PROVINCE OF BRITISH COLUMBIA.

DEPARTMENT OF AGRICULTURE
(WOMEN'S INSTITUTES).

BULLETIN No. 46.

FOOD AND DIET:
PART I.

—BY—

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THE GOVERNMENT OF
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DEPARTMENT OF AGRICULTURE,
VICTORIA, B.C., October, 1912.

The Honourable Price Ellison,
Minister of Agriculture.

SIR,—I have the honour to submit herewith Bulletin No. 46, entitled "Food and Diet, Part I.," prepared on behalf of the members of the Women's Institutes.

I have the honour to be,
Sir,
Your obedient servant,

WM. E. SCOTT,
Deputy Minister of Agriculture,
Superintendent of Institutes.

FOOD AND DIET:

PART I.

THERE was a certain little Dutch boy, named Jacob Moleschott, born in the Netherlands so long ago as August 9th, 1822, to whom the study of the human body and its functions were of such absorbing interest that he became, in course of time, a foremost authority on the processes by which the food we eat becomes built up into our very substance, changing in marvellous fashion into blood, bones, muscles, and nerves. Indeed, young Moleschott devoted his brilliant abilities to this subject of human nutrition to such purpose that he held the position of Professor of Physiology (i.e., the knowledge of how each part of the body performs its special work) at no less than three prominent European universities, and was made a Senator of the Kingdom of Italy while still in the prime of life.

His opinion on matters connected with food and diet is consequently entitled to respect, and the quotation of one of his favourite sayings will form a good introduction to this bulletin:—

"COURAGE, CHEERFULNESS, AND A DESIRE TO WORK DEPEND MOSTLY ON GOOD NUTRITION."

That is to say, that when in good health we possess *courage* to face uncomplainingly the little frets and fatigues of daily life, as well as the power to brace ourselves to solve its big problems or to bear the shock of bereavement, suffering, or loss.

Cheerfulness does not desert us when engaged in the monotonous round of daily tasks, any more than when surrounded by a party of merry friends. Infused with the buoyant energy of health, the *desire for work* is so keen that it is carried on as conscientiously in the privacy of family life as when stimulated by the competition of the commercial world or by the applause of public opinion. On the contrary, when weak or poorly—that is, when nutrition is defective—this energy for work gives place to weary boredom and languor.

Seeing, therefore, this

CLOSE CONNECTION BETWEEN FOOD AND EFFICIENCY,

it is obviously our duty to learn at least the broad principles upon which healthful diet depends. There is, of course, a still prevalent opinion that what we eat or drink is purely our own concern, a question merely of taste, convenience, custom, or purse. Whereas modern teaching confirms the opinion of Jacob Moleschott, that to a large extent harmonious living depends on daily diet.

WHAT IS NUTRITION,

that it should bulk thus prominently in the comfort, the happiness, and the productiveness of life? To be in a state of good nutrition may be defined as that condition of the body when all its requirements for growth, repair, and capacity for work are satisfactorily fulfilled. Professor Chittenden (of Yale University, U.S.A.), who is devoting his life to the promotion of intelligent human nutrition, through his study and teaching on this vital subject of food and diet, has aptly described these requirements and their accomplishment by means of food as

THE THREE GREAT MYSTERIES OF LIFE.

How rarely most of us give even a passing thought to either one of these "great mysteries":—

(1.) The power of the child to grow:

(2.) The power of the body to repair its worn-out parts:

(3.) The power it possesses to perform work; not only what is commonly called work—namely, muscular activity carried on under the conscious direction of the brain—but also those marvellous, ceaseless activities of the internal organs—heart, lungs, liver, intestines, for example—performed independently of our will, which are practically continuous throughout life.

THE GROWTH OF THE BRAWNY, MUSCULAR MAN,

from the microscopic atom which was his beginning, depends materially upon the food with which he is supplied during the twenty-five years of active, bodily growth.

Measurements show conclusively that growth in height and weight are influenced to a remarkable degree by

THE DIET OF THE CHILD.

Thus the results of a most carefully conducted investigation carried out in Scotland showed that, in families where the income was approximately equal, the children of careless, ignorant parents, who took no trouble about the character of their food, averaged at thirteen years of age 11 lb. less in weight and 3¼ inches less in height than children in homes where thought and trouble were given to this important matter. But of far greater moment than the quantity of bodily increase is its *quality*.

Mental capacity, a well-balanced nervous system, a high standard of morality, are the product, to a degree realized by but few of us, of the standard of nutrition maintained during the years of growth.

THE WEAKNESS AND LOSS OF FLESH ASSOCIATED WITH DEFICIENT FOOD,

and the fact that death succeeds prolonged starvation, are results so familiar that no further proofs are called for to show that, in the absence of suited food, the daily wear and tear of the body are not made good; it wastes away, while the power to move and work gradually ceases.

Now, most of us have at some time or another heard

THE HUMAN BODY COMPARED TO A STEAM-ENGINE;

though, as a matter of fact, it is infinitely more marvellous in its construction and mode of work than any man-made machine. Still, the comparison helps us to explain this subject of what food does for our bodies; for some kinds of food may be described as the *building material* of which the engine is constructed, while other kinds of food (called "*energy-producers*") correspond to the fuel employed to heat the engine's boilers. If the metal of which the engine is constructed is poor in quality, or if repairs be carelessly carried out, the engine fails to do good work, no matter how abundant and excellent is the fuel with which its fires are stoked. Or if the fuel be poor in quality or deficient in quantity the most perfectly built engine becomes useless. Similarly with the body. If poor material is supplied in the form of food, either growth, power of self-repair, or capacity for work, or possibly all three, will suffer to a greater or less degree.

