is, of course, prevented by abstaining from the articles which cause it, and taking, instead, those which contain the elements necessary for the healthy action of the brain.

My attention was, many years ago, particularly directed to this subject from motives of strong personal interest in it; and I have often had occasion to prescribe for others the course that I have found useful to myself, with a success which fully confirms me in the view of the subject just given.

At the age of forty my father commenced having premonitory symptoms of apoplexy, and from the age of forty to fifty had a number of slight attacks, and one quite severe; but he made no change in his habits, eating habitually highly-carbonaceous food, and drinking, as the custom then was, brandy, or some other alcoholic drink, three or four times a day, and, at the age of fifty-four, he died suddenly of apoplexy. At the age of forty I also, having inherited his form and constitutional characteristics, commenced having the same kind of premonitory symptoms of apoplexy, which also continued and increased till after the age of fifty, although, supposing then that that was all that would be necessary, I abstained from all alcoholic drinks and stimulating condiments; but having an attack that rendered me unconscious for an hour or more, I found something more was necessary to save me from my father's fate. After that I gradually diminished my carbonaceous food till I came up, I think, to the true philosophy of eating; and now, at the age of sixty-four, I have, I think, eradicated all hereditary tendency to apoplexy, not having had, for some years, even a headache, or other premonitory symptom of it; and, besides having disposed of other infirmities, I have more energy, more power of endurance, mentally and physically, and more recuperative power, than I had at the age of forty.

I make the sacrifice of publishing these personal items in hope of benefiting others who may have similar hereditary tendencies, and in the hope of corroborating, if not confirming, the opinion elsewhere expressed, that hereditary diseases are not necessarily incurable, nor hereditary tendencies ineradicable.

THE CAUSE AND PREVENTION OF DEFECTIVE TEETH.

In one important respect the teeth differ from other organs of the animal economy — they have no recuperative power. But, to compensate for this defect, they are made of materials more indestructible than those of any other organs; so that being properly supplied with the elements requisite for their formation and nourishment, and used in accordance with Nature's laws, they last the lifetime of the animal, and are not subject to disease. Thus we find in animals in their natural state sound teeth to the end of life.

The elephant a hundred years old has no defective teeth, unless they have been injured by accident, or have been made to eat improper food in the service of man. But animals subjected to unnatural food have defective teeth, and, if shorter lived than man, and the enamel less firm, are sooner influenced by improper food.

The teeth of the cow, for example, that is made to live on the dregs of breweries and distilleries, begin to decay in a very short time. But in this case the cause of the decay is not physiological so much as mechanical, for it is found that the decay is more or less rapid according to the temperature of the swill which they are obliged to eat — those at a distance from the distillery, whose food gets cold before it reaches them, preserving their teeth longer than those who, being near, take it hot from the vat.

This brings us to a consideration of the different laws, the disobedience of which is the cause of defective teeth, as it is of all our diseases and sufferings. The universe, and everything in it, whether of mind or matter, from the inorganic atom that can be seen only with a microscope to the mind of the highest archangel, is moved, and changed, and regulated by fixed laws; and while these laws are permitted to act harmoniously, all is well, but disobedience to any one brings its penalties. All suffering and all defects may, therefore, be traced to the disobedience of some law of our being; and the question before us is, Why do not our teeth, like the teeth of other animals, last our lifetime? That they are made as perfect, if the right materials are furnished, there cannot be a doubt.

But are the necessary elements furnished to children as they are to the young of other animals? And do we not subject our teeth to deleterious influences from which animals that obey their natural instincts are exempt?

The forming young of other animals, while dependent on the mother, get lime, and phosphorus, and potash, and silex, and all the other elements of which the teeth are composed, from the blood or milk of the mother, and she gets them from the food which Nature provides containing these elements in their natural proportions.

But where can the child in its forming state get these necessary elements, whose mother lives principally on starch, and butter, and sugar, neither of which contains a particle of lime, phosphorus, potash, or silex? Nature performs no miracles. She makes teeth as glass is made, by combining the elements which compose them according to her own chemical principles. And this illustration is the more forcible, because the composition of the enamel of the teeth and of glass is very nearly identical; both, at least, requiring the combination of silex with some alkaline principle.

If, then, the mother of an unborn or nursing infant lives on white bread and butter, pastry, and confectionery, which contain no silex, and very little of the other elements which compose the teeth, nothing short of a miracle can give her a child with good teeth, and especially with teeth well enamelled.

Nature does what she can for innocent and helpless unborn and nursing infants, by using all available materials, even getting them from the teeth of the mother. And hence, it is well known, that starch, butter, and sugar-eating young mothers always suffer most from their teeth, and go to the dentist most, while an infant is dependent on them for support, as they suffer also, at these times, from neuralgia, headaches, dyspepsia, &c., as I have elsewhere explained, for want of the elements which keep the brain and nerves in a healthy condition.

Thus, instead of "visiting the iniquity of the fathers upon the children,' Nature, as far as possible, protects innocent children, and visits on their mothers the penalty for their own transgressions. But there are cases where, in accordance with natural law, children must suffer for the transgressions of their parents. And defective teeth are an illustration of this statement. The enamel of the teeth, wanting, as it is, and from the nature of its composition must be, in all recuperative power, if once broken or defective can never be restored, and the toothache that follows from the inflammation and exposure of the nerves, &c., the child must suffer, while the mother alone is responsible. But this is an exceptional case; all other organs, having recuperative power, are capable of restoration, even though they may be feeble and defective in consequence of the mother's neglect; and even this exception may, by restoring deficient elements, be confined to the first set of teeth. This, being a very important practical point, deserves to be strongly presented.