A large proportion of discomfort, languor, irritability, disappointments in life, as well as actual sickness, are the results, not of *deficient food*—that would be easily understood—but of

DEFECTIVE FOOD;

a much more common fault in a country where the standard of living is fairly high. Money may be freely spent upon the most costly forms of food and endless trouble may be lavished on its preparation, but the results are fruitless, or even actively detrimental to health, if the food is not suited to the eater.

It is no exaggeration to say that

THE SUFFERING ASSOCIATED WITH ERRORS IN DIET IS INCALCULABLE.

Bodily vigour is diminished, mental alertness is dulled, there is failure to resist disease, and a general deterioration is brought about. The conclusion of the whole matter may be briefly summarized as follows:—

Food is the most important source from which material is supplied for the growth of the body, for its repair, and for furnishing it with material from which to produce heat or energy for its activities.

The study of nutrition is concerned—

(1.) With the various ways in which the different kinds of food and drink serve the needs of the body throughout life:

(2.) The value of these different kinds of food and drink under different circumstances or for different purposes.

OUGHT WE THEN TO GIVE CONSTANT CONSIDERATION TO WHAT WE EAT AND DRINK?

The reply to this most natural inquiry will take the form of another question, namely: Who is included in this pronoun "we"? If it includes each member of every household, the answer will be

AN EMPHATIC "NO."

It would be morbid and undesirable to concentrate too much attention upon the selection of our daily diet, but if the "we" refers to housewives only, then the answer would be

AN EQUALLY EMPHATIC "YES."

It is plainly the cook's duty to prepare and present at table food suited to the requirements of the consumers. What these requirements are it is the purpose of this bulletin to show.

THE LESSONS OF EXPERIENCE.

In order to understand why experience has guided healthy human beings to choose and to combine at one meal those foods which are in common use all over the world, it will be of interest to learn what each kind of food does for the body after it has been digested, for then it becomes apparent how reliable a guide Nature is, if we will but follow her lead. Take, for example,

A MIDDAY MEAL

of roast, stewed, or boiled meat, potatoes, cabbage, bread, stewed fruit, with a light pudding or cream. Millions of families sit down to just such a meal daily in the continents of Europe and America.

Why is this combination of food so generally chosen and enjoyed? Well, *lean meat builds up and repairs the bodies* of those who have been spending several hours in various forms of activity, physical or mental.

Fat meat supplies fuel for the furnaces of their bodies, which need to be stoked periodically, as the reservoir of a lamp needs to be refilled with oil.

Potatoes, bread, and a light pudding (if that form part of the menu) *provide fuel also*, but of a somewhat different kind from the fat of meat, or cream. It can be turned to account more quickly as a source of heat or energy in the body. It might be compared to the kindling, useful to start a fire or to revive it, whereas fat resembles more nearly the coal subsequently employed to keep the fire in over many hours. Or, to use another simile, fat taken as a fuel-food resembles the money lying at our account at the bank, to be drawn upon when the money in our purse (which we spend daily, and to which we can compare the fuel supplied by cereals, vegetables, and fruits) needs to be replenished or supplemented.

Finally, the cabbage and stewed fruit eaten at this dinner consist almost entirely of *water*, of which the body requires a very large amount. They also contain what are known as "*salts*," mineral substances which are necessary to the building-up and well-being of the body.

Many people add condiments (i.e., pepper, mustard, vinegar) to their food as they eat it; and some form of beverage is taken with every meal to satisfy the body's need for fluid. This review of the

CONSTITUENTS OF THE FOOD TAKEN AT AN ORDINARY MEAL

shows that they may be separated into five kinds or classes, to which attention must now be given.

It is advisable from the beginning of our study to assign the correct name to each class of food, so that future references to this subject may be easily understood. Indeed, there is no difficulty in remembering either these names or the particular work each does in the body, for, of the five names, three are quite familiar, viz.: *fat, salts*, and *water;* and the other two act as reminders of their functions in the body.

By far the most important class of foodstuff is the first, known as *protein*, a word which signifies *to be of the first importance, to be pre-eminent;* because only the foods found in this class contain the building material indispensable to life. Were they banished from the diet, death would inevitably ensue. Meat, fish, game, poultry, eggs, milk, and cheese, all contain this vital "protein." It is present also in corn, wheat, oats, peas, beans, and lentils, but in less digestible form than in animal foods.

In the second class—viz., *fats*—are included animal fats, such as suet, dripping, lard, butter, and cream; as well as vegetable fats, olive-oil, for instance, and the oil contained in nuts. These fats are all sources of heat and energy to the body, whence they are distinguished as fuel or warmth-giving foods.

It has already been pointed out that the third class, called *carbohydrates*, consists also of energy-producing or fuel foods. Its very name suggests this office, for it is composed of two Latin words meaning coal and water. That the name accurately describes the composition of the foods found in this class becomes apparent when it is understood that they consist chiefly of water and of solid substances, which serve the body much as coal, oil, or wood serve an engine. These solid substances are forms of starch and sugar, and are present in flour, cornstarch, rice, sago, tapioca, potatoes, oatmeal, and other farinaceous foods and cereals; while sugar is found in all fruits.

A potato, for instance, consists of 81 per cent. of water and rather more than 15 per cent. of starch. Fresh peas contain 78 per cent. of water and 16 per cent. of starch; and though rice or cereals are almost pure starch when purchased in a dried condition, large quantities of water must be used in their preparation before they are fit for food. Most fruits, such as apples, peaches, or berries, contain from 85 to 90 per cent. of water and from 5 to 15 per cent. of sugar.

"STOP A MOMENT,"

some one will exclaim. "You have mentioned oatmeal in two classes of foodstuffs, once as an illustration of those containing body-building material and then as an example of carbohydrate food. Now, which statement is correct?"

Both are right, my friend, for, rich as oatmeal is in protein, it is even richer in carbohydrates, and perhaps it may surprise you further to learn that it contains fat too. It is owing to the fact that cooked oatmeal contains representatives of all five classes of foodstuffs—protein, fat, carbohydrates, salts, and water—that the Scottish nation was celebrated for its vigour of mind and body when oatmeal combined with milk constituted the main sources of its food-supply.

The question also enables a passing reference to be made to

ANOTHER POINT OF EQUAL IMPORTANCE AND INTEREST,

which will be dealt with more fully later on, viz.: that no foods—except sugar, cream, and olive-oil—contain only one class of nutrient. From three to all five of the five classes are represented, though to a very variable amount, in each form of food—bread, meat, or berries, for instance; but, for convenience, it is customary to group each food in the class of which it is the most representative.

Now, we must return to the enumeration of these classes, of which the next in order is the fourth, consisting of *salts* or *mineral matters*, such as iron, potash, phosphorus, lime, and several more. These salts are urgently needed to maintain the health of the body as well as to build its parts. If the supply were to cease, so would life, even though an ample diet in all other respects were provided. It is not, therefore, a matter for surprise that they are found in every form of food eaten by man, as well as in most drinks, water included. Their chief source of supply, however, is in cereals, vegetables, and fruits; hence the stress laid upon the inclusion in the daily diet of cabbage, salads, etc. The adult human body contains about 7 lb. of these mineral matters.

The last, but by no means the least important, class to be mentioned is *water*. About two-thirds the total weight of the body consists of water, so that its claims to constitute a class of food are immediately apparent. Water must be consumed to maintain this proportion as well as to furnish the 4½ pints of fluid, more or less, which are given off daily from the lungs, skin, and internal organs. As the body possesses a very limited capacity to form water in its own tissues, most of its needs must be supplied from its diet. To furnish this supply

ABOUT HALF THE WHOLE WEIGHT OF SOLID FOOD EATEN CONSISTS OF WATER,

besides which another 2 or 3 pints should be taken daily in liquid form, preferably as pure water.

RESTRICTION IN THE DAILY CONSUMPTION OF WATER

means interference with the complex chemical changes always proceeding in the digestive system, muscles, and other parts of the body. When these are interrupted or hindered by an insufficient supply of water, indigestion, constipation, gout, and many other forms of disorder and discomfort occur or are accentuated.

We are apt, too, to ignore the benefit derived by the body from a thorough cleansing within as well as without. A tumbler of hot or cold water drunk on rising in the morning or on going to bed at night is as beneficial to health as the morning or evening "tub." The water washes away and dissolves mucous and other matters in the digestive tube, leaving it fresh and clean for the reception and digestion of the next meal.

A SIMPLE AND OFTEN EFFECTIVE TREATMENT

for occasional attacks of indigestion is to rest the overtaxed organs by abstaining from all food for twenty-four hours, meanwhile sipping a cupful of hot water every two or three hours.

In any case, remember this; that, unless the consumption of water be restricted by doctor's orders, the body benefits by taking at least a quart of fluid a day *as water*, not even in the form of tea, coffee, or cocoa; on the understanding, of course, that the water is pure; or, if the only available source be suspicious, that it is made safe by boiling for from twenty minutes to half an hour.

A little reflection in the light of the information just gained will amply confirm the statement made earlier in this bulletin—namely, that experience has guided healthy human beings to choose just the right forms of food for the upkeep of his body. This fact becomes quite clear when the classes of foodstuffs, with illustrations from their representatives in daily use in our homes, are arranged in tabular form:—

Body-building Foods.	Heat- and Energy-producing Foods.
(1.) *Protein*—Meat, fish, milk, eggs, cheese, peas, beans, etc.	(1.) *Protein*—In the foods just enumerated.
(2.) *Mineral Matters or Salts*—These are found in all foods, but especially in vegetables and fruits.	(2.) *Fats*—Of meat, eggs, butter, cream, oil, etc.
(3.) *Water*—Present in all foods, but needs supplementing in fluid form.	(3.) *Carbohydrates*—Present in cereals, farinaceous foods, most vegetables, and all fruits.

One more explanatory remark is necessary about these classes before passing on to the next part of the subject. Readers will have observed that

PROTEIN APPEARS IN BOTH GROUPS OF FOODSTUFFS,

though it has been mentioned as a body-building food only. The fact is that protein *can* fulfil both these vital functions (another reason for its proud title of "pre-eminent"). But it is rarely relied upon to serve the double purpose of body-builder and energy or heat producer. In the first place, because it is chiefly found in the most expensive kinds of foods—eggs, meat, poultry, etc.; in the second place, because these foods contain their nutrients in very concentrated form; whereas, strange as it may sound, a certain bulkiness in the

diet is essential to the maintenance of health. Before this fact was known repeated efforts were made to supply only highly concentrated food to explorers or to armies on the march, and

MUCH SURPRISE WAS EXCITED

at the disappointing results of the experiments. By degrees these were traced to the detrimental effects of insufficient bulk in the food consumed. This desirable element is furnished by the carbohydrate foods, a fact which will be further explained a little later on.