Second Teeth may be made Sound where the first were Defective.

The second tooth of a child is formed from materials furnished in the blood, secreted, or taken up, and used in forming it by a mysterious power imparted to the little gland, or nucleus, placed for that purpose directly under the first tooth, but entirely independent of it. This mysterious power acts in this, as in all other organs, with unerring certainty, and if the right elements are furnished in the blood, will be sure to find them, and furnish them in right proportions to the forming tooth.

It is, therefore, no more certain that glass can be made by using the right materials in the right way than it is certain that teeth, good and sound, will be made by using the right materials in the right way. Cheer up, then, disconsolate mothers, who weep and mourn, as you must, for the toothache of your little one, for which you feel to be responsible. If the second teeth are yet to come, you have still space for repentance, and works meet for repentance.

But what articles of food will make good teeth? Good milk will make good teeth, for it makes them for calves. Good meat will make good teeth, for it makes them for lions and wolves. Good vegetables and fruits will make good teeth, for they make them for monkeys.

Good corn, oats, barley, wheat, rye, and indeed everything that grows, will make good teeth, if eaten in their natural state, no elements being taken out; for every one of them does make teeth for horses, cows, sheep, or some other animal. But starch, sugar, lard, or butter will not make good teeth. You tried them all with your child's first teeth, and failed; and your neighbors have tried them, and indeed all Christendom has tried them, and the result is that a man or woman at forty with good, sound teeth is a very rare exception.

Nothing, then, can be clearer than your duty to keep from your children confectionery, pastry, white bread and butter, gingerbread and sweet cakes, and feed them instead on milk, unbolted bread, meats, eggs, fruits, vegetables, or anything else in short which they best relish, from which have not been taken any of their native elements. But you must attend to this early; for if children live on carbonaceous food, and the necessary elements are not furnished till the second teeth are formed, "there remaineth no more sacrifice for sin, but a fearful looking for of judgment.' The teeth will either come in a defective state, or the enamel will be thin and easily broken, and the juices of the mouth, being admitted into the tooth, cause its decay, without the possibility of cure. For a time, the orifice being filled, the decay may be suspended; but the enamel being imperfect and thin, will soon give way in some other place, and there is no saving them.

HOW TO PREVENT DISEASES OF HEART.

The circulation of the blood is a mechanical operation, and the action of the heart on the blood, drawing it from every part of the system through the veins, and sending it to every part through the arteries, is like the action of a fire-engine drawing water from a cistern through a hose, and sending it, at the same time, through another hose, into every part of a building on fire. And the arrangement of valves by which this double action is accomplished is alike in both operations.

Many of the difficulties and embarrassments of the action of the heart are also mechanical. Sometimes there is an organic congenital malformation by which the heart is imperfect, and, of course, it can never perfectly perform its function, and the circulation is irregular and defective. Somctimes the valves get out of order, or become hardened like bone, and act very imperfectly in preventing the regurgitation of blood, and, of course, the circulation is deranged. Sometimes the accumulation of fat around the heart prevents its free expansion, and embarrasses its action. Sometimes contraction of the chest, as in tight dressing, embarrasses the action of the heart, and palpitation and fainting are produced; and this, indeed, is so commonly the cause of fainting that everybody almost instinctively cuts the strings at once, in such cases, as a rational means of relief.

Sometimes the embarrassment is from increased pressure of the blood, causing distention of the blood-vessels and of the heart. Sometimes the embarrassment and irregular action are caused by irritability of the nervous system, and sometimes by overheated and stimulating blood. We may not be able perfectly to understand the cause of all these different difficulties or diseases of the heart; but they are all undoubtedly connected with erroneous diet or erroneous habits, for other animals in their native conditions have none of these troubles or diseases, although the circulation is effected by the same mechanical arrangement.

How congenital defects, or ossification of the valves are produced, I do not profess to understand; but the cause and means of preventing and curing, or, at least, alleviating the other difficulties, I think can be understood and explained.

As we cannot stop the heart, to repair its valves when once deranged, as we can stop an engine for repairs; and as Nature cannot, in the nature of the case, repair ossified or displaced valves, that trouble can never be removed, when once established. And this is true of enlargement of the heart, or arteries, or veins about the heart, or indeed of any other organic affection. And in such cases the question to be considered is, How can such persons live, so as to be comfortable, with such difficulties? The right

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course of treatment in such cases can be illustrated and enforced, perhaps, by the management and results of two cases.

More than thirty years ago I was consulted in two cases of organic diseases of the heart very nearly alike, and very clear cases of incurable disease. Both of about the same age, free livers, and accustomed to stimulating food and some stimulating drinks, but of very different tempers; of religious character, and power of self-control, and both so seriously affected as frequently, when excited or fatigued, to fall into an unconscious state, and remain in it for hours. They were both told their lives were in their own hands, and advised to abstain from carbonaceous food, stimulating drinks, condiments, and medicines; avoid all excitements, mental and physical, and never allow themselves to run or get fatigued, even if their houses should burn down over their heads — in that case just deliberately walk out and let them burn, rather than fight the fire themselves.