A very natural question at this stage will be: How has accurate knowledge been gained of just

WHAT SERVICE THESE CLASSES OF FOODS RENDER TO THE BODY?

The part played by these foodstuffs in the nutrition of the body has been quite gradually discovered by close observation and by scientific methods of various kinds, so that to-day, when it is desired to understand accurately the particular worth of any form of food, it is submitted to

FOUR DIFFERENT KINDS OF TESTS,

known respectively as: (1) The chemical; (2) the physical; (3) the physiological; and (4) the economic.

(1.) *Chemical* tests for food-value are designed to discover the exact amount of each nutritive constituent a food contains. The bread, meat, cheese, or other substance is subjected to certain processes which enable the trained worker to separate out the protein or fat or carbohydrate or mineral matters present, no matter how minute a proportion they may form of the whole. In the early days of these chemical investigations into food-values the interesting fact was discovered that *similar constituents to those in man's chosen foods are present in his body*, not, of course, in the form familiar to the naked eye; for the food eaten has to pass through many changes during the intricate process of digestion before it can be carried by the blood and lymph to the bones, muscles, nerves, and various organs the structure of which it maintains.

Fig. (1) gives an idea of the relative amount of each of these five classes of substances which are found in the full-grown body; naturally not massed together as in the illustration, but dispersed in varying amounts and proportions and forms in the different tissues.

Obviously, therefore, it is a matter of importance to supply the right amount of each substance by means of our daily diet, in order to maintain their relative proportions in the body. Too much protein or too little fat might conceivably disturb the balance of health. That is just

THE LESSON MAN IS LEARNING AT SOME COST

and by slow degrees. An excess of protein does not mean an increase of strength or a finer body. Rather it results in disordered nutrition instead of growth; in debility and dyspepsia instead of strength; and if there be too little fat in the diet the deficiency is associated with

MANY FORMS OF ILL-HEALTH;

a tendency to "take cold," or to contract tuberculosis, or to suffer from constipation; to name but a few of the results now known to follow an

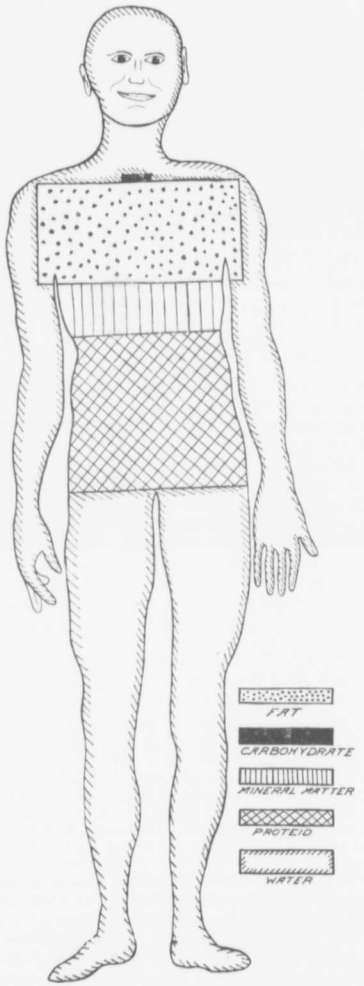

Fig. 1.

insufficient supply of this important foodstuff. Before life became so artificial as it is to-day, instinct guided human beings to a surprising degree not alone in the right choice of their foods, but in their correct combination also. Eggs, rich in protein, have been eaten for untold generations with bread, rich in carbohydrates, and butter, a form of pure fat. Some kind of vegetable has been habitually consumed with meat or poultry; beans, rich in protein and carbohydrates, are still allied with fat pork; veal, deficient in fat, is eaten with rashers of bacon; the acid of apple-sauce is a usual combination with the highly concentrated forms of protein and fat found in pork or goose.

THE FAULT OF TO-DAY

lies in the failure to adapt old and often in themselves good customs to modern requirements. Thus the combination and quantity of certain common foods, suitable to a man taking hard exercise or whose consumption is limited by the difficulty of securing much of it, become unsuitable when selected by the sedentary town dweller, or by the man in easy circumstances, who can eat just as much as he likes; which is quite a different thing from just the amount required by his body! This point will be treated more in detail in Part II. Meanwhile, further and fuller reasons must be given why other means

OF ESTIMATING FOOD-VALUES

call for consideration, besides the method of identifying its chemical constituents. Were a housewife to study these only, she might soon find herself in the same plight as a friend of mine, who had listened with great interest to a lecture on

THE CHEMICAL CONSTITUENTS OF OUR DAILY DIET,

from which she learned that cheese and dried cod-fish contain very high proportions of protein (cheese, 35 per cent.; salt cod, 25 per cent.), and that pleasant flavours promote digestion. This lady was most anxious to rear up a family of tall children and loved to consult their tastes whenever possible; so she proceeded to apply to her menus the information thus recently acquired. Soon the doctor was summoned to a houseful of querulous, dyspeptic children, whose mother, full of the best intentions, had been providing a diet in which cheese and salt cod figured daily; and who had permitted unrestricted access to jam and pickle jar, as well as to sauce-bottle, in her desire to please their palates.

Poor woman; she learnt a very sharp lesson on

THE RISKS OF TOO SLIGHT A KNOWLEDGE OF A BIG SUBJECT.

The doctor explained to her that, in the first place, no child under ten or twelve years of age should even know the taste of cheese, salt cod, pickles, or sauces—foods to be eaten at any age with discretion. In the second place, he pointed out that she had gained this imperfect information because she had attended but one lecture of a course. In the succeeding lectures to that to which she went, the lecturer had explained why chemical analysis alone, useful as it is in its place, is an insufficient guide as to the food-value to the human body of the articles eaten at the different meals.

A CHEMICALLY PERFECT FOOD MAY BE IMPOSSIBLE OF DIGESTION

or otherwise unsuitable to the consumer; consequently, great importance is attached by competent authorities to the three other tests just mentioned.

The second of these, namely,

THE PHYSICAL TEST FOR FOOD-VALUES,

will now be discussed. To enter intelligently into the worth of this test readers must be reminded of Professor Chittenden's three great mysteries of life: (1) The power of the body to grow at the expense of the food eaten; (2) the power to renew the worn-out parts of the body by the utilization of the daily diet; and (3) the power to derive energy from this supply to run the machinery of the body, and thus to work.

HOW IS THIS ENERGY DERIVED FROM FOOD?

An engine derives energy from the steam generated by the water in its boiler, which is heated by the combustion of fuel in its furnace. We constantly talk, too, about the body's furnace and how it is stoked by the fats and carbohydrates present in the food we eat; but all the time we realize that what we say is, after all, but a figure of speech. Nevertheless, food *does* seem to warm us up on cold days, when we thoroughly enjoy suet puddings, hot buttered toast, or pork and beans; whereas in warm weather we instinctively turn from these foods and choose fruit, custard, and sponge-cake.

To take another example of what our sensations teach us to the connection between food and energy. Every one has noticed that, when wearied by a long spell of work,

A GOOD MEAL REVIVES US AMAZINGLY

and restores our flagging energies; and we have all experienced at some time or another that when very hungry, even pleasures lose their savour; but soon after taking food a sensation of refreshment is felt and we resume our work or play with renewed zest. There can be no doubt that

FOOD AND ENERGY ARE CLOSELY CONNECTED.

Yea, more than this, food—its sufficiency or deficiency—can and does affect the character and direction of the actions by which energy is outwardly expressed. Have you ever heard that

THE TERRIBLE EXCESSES OF THE FRENCH REVOLUTION

may be attributed to brains disordered by starvation? By one of life's perplexing ironies, this poor, starved people actually guillotined, in their misdirected energy, the great founder of modern chemistry, Lavoisier, who, before his execution in 1794, had fortunately set men on the right road to discover the character of the changes undergone by food in the body, which result to the eater in a supply of energy for work.

Since the days of Lavoisier, the process he dimly perceived has been clearly traced. It is now proved that these changes are brought about by

A PROCESS OF SLOW COMBUSTION,

technically called "*oxidation*," always going on in the liver and muscles. The process does not exactly resemble the rapid combustion, accompanied by

smoke and flame, to which we are accustomed in our stoves; but it is similar in character, though very different in degree. The heat of the body in health rarely exceeds 99° Fahr., whereas that usual in a stove is many times as much; even in an oven attached to a stove the temperature may register 400° Fahr. or more.

Are we not all familiar with the fact that

ONE RESULT OF ACTIVE EXERCISE IS TO QUICKEN THIS PROCESS

of combustion in the body? In cold weather we instinctively run, dance, or otherwise take active exercise to "get warm"; while in hot weather we move about slowly and as little as we can in order "to keep cool." If the body becomes disordered by disease, then combustion may increase too rapidly; the patient "burns" with fever; and if the temperature rise and remain too high he "burns out"—that is, he dies. In an invalid, weakened by long illness, the process of combustion proceeds too slowly; the temperature is "below the normal," blankets and hot-water bottles are needed to keep the body warm enough to live.

SOMETIMES THE FURNACE IS CHOKED WITH IMPERFECTLY CONSUMED FUEL.

The amount of fuel-food eaten has been in excess of the body's needs or unsuited to its capacity for digestion. Measures are resorted to to clear out the accumulation, by means of purgatives or otherwise, while food is temporarily withheld.

Evidently, then, there are many points of general resemblance between the combustion with which we are familiar in engine or kitchen-stove and that proceeding so marvellously within our bodies.

The results of Lavoisier's observations led his followers to make many further discoveries bearing on food as a source of energy to the body. The fact was discovered that

IF A PORTION OF DRY FOOD IS BURNED, IT WILL GIVE OUT A DEFINITE, MEASURABLE AMOUNT OF HEAT.

An ounce of lean meat, for instance, yields just so much heat, an ounce of butter yields so much, an ounce of sugar so much; consequently, their relative worth as sources of heat to the body can be accurately measured; though that is not exactly the point I now want to make, which is this: After a large number of experiments had been made and many years of devoted labour had been expended, the further fact was proved that, when digested, these foods supplied an amount of energy equal to the amount of heat they produced when burned outside the body. The result of all this scientific work is that the energy-value of anything we eat can now be as accurately measured as the weight of flour, sugar, and raisins are measured for a cake or pudding. It is true that

THE HOUSEWIFE USES OUNCES AND POUNDS

as her scale of measurement, whereas the student of food-values uses what he calls "calories" ("calor" is the Latin word for heat) when he estimates how much heat—or its equivalent, energy—is given up to the body by the portion of meat, bread, jam, or fruit consumed at a meal.