Their reception of the advice was characteristic of the two men, and the results such as might have been expected. One said, after a few moments of silence, but in great agitation, About dying, I am not particular; but while I do live I shall have my brandy and my fat beef as usual. I am not to be all my lifetime subject to bondage for fear of death.' — In less than three weeks some neighbors' hogs got into his garden, just as he had finished his dinner of fat beef, and had taken his brandy to make it digest. In great excitement he ran out after them, and fell down dead in the garden.

The other gentleman said, "It is clearly my duty to 'keep under my body, and bring it into subjection,' according to the example of the Apostle.' — He is now living, at the age of seventy-six, and enjoying comfortable health, having, for thirty years, lived "a quiet and peaceable life, in all godliness and honesty,' and having been exempt from those fainting fits which so distressed and alarmed his friends; indeed, having enjoyed vastly more in eating and drinking than if he had put no restraints on his appetites, and even more than if he had only put on them such restraints as are customary in the class of virtuous and excellent people to which he belongs.

If palpitation, shortness of breath on going up stairs, fainting fits, distress about the heart, any or all are produced, as they often are in persons predisposed to obesity, by accumulation of fat about the heart, the remedy is simple and sure: for if the material of which fat is made be not supplied, fat will not only not be made, but if made will be absorbed. Follow, therefore, the directions given in the chapter on Corpulence.

If these symptoms are produced by tight lacing, the remedy is equally simple, and upon the same principle — stop the supply of strings, and belts, and corsets.

If they are produced by heating food, stimulating drinks and condiments, of course these are also to be withdrawn, and the cure is certain. If by derangement of the nervous system, follow the directions in the chapter on Apoplexy, Neuralgia, and Nervous Diseases.

While, therefore, I do not deny that there are cases of enlargement of the heart and arteries that must prove fatal in spite of all treatment, yet, in most cases, by following the foregoing suggestions, I have not a doubt that in functional cases a radical cure can be effected, and in organic, a great modification and improvement of the symptoms.

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HOW TO CURE CORPULENCE.

ADIPOSE substance, or fat, is deposited under the skin for three purposes: 1. To protect the system from cold, or, in other words, to retain the heat of the body, fat being a good non-conductor of heat. 2. To form an insensible cushion to protect the internal organs from the effects of concussions, pressures, &c. 3. To fill up the angles and interstices formed by the attachments of muscles to the prominences of bone, &c., so as to leave the outlines of the body rounded and beautiful, Nature's lines of beauty being always curved, while sharp and angular lines are given for utility.

This fat is composed of the same carbonaceous elements as are used by the lungs to furnish animal heat, and, if not otherwise supplied, as in case of sickness, when fat or other carbonaceous food cannot be digested, or in fasting, they are supplied by absorbing this adipose covering, and this we call losing flesh, or growing poor.

On this account fat men bear fasting longer than lean men; and on this principle hibernating animals, as the raccoon, badger, and the brown bear, fat up in the summer on the abundance of food that is then furnished them, and in winter crawl into their dens and live on themselves, coming out in the spring poor and haggard, and ready for a new supply. And here we have the foundation for philosophical cure for obesity.

Butter, the fat of meats, starch, and sugar furnish animal heat, and also the adipose covering which, in excess, constitutes corpulence. Some of these principles the lungs must have every moment, or we die for want of animal heat. If, therefore, these carbonaceous principles are not supplied in food, they are taken from the fatty accumulations under the skin — the deposits being withdrawn in case of necessity, just as a banker uses his surplus funds when he gets into a pinch. This withdrawal of fatty deposits is seen every day in fevers and other diseases, when food cannot be digested, and is seen also in fastings, as in shipwrecked mariners, &c.; and it has been proved in such cases that fat men live longer than lean ones.

By experiments on prisoners in Scottish prisons (see page 98), it is seen that fourteen ounces of carbonaceous food are required, in a moderate temperature, at rest, to keep up the weight of the body, and by the rations of English soldiers, etc., it is also seen that in active service from twenty to twenty-two ounces are necessary. If less than these amounts are supplied, the balance is withdrawn from the deposits under the skin, as has been proved over and over again by experiment.

The five hundred prisoners, in five different jails in Scotland, above referred to, had, on an average, thirteen ounces each day for two months, and they lost in weight six hundred and fifty-three pounds, varying somewhat in different prisons, according to the different nutritive value of the different articles used; but in like circumstances losing in just the proportion as the sugar, starch, or fat fell below the requisite amount.

We have, then, a standard by which to judge of the requisite amount of starch or sugar necessary to keep the deposit of fat good. We must, however, remember that butter and the fat of all meats contain two and one half times as much fattening qualities, in a given weight, as starch or sugar, containing, as they all do, no water, while starch and sugar contain seventy-five per cent. of water.

If, then, a man of average weight, say one hundred and fifty pounds, wishes to retain the deposits as they now are, and continue that weight, in, perhaps, nineteen cases in twenty he will succeed, and remain, year after year, by eating any of the articles in the foregoing table in such proportions as to get, with his necessary nitrates, from fourteen to twenty-one ounces of carbonates, according to his exercise, in moderate weather — in hot weather less, and in cold weather more.

But it is not expected, nor is it desirable, that he should weigh out his food, and the table is not prepared for that purpose; still it will be found useful to have in mind the relative value of different articles of food in heating and nutritive properties, both while furnishing and eating his dinners.

If he lives on articles of food as Nature has furnished them, his appetite will direct him both in regard to the quantity to be eaten, and the articles to be eaten together; but, as I have elsewhere explained, if he add to these articles of food either fine flour, which is mostly starch, or sugar, he will, in proportion to the amount used, increase the amount of heating and fattening food without increasing the strengthening; and if he add butter, or lard, or the fat of meats, he adds, in proportion to the amount used, two and one half times as much to his carbonates, without increasing his nitrates.

In that case one of two undesirable consequences will follow — he will increase in fatness, if predisposed to obesity, and the blood will become heated by this extra carbon circulating in it before being deposited, and also by retaining the heat in the system as a non-conductor, or the extra carbonaceous material will be cast off as unnatural waste, and being unnatural will ferment, causing flatulence, and irritation, and the colics, and bowel complaints, which are the natural consequence.

If, on the other hand, he takes food containing less than from fourteen to twenty-one ounces of fat and heat-producing food, he will draw on his deposits to an amount proportionate to the deficiency, and to the amount of exercise which he takes. Moreover, inasmuch as corpulence, or extra fatty deposits, comes generally from extra, and not from natural, carbonaceous food, it is not necessary, except where the constitutional tendency to obesity is very strong, to reduce the supply of natural food at all, as the cause is removed by cutting off the extra carbon, and the extra fat is absorbed.

And, besides, in cases where the tendency to corpulence is not constitutionally strong, it is often only necessary to abstain from that one principle of carbonaceous food which has the strongest tendency to produce fat — doing it, not by the process of digestion, but by a mere transfer of fat from one animal to another, whereas sugar has to be digested to be converted into fat, and starch has first to be converted into sugar before it can be converted into fat.

Of this very simple process of curing obesity, let me give an illustration. A gentleman of ordinary height, who weighed two hundred and ten pounds, and his wife, rather short in stature, who weighed, I think, one hundred and sixty pounds, under my direction tried the experiment of abstaining from butter, and mostly from the fat of all meats, except as they were necessary with steak, fish, &c., which were deficient in this principle; but eating sugar and fine flour moderately, as usual; never, however, using butter with white bread or other farinaceous food, but eating cheese instead.

In a few months the gentleman had withdrawn twenty-five pounds of fatty deposits, and the lady about fifteen. And, being satisfied with their improvement, they have, for the last three years, remained at the same weight, by simply being careful not to eat an excess of any carbonaceous food; eating, however, butter and all kinds of fat within the limits prescribed.

William Banting, the Englishman, is also an example of cure of obesity by abstaining only partially from extra carbonaceous food. He reduced himself, according to the statement in his pamphlet, from two hundred and two to one hundred and fifty-six pounds, by "abstaining as much as possible from bread, butter, milk, sugar, beer, potatoes, and some kinds of wines, as port; and living on beef, mutton, and other meats except pork, and any vegetables except potatoes, with good Madeira, claret, and sherry wines, and a *tumbler of gin, whiskey, or brandy grog, at night*, as a night-cap.'

But neither Banting nor his medical adviser seems to have had but an inkling of the principle upon which the change was effected, the one seeming to think it was a process by which to kill a disease which he absurdly calls a "parasite," and the other that it was produced by some chemical effect on the secretions of the liver; but neither comprehended the simple principle on which the whole effect was produced.

Nor did they understand what principles in food should be avoided, or why they should be avoided. Accordingly we find bread, milk, and potatoes condemned, while alcohol and fat meat are allowed. Indeed, the cure seems to have been effected by a mere blunder, in which it happened that, although the alcohol and the fat in beef and mutton must have retarded the process of absorption, and, of course, delayed the cure, still, in spite of this error, the cure in his case was effected by abstaining from starch, sugar, and fat in other food, which brought the amount used daily below the fourteen to twenty ounces required to keep up the deposits. But in the directions given in the pamphlet there is nothing to show that the tumbler of gin, whiskey, or brandy "nightcap" was not as important in the cure as beefsteak or fish; and hundreds who never drank these death-dealing articles before, are now taking, by the recommendation of Banting, enough every night to give them a regular fuddle, as a part of the necessary process of curing obesity. And yet everybody knows that alcohol, in any form, tends to produce obesity — not, however, by adding to the fat, but by retarding absorption.

In spite of these absurd and conflicting recommendations, those whose tendency to corpulence is not very strong, have succeeded in reducing it by these conflicting directions; but, on the other hand, those whose predispositions to it are strong, and whose appetites for carbonaceous food are also strong, fail altogether, or, if they partially succeed, finding the sacrifice too great, fall back to their old habits, and take on again their old burdens of flesh.

But those who set about this matter scientifically, and, instead of confining themselves exclusively to "beef and other meats except pork, any vegetables except potatoes, with good Madeira, claret, and sherry wines, and a tumbler of gin, whiskey, or brandy grog, as a nightcap," and thus being obliged to be more scrupulously abstemious in some things, on account of the counteracting influence of the others, taking from the whole bill of fare which God has given them, consisting of "every living that moveth," and every thing that grows, that is, or can be made, agreeable to the palate in its natural state, or by adding such principles, in an agreeable form, as are needed to supply necessary elements, may eat what they please, and all they desire, and still reduce their surplus fat, if they will only see to it that the carbonaceous matter comes below the requisite fourteen to twenty ounces.