An ounce of *fat* measured by this "heat" scale yields more than twice as much heat, and therefore energy, as do similar amounts of *protein* or *carbohydrate*.

WHITE OF EGG IS PRACTICALLY PURE PROTEIN.

If the white of an ordinary-sized egg is burned with proper precautions, it yields 16 calories.

SUGAR IS PRACTICALLY PURE CARBON.

If a small lump be burned, of the same weight as the white of egg, it also measures 16 calories.

OLIVE-OIL IS PRACTICALLY PURE OIL OR FAT.

If a corresponding weight of olive-oil be burned (about a thimbleful), it would yield nearly 40 calories; that is more than twice the amount of heat measured in the other two cases.

It is a sound instinct, then, which impels us in cold weather or when doing hard manual work to eat more fat-containing foods than when sitting quietly at a desk or worktable; or when "melting" with heat at midsummer. A man doing hard, muscular work needs to eat daily food which will furnish him with about 3,000 calories.

TABLE OF NUTRITIVE VALUE OF SOME COMMON FOODSTUFFS.

1 lb. of	Calories a lb.	Refuse, per Cent.	Water, per Cent.	Protein, per Cent.	Fat, per Cent.	Carbohydrates, per Cent.
Sugar (granulated)	1,857	..	..	..	..	100
Rice	1,630	..	12.4	7.8	0.4	79
Peas, beans, or lentils, dry	1,590	..	13.2	22.3	1.8	59.1
Meats (about)	928	12	55	16	15	..
Fish (fresh)	388	30	45	12	4	..
Milk	325	..	87	3.3	4	5
Potatoes	325	15	67.1	1.8	0.1	15.3
Bananas	290	40	44.5	0.7	0.5	13.7
Apples, grapes, etc.	285	25	60	1	0.9	12.9

A LUMP OF BLUBBER AFFORDS AS KEEN PLEASURE TO AN ESQUIMAUX CHILD

as does a stick of chocolate to one of our own small folk or a banana to a little blackamoor in the Tropics, because it lives in an intensely cold climate and its body-furnace calls for more vigorous stoking. How is it, then, that few people can take fat in any quantity, if it is so useful as a source of heat and energy to the body?

The answer to this inquiry is found in the fact that

FAT IS MORE DIFFICULT TO DIGEST,

and takes longer to undergo the series of changes necessary before it yields energy to the body, than is the case with foods containing protein or carbohydrates; so we find that mountain-climbers, harvesters, or men on a long march, eat, by preference, chocolate, preserves, or molasses in large quantities; because sugar undergoes more rapid combustion in the liver and muscles than fat does; thus the energy it yields is more quickly available to meet any unusual call.

CAUTION.—Do not hastily conclude that our consumption of sugar may be unlimited, or that the more sugar we swallow the higher will be the degree of energy we attain.

More information on this point will be given later on; meanwhile remember the profound truth of St. Paul's behest "to be temperate in all things."

MAKE A MENTAL NOTE OF THIS FACT, HOWEVER:

The starved or ill-nourished individual is incapable of good or prolonged work, mental or physical, because he is insufficiently supplied with the fuel-food which constitutes the foundation of bodily energy. Here is a good illustration of the fact:—

Concern was excited, some years ago, by the poor physical condition of the children at the Duke of York's School in London, an asylum founded for the orphans of soldiers. The fault lay partly with the overcrowded dormitories, partly, it was thought, in the prolonged hours spent in school. More sleeping accommodation was provided and book-learning was reduced, one-half of each day being given to manual training in workshops and to physical drill. Imagine the committee's disappointment when

THERE WAS AN IMMEDIATE FURTHER DROP IN THE AVERAGE HEIGHT AND WEIGHT

of the already undersized and delicate children, who seemed, in some way, conscious of their deficiencies, for, out of 460 boys, eighty besieged the dispensary every day, asking for cod-liver oil. No pains were spared to discover where the error lay in their management; and at last the true cause was found.

The children were being called upon for an amount of work quite beyond their strength, and certainly beyond the energy furnished to them in their diet. Calculation showed that

THE ENERGY-PRODUCING FOOD SUPPLIED WOULD SUFFICE FOR ONLY HALF THE AMOUNT OF WORK DEMANDED OF THEM.

The boys were getting too little body-building material and too little fat. The little fellows begged for cod-liver oil, not alone for its own sake as a fuel-food (though naturally they were ignorant of this technical fact), but because a slice of bread and butter was usually given with it!

Directly an adequate diet was supplied the cod-liver-oil appetite vanished, and the children gradually gained in health and energy.

Readers may be interested to know, by the way, that

THE AMOUNT OF WORK DONE BY THE BODY CAN BE AS ACCURATELY MEASURED AS THAT DONE BY A MACHINE.

When this calculation has been made, it becomes comparatively easy to estimate just the amount of fuel or energy-producing food needed by the worker. Be pleased to note, however, the precaution exercised by the word "*comparatively*." The reason for its use leads us on to the third and most important test of all for food-values, viz.:

THE PHYSIOLOGICAL TEST.

This test approaches the subject by putting the following series of searching questions to every foodstuff, or food-fad, or much-advertised patent preparation, as it passes them in review:—

(1.) How does it behave in the stomach and intestines?
(2.) Is it easily digested?
(3.) To what extent is it absorbed?
Truly has it been said that

WE LIVE, NOT BY WHAT WE EAT, BUT BY WHAT WE ABSORB.