Or the same thing can be accomplished by being careful that no article of food contains more than its due proportion of carbonaceous food, and some contain less; and if some do contain more, that others containing less be used at the same time. For example: Suppose the meal before you consisted of unbolted bread, milk, eggs, beef or mutton, of average fatness, cooked in its own gravy. As all these articles contain just their natural proportions of carbonaceous nourishment, you might eat as much of either or all as the appetite demanded, without increasing your deposits of fat; and if the beef or mutton were perfectly lean, you could add an equivalent for the fat in butter, with out varying the effect. But if, instead of unbolted meal bread, your bread was from superfine flour, and instead of milk you had butter, thus far you would get nothing but carbonaceous food; and then if you add to your eggs butter, and to your beef and mutton gravy from fat pork, or flour and butter, you have before you, instead of food containing its natural proportions of carbonates and nitrates, probably double the necessary amount of carbonates; and in eating all you want, to get the necessary supply of muscle-making food, you have eaten, perhaps, a third more fat-making food than is needed, and the surplus must either be added to your adipose deposits, or be thrown off as waste.

Now, this is just what the better classes in England, and all classes in New England, are doing every day; and therefore all who are predisposed to obesity, and have not exercise enough to work it off, are constantly waxing fat, while the lean ones are suffering from the effects of this heating food in some other way.

These facts and these principles cannot be disproved, and it follows that, with but little sacrifice, most people, even if inclined to corpulence, can regulate their weight as they please. Indeed there is not only no sacrifice even of the pleasures of eating, but a positive addition to gustatory pleasures, in confining ourselves to such articles of food as are best adapted to our condition. And this is the testimony of every man who has had perseverance enough to overcome the first cravings of a perverted appetite. After the first short struggle with it, unless the struggle is prolonged by an occasional indulgence, which, of course, prolongs the struggle, the appetite and taste soon conform to their primitive condition of craving and relishing best just the food that is best for us, and we return to our simple, child-like love for natural food, cooked without abstracting any of its essential elements, or adding anything injurious.

LEANNESS: ITS CAUSE AND ITS CURE.

ALL animals but man are fat or lean as they are fed on carbonaceous food and are kept still, or on nitrogenous food and are permitted to run at large. The farmer lets his oxen run at large, or works them, till the muscles are developed, and they are grown to a sufficient size to be profitable for beef, and then shuts them up, and feeds them freely on Indian corn meal, and they immediately begin to fatten up for beef, and within certain limits the fat accumulates in proportion to the meal they can be induced to eat.

In some places, also, hogs are permitted to range in woods and fields for acorns and grass till they are sufficiently grown, and then are brought in, as poor as hounds, to be fatted up for the market; and a calculation can be made with accuracy as to how many pounds they are gaining each week, by noticing how much corn meal is consumed; and two pigs of the same family will generally keep of about the same weight if treated in the same way.

But let a family of men live on the same food, and have the same amount of exercise and the same general habits, and some members will be lean as wolves, and others as fat as pigs.

The same elements are found to compose the flesh of the pig as compose the flesh of man, and the same general arrangements are found for digestion and assimilation, and generally, especially in their fully domesticated state, the same kinds of food are given to them as to men. Pigs, however, get the skimmed milk and bran, which strengthen the powers of digestion, while men get the butter and fine flour, which weaken the powers of digestion; and this fact gives us the means of explaining the otherwise enigmatical question, —

Why is it that a pig, with digestive organs and appetites, if not habits and dispositions, like his master, should always, with good food, be "fat and flourishing," while his master, with better, or at least more carbonaceous food, may be as "ill-favored and lean-fleshed" as Pharaoh's kine? Let us see if this enigma can be explained.

We are fattened, as we are strengthened, not necessarily by what we eat, but by what we digest; and constantly overburdened as the human stomach is (in this country among all classes, and in the cities of Europe among the better classes) with an excess of carbonaceous food, such as butter, sugar, lard, starch, &c., which is never all digested, after a while it seems to get discouraged and to cease to try to digest it.

In such cases, those who are predisposed to obesity become fat, but weak, languid, and stupid, — the carbonaceous food being better digested than the nitrogenous or phosphatic; while those who are predisposed to leanness may have muscular or mental strength, — the nitrogenous and phosphatic in them being digested, but not the carbonaceous, — but become lean and haggard, and the redundant carbonaceous food, except that which supplies animal heat, is all wasted, and that, in such persons, is generally deficient.

But pigs, not having predispositions, except to obesity, and not often having their digestive powers weakened or embarrassed by extra carbonaceous food, digest and give credit for all they eat. I have been told, however, that pigs may be cloyed by overfeeding, so as to lose flesh while more corn meal is before them than they can eat, and that, by continued overfeeding, they will continue to grow lean. In such cases, in order to fatten them, the food must first be withheld until they become hungry, and then, by feeding at first sparingly, and keeping the supply below the demand, their digestive powers will gradually recover, and they will fatten like other pigs.

Here, then, we have an illustration of my position as to the cause of leanness, and at the same time a hint as to the cure of it. The cause of leanness, in this country at least, is never the want of carbonaceous food, but from overloading the stomach with it, as before described. What, then, can be more rational than to take a hint from the farmer with his pigs, and keep the stomach supplied with good strengthening and fattening food only just as it is really wanted and will be digested, never eating without an appetite, and never eating anything but good food, so cooked and served as to be eaten with a good relish?

In this way, I venture to assert, that any man, however predisposed to leanness, may give his bones an adipose covering to any desirable extent. But what course will secure perpetually a good appetite, a good relish for food, and good digestion?