Chemical analysis may show a substance to contain just the right proportions of protein, fat, or carbohydrates; it may yield a satisfactory degree of energy in the process of slow combustion; but, unless it is easy of digestion and unless its nutritive constituents can be absorbed by the blood, it is valueless as food.

SAWDUST, PETROLEUM, HOOF-PARINGS,

for example, can pass the first and second tests triumphantly; but they fail to fulfil either requirement of the third—they can neither be digested nor absorbed.

What is the distinction, you will inquire, between these two

PROCESSES OF DIGESTION AND ABSORPTION?

In the first place the digestion of food *must* precede its *absorption*. The several stages of digestion may be roughly outlined as follows; they are far too complicated and elaborate to be described in detail in popular language:—

(*a*.) The selection of suitable food in market or store. Dirty, stale, diseased, bruised, or "sophisticated" foodstuffs should be rejected.

(*b*.) The proper preparation of the chosen food in the kitchen, either by cleansing, manipulation, or the application of heat. (*See* Bulletin 36.)

(*c*.) Thorough mastication of the food by the teeth; a process of crushing and grinding, by which nutritive constituents are set free and large surfaces are formed, upon which the digestive secretions may act. To "bolt" food is to remain unfed and cruelly to irritate the organs of digestion.

(*d*.) The swallowing of the food and the passing of it on to organs and secretions thenceforth *beyond* our control, but the efficiency of which are much influenced by a process entirely *under* our control—namely, sufficiently prolonged mastication.

Every one ought to know that

PROPERLY CHEWED FOOD

stimulates the stomach to perform its part efficiently in this marvellous process of digestion. Similarly, while the stomach is accomplishing its own task in masterly fashion, it incites the intestines and pancreas (sweetbread) to an equally high standard of performance. If

THE WHOLE SEQUENCE OF EVENTS

is to be perfectly carried out, no detail must be slurred over or omitted, otherwise the succeeding stage of nutrition cannot be successfully accomplished. Fortunately, therefore, Nature has kept the greater part of the prolonged process of digestion in her own hands. Were it entrusted to us it would not be half as well performed; indeed, just as soon as we concentrate our attention upon one or other stage of the journey taken by our food through our bodies, just so soon is the stage interrupted and all sorts of accidents occur.

Have you ever heard that

EVERY PARTICLE OF FOOD CONSUMED,

whether it be a spoonful of milk-pudding or a hard cracker, must assume a *fluid form* before it can serve the body as nourishment? Digestion is largely a process of *liquefaction*, and the change has to take place somewhere between the lips and the marvellous surface of the small intestine, which absorbs and passes these fluids through its own substance to the blood and lymph which bathe every portion of the muscles, nerves, bone-cells, etc., of which the body is built up.

The long tube, which extends from the mouth right through the trunk, in which digestion takes place, is, virtually, as much cut off from direct communication with the lungs and heart, for instance, or with the limbs, as if it were completely outside instead of inside the trunk. Consequently,

THE WELFARE OF THE WHOLE INDIVIDUAL

depends upon—

(*a.*) The reduction of nutrient material to fluid form within this tube;

(*b.*) Upon the efficiency with which it is absorbed and distributed to the different tissues, which call for repair or energy.

If the food is by its nature incapable of digestion, as, for example, the skins, stones, and seeds of fruit and vegetables; or if the surface of the intestine is unequal to its work, as in cases of cholera or typhoid fever; or if the eater is worried or plunged into profound thought, so that an unusual amount of blood is busy in the brain; or if he is overtired, so that the blood and nerves are half poisoned by the chemical results of great fatigue—then no absorption is possible, and all sorts of miseries, known as indigestion, are the result.

NOW FOR A WORD OF GOOD ADVICE.

If the appetite fails, do not hurry to force it; just go without eating until hunger returns. No healthy person suffers from occasional absence of all food, except water, for twenty-four to thirty-six hours. Hunger is the body's cry for food; when it wants nourishment, hunger makes itself felt. A loss of appetite in a healthy, well-fed person usually means that too much food or food of an improper kind has been eaten; or maybe the eater was overtired, worried, overexcited, or otherwise incapable of making use of the food he forced down, thinking it the right thing to do.

FOLLOW NATURE'S LEAD,

and do not force food on the unwilling digestive organs; they will ring an insistent dinner-bell when ready for work. Of course, if illness be the cause of loss of appetite, then the form and frequency of the diet is a matter for the physician to decide.

It may be useful here to mention another important fact. Readers may be puzzled over

THE APPARENT INCONSISTENCY

of insisting that all food must be well absorbed and yet saying (on page 11) that unless some indigestible material be eaten, such as cellulose, constipation

follows, with all its long train of disagreeable companions. The fact to which attention is now to be drawn reconciles these two apparently contradictory statements. In describing meat as rich in protein or bread as a carbohydrate food, it is not meant that these foods contain *only* protein or *only* starch. In almost every case these nutrients are combined with a greater or less amount of the other four classes of nutritive substances as well as with cellulose or similar indigestible fibrous matters, from which it is the work of the digestive organs to separate them. The residue remains in the intestine to serve the purpose of "ballast," which, in the course of its expulsion from the intestine, carries with it other undesirable products, which have accumulated in the process of digestion.