How to secure a good Appetite.

A good appetite cannot be permanently secured without regularity in times of eating.

The stomach cannot, like the heart and lungs, work continually, but is intended to have its time for labor and its time for rest. It is, however, very accommodating, and will furnish the requisite juices, and perform the requisite labor of digesting food, once, twice, and even four or five times a day, if its task is given it at regular hours; but it must have rest: and to insure vigorous digestion, that rest must be as long and continuous as the regular hours of sleep. The frequency and time of meals for laboring men, — if they can have good nourishing food, and that which is not too easily digested, — are probably three times in twenty-four hours, say at six in the morning, twelve at noon, and six at night, the morning and noon meals containing the principal elements for muscular power, while the evening meal is such as will not, in the exhausted state of the system, require much digestive labor. And for sedentary men two meals are sufficient — one in the morning and one in the afternoon, at some regular hour. With this arrangement a good appetite will be secured at every meal, especially if we scrupulously avoid taking food between meals, or within three hours of the regular time for sleep. Digestion will go on while we sleep, unless the powers of the system are greatly exhausted by the labors of the day; but sleep is never quiet and refreshing while the stomach is oppressed with food, and digestion is never well done while the system is exhausted, as we have all had occasion to notice.

And here, perhaps, as well as elsewhere, I may explain the reason for these suggestions. Sleep — "tired Nature's sweet restorer" — imparts to the system all the nervous or vital energy which is necessary for the duties of the day, and to keep all our functions in healthy, harmonious action, and secure a good appetite for food. This vital energy must be expanded during waking hours, partly in mental, partly in muscular, and partly in digestive exercise. We may so expend it all in intense and continuous mental effort as to have none left for muscular or digestive powers, as we have seen in cases where lawyers or legislators have given their whole powers of mind to an important case till Nature became exhausted, and they could neither walk nor digest food till partially restored by sleep. Or we may so expend the vital energy in muscular exertion as to exhaust the whole vital force, and not be able to think or to digest food till the vital energy is restored by sleep. Of this we have seen examples in men at a fire, or in a flood, or some other similar emergency, who would fall down in utter exhaustion; and to prevent taxing the digestive powers in such a state, Nature provides that all food should be thrown from the stomach, and none afterwards received till sleep should restore the exhausted powers. Or we may so engorge the stomach as to expend all our vital powers on digestion, and become incapable of mental and physical exercise, and even to destroy the powers of life. Of this we have seen frequent examples. Two miserable men made a wager on eating eggs. The man who should eat the greatest number in twelve hours should be supplied with grog for a week. Before the end of twelve hours both fell into a stertorous sleep, from which one never recovered, and the other not for some days.

From these principles and facts we get some valuable hints in regard to mental, physical, and digestive management, and may infer that if we desire a good appetite in the morning, when, having most vital power, a good appetite is most valuable, we must not eat a hearty meal at night, when the system is exhausted, but must always give the stomach its regular tasks and its time to rest; and this is found to be true in other animals whose digestive apparatus is like that of men.

The horse is kept in good condition only by being fed at regular times, and pigs also thrive much better if food is withheld except at regular hours.

To secure a good appetite we must eat good food.

Food, to be perfectly digested, as we have elsewhere seen, must be taken only in such quantities as the system demands, and if we take only natural food, in which is the appropriate mixture of necessary elements, the appetite can always be trusted to interpret the demands of the system, and in that case we should never eat too much. But eating, as we do, flour, butter, and sugar, which have but a part of the elements required, these articles can only be digested as they are eaten with food deficient in the elements which they contain, and these are very few. Consequently these redundant articles, in just about the proportions in which they are eaten, remain undigested in the stomach and bowels, causing flatulence and derangement of the secretions of the stomach, mouth, and all the digestive organs, and the sordes of the teeth, bad taste in the mouth, foulness of breath, and fastidious appetite, &c., which they always have who live on these concentrated carbonaceous articles.

How to secure good Relish for Food.

The importance of eating food with a good relish we have elsewhere explained (see pages 207–211), and we have also shown what considerations are necessary in regard to cooking, condiments, etc.

What we now want to know is, what course will best secure such a relish for every meal of food as to induce digestion sufficient to supply the wastes of the system, and have a surplus for filling up the sharp angles, and for covering up the bones and muscles with a warm and comely coat, and to secure this influence permanently, according to the evident intention of Nature? For a single meal, that which combines a good supply of carbonaceous elements with nitrogenous and phosphatic, in such a manner and with such accompaniments as to secure the highest possible gustatory enjoyments, would be most fattening; but extraordinary gustatory enjoyments can no more be permanent than other extraordinary pleasures, and the reaction and subsequent disrelish for common and natural enjoyments are proportionate to the excess. And to attempt to keep up the relish for food by keeping up a supply of everything especially agreeable, would prove an utter failure; for they enjoy the least who try the hardest to tempt the appetite with the greatest variety of good things. Soon becoming cloyed with everything rich and savory, while nothing else can be relished, the choicest viands, however nicely prepared, become loathsome and even disgusting.

But the appetite never cloys with food as Nature furnishes it, if so prepared as best to develop the relish which naturally belongs to it, especially if we cook but a small variety for the same meal, so that some variety can be had continually; but if we cook together to-day all the variety of meats and vegetables in common use, and mingle their flavor together, as is done in restaurants and hotels, although we may have for once an agreeable combination of flavors, yet having, as we must have, the same combination to-morrow, the next day, and continually, it soon becomes tiresome.

To secure good digestion and a good adipose covering, two things more are needed, — one is to eat slowly, and the other is included in that beautiful description of a good and happy people, they "did eat their meat with gladness and singleness of heart."

Good Digestion depends on eating deliberately.

No one habit in this country contributes so largely to dyspepsia and leanness as that of bolting food. Probably the average length of time devoted to the principal meals is not over fifteen minutes among business men, mechanics, and laborers. That such a habit must be productive of indigestion, and consequent leanness, will be made apparent by considering the object accomplished by masticating food. One great object is to keep in the mouth, in contact with the nerves of taste, the savory morsel till its flavor has aroused the secretions of the juices, which are the principal agents in the process of digestion, and gathered them not only in the mouth, but also in the stomach. That the presence in the mouth, and even the sight and smell of food which we relish, does arouse these secretions, we cannot have failed to notice.

Another object in masticating food is so to comminute it, that when received into the stomach the gastric juice will be admitted at once to every particle, and the process of digestion be commenced at once in every part of the morsel. But how different from this natural condition is the food in the stomach of the man who bolts his food in morsels as large as can be made to pass down, and, in the time necessary to prepare a single ounce for easy digestion, has filled his capacious maw with these enormous masses of indigestible food! I have seen masses of beef thrown from the stomach after remaining there undigested three or four days, or even a week.

Can we wonder, then, that we find among our merchants and business men, who never can spare but fifteen minutes for their meals, so many cadaverous, desiccated, "ill-favored and lean-fleshed" specimens of humanity? The wonder is, that, not conforming to the conditions on which good healthy juices are secreted, and not comminuting the food, so that those that are formed can come in contact with the massive morsels, except on their surface, enough can be digested to keep them alive.

Good Digestion is promoted by Cheerfulness.

Nothing is better understood than that there is a connection between cheerfulness and good digestion; and the trite expression, "to laugh and grow fat," undoubtedly had its origin in observation, if not in philosophy. What an astonishing amount and variety of food can be disposed of, and perfectly digested, at one sitting of two or three hours, by a company of cheerful and happy, not to say jolly and merry, old friends, and that without alcohol, or any other unnatural stimulus, to help digestion! I venture to say more than three times as much as the same individuals could eat and digest in the same time if each took his meals by himself.

And this one fact is worth more than all else I can write to show the dependence of the digestive powers on the state of the mind, and to prove that he must be lean and haggard who, keeping his mind constantly on his business, bolts his meals in silence and solitude, even in the presence of his family. I commend it to the careful consideration of uncomfortable mortals who never properly digest their food, and whose bones are too poorly clothed with flesh, and too poorly protected ever to allow them quiet rest, and who, therefore, envy "fat, sleek-headed men, and such as sleep o' nights."

From these considerations I venture to affirm, that any man not absolutely sick, who so trusts in Providence as to be able to obey the spirit of the injunction, "Take no thought for the morrow;" who keeps from his stomach, except as they are needed for animal heat, such heating food as butter, starch, and sugar, and who, therefore, digests all he eats; who eats at such regular and appropriate times as to secure rest for the stomach and a good appetite; who never taxes the stomach with food when tired and exhausted; who eats nothing that cannot be relished, and nothing the relish of which is not natural, or allows anything to enter the stomach that is not needed as food or drink; who takes his food so deliberately as to have it properly masticated and lubricated, and who eats his "meat with gladness and singleness of heart," will be exempt from dyspepsia, and his bones will be covered with a comfortable and comely coating of flesh.

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APPENDIX TO REVISED EDITION.

A, PAGE 33. — The discovery made by Dr. Hayes, that the muscle-making elements of nourishment reside in the outer crust of wheat and other grain, is a very important one, and though its practical application has been delayed for twenty-five years, will yet result in saving thousands from Apoplexy, Chlorosis, Consumption, and hundreds of other ills which come from the use of concentrated carbonaceous food in the civilized world; and as a counter claim for the honor of the discovery has been set up, I feel it to be my duty to go for the right, and protect my record. I have therefore obtained the following testimony on this point. Dr. Samuel L. Dana, who is known and respected by every chemist and scientific man in the country, writes: "In 1841 or 1842, Dr. Hayes showed me his process in detail of testing whole grain, which was entirely new and original at the time." There was also in 1844 a report to the Patent Office, giving Dr. Hayes credit for the discovery; but the most marvelous testimony (considering the new claim) remains to be given. In the "Report of the Geology of New Hampshire," by Charles T. Jackson, M. D., page 256, speaking of this application of tests to the whole grain, are these words: "This experiment was first made by Dr. A. A. Hayes."

B, PAGE 16. — The use of the terms Nitrates, Carbonates, and Phosphates, has been criticised; but the reader will remember that the object of the book is to instruct unscientific readers, and that in using the terms as I must, perhaps, one hundred times, it is quite a saving of labor to write Carbonates and Nitrates, rather than Carbonaceous Elements, Nitrogenous Elements, etc., and as no pretense is made for scientific accuracy, the criticism is hardly fair.

C, PAGE 215. — As a means of preserving the flavor of tea and coffee, the "Old Dominion" coffee-pot is a philosophical arrangement; as is also, on the same principle, the arrangement for preserving the flavor of meats and vegetables by Zimmerman's steamer, and Duncklee's improvement on it — an invention of inestimable value, both as a means of economy in fuel and of wholesome cookery. The principle is the same in both, but Duncklee's is more easily kept clean.

D, PAGE 63. — After consulting one of the most critical scientific scholars in Boston, in regard to the propriety of attempting to convey to common-sense minds, in the most concise manner possible, without technical language or more of detail than necessary, just so much of Physiology and Chemistry as would enable them to understand the subject, I wrote the sentence referred to (p. 63), and many others of a similar character, not thinking it possible that any man of common sense would understand this to be a full explanation of all the author knew of Chemistry, Physiology, or any other of the sciences; but a professor of some school or college out West, of whom I never before heard, covers seven pages of a respectable monthly in Detroit, in quoting these sentences, and showing how much more is known of Chemistry and Physiology, than the author seems to know, etc., etc., beginning by comparing the "Philosophy of Eating," with the philosophy of "the dawdling Mrs. Jefferson Brick," and closing with the grave advice, that the author should correct his second edition, after first "informing himself in Physiology," etc. After all these, and a dozen more similar, imputations against the book, and the author's knowledge of Chemistry, Physiology, Botany, and even Grammar, capping the climax of disparagement with "We wonder a little why his book was written, unless it was to sell," the Professor shows his appreciation of the intellect and acquirements of his professional brethren, to whom he writes as follows: "In conclusion, I would recommend the book as containing much that *is instructive to most professional*, as well as non-professional, readers"!

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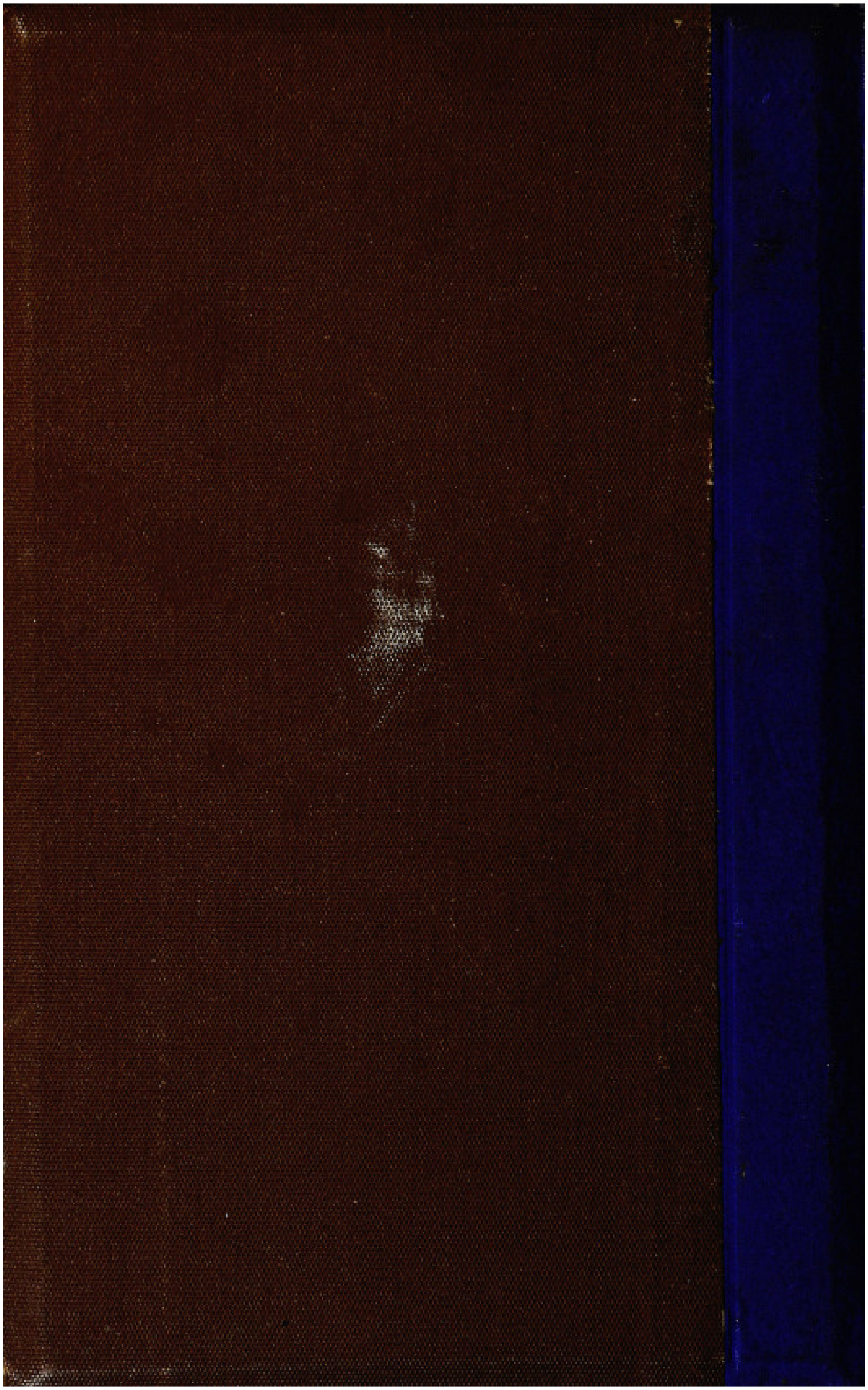

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