Let us suppose that a man requires 4½ oz. of protein to repair the daily wear and tear of his body; he could find no foodstuff in which this protein occurs in pure uncombined concentrated form. He would have to eat 1½ lb. of meat, for instance, in order to get his 4½ oz.; or if he preferred eggs and milk, he would have to drink two quarts of milk and eat nine eggs! Of course, such a diet is mentioned only to illustrate my point, not as an example to be followed. Once more it must be emphasized that

THE METHODS OF EXPERIENCE

find full confirmation when subjected to the tests now under consideration in respect of food-values. A healthful diet must be a mixed diet; then the excess of a particular nutrient in one article, such as protein in meat or fish, is balanced by the high proportion of starch in another, such as potato or rice; or of fat in another, such as butter. Part II. will deal more at length with this matter of the constituents and combinations of foods in common use, but, just in passing, mention may be made of another interesting fact—namely, that after the first two or three years of life, the nutritive substances in milk and soup are better absorbed when bread is eaten with them than when taken alone.

Another factor of physiological importance must not be overlooked; it is that of

INDIVIDUAL TASTES OR DISLIKES IN FOODS.

This is a matter which materially influences the absorption of food. There is profound truth in the old saying that "One man's meat is another man's poison." The food which makes your mouth water, for instance (a good omen for its digestion, by the way), may leave mine unaffected or even seem to parch it up, so objectionable to me is your favourite dish.

Eggs are actual poison to some luckless individuals, just as mutton occasionally produces nausea in others, or shell-fish may be the cause of nettle-rash. A sufferer from severe asthma has been known to enjoy freedom from this distressing complaint after a supper of lobstar salad, while tortured for hours after a meal of boiled fish. Generally speaking, food hated is food wasted.

Food has been compared by one writer to ore, and the nutrients it contains to the precious metal concealed within the ore. Digestion is the process by which the body secures these hidden treasures. The *chemical* test tells us how much metal is present in a given mass of ore. The *physiological* test shows whether the body *possesses the machinery or tools necessary to extract and utilize it.*

The fourth and remaining test to be discussed is

THE ECONOMIC TEST FOR FOOD-VALUES.

It concerns itself with—

(1.) The price we pay for our foods;

(2.) The amount of them we waste; and

(3.) Their management in the kitchen.

Professor Atwater used to say that for persons in good health, foods in which the nutrients are most expensive are like costly jewels. People who are well off may be justified in buying them, but they are not economical.

Besides getting good value for our money by an understanding choice of foodstuffs, we ought to check extravagance along two other lines. Many of us eat more than we want, or, rather, more than the body needs, and there is often careless waste of food.

THE THRIFTY HOUSEWIFE

will constantly ask herself: "Are the nutritive substances contained in the food I should like to buy worth the price asked? How much energy will be furnished for that sum; how much building material will it supply?" To quote Professor Atwater again: "There is no more nutriment in an ounce of protein or fat of the tenderloin of beef than in that of the round or shoulder." . . . "A quarter of a dollar invested in the sirloin of beef at 22 cents per pound pays for one and one-seventh pounds of the meat with three-eighths of a pound of actually nutritive material. This would contain one-sixth of a pound of protein and one-fifth of a pound of fat, and supply 11,120 calories of energy. The same amount of money paid for oysters at the rate of 50 cents per quart brings two ounces of actual nutrients; an ounce of protein and 230 calories of energy. But in buying wheat flour at $7 a barrel, the 25 cents pay for six and a quarter pounds of nutrients, with eight-tenths of a pound of protein and 11,755 calories of energy."

BREAD IS UNQUESTIONABLY THE CHEAPEST FORM OF FOOD

where energy is concerned. It will furnish *for the same cost* three times the amount of energy which would be obtained from milk or ten times as much as could be got in the form of meat *for that amount of money*. If building material is in question, peas rank first as a source of cheap supply. They work out at about half the cost of cheese. Were an equal expenditure made on both foodstuffs, peas would keep the body in repair for two days, while there would be only enough protein in the cheese for one day's requirements.

But, because cheaper to buy and chemically satisfactory as regards their nutritive constituents,

PEAS ARE NOT THEREFORE SUPERIOR TO CHEESE

as builders-up of the body. It must be borne in mind that each test has to be passed by the particular foodstuff under consideration before its order of merit can be conferred. There are two drawbacks to peas. They call for prolonged cooking, and their nutrients are difficult for the digestive organs to extract and for the tissues to absorb. A large quantity must be eaten to furnish all the body needs. Cheese, on the contrary, need not be cooked and is highly concentrated; but here lies another pitfall, cheese is unsuitable as a food unless five or six times its bulk of bread or cracker or biscuit is eaten with it to furnish the requisite bulk.

VEGETABLE FOODS,

which consist chiefly of starch and sugar, are far cheaper than are animal foods, of which the protein value is high. For this reason, it is fortunate that from four to five times as much carbohydrate is called for in our daily diet as of the more expensive proteins and fats. But, unfortunately,

THERE IS A GENERAL TENDENCY TO EXAGGERATE

these relative proportions in favour of the less expensive and often more attractive carbohydrates. Few people can resist the enticements of cakes, puddings, candies, or fruit, and eat them in excess of their requirements. The point cannot be too strongly emphasized that, if in comfortable circumstances, we constantly

EAT TO PLEASE OUR PALATES AND CHOOSE OUR FOOD ACCORDING TO THE LENGTH OF OUR PURSES,

not from an intelligent sense of what is best for us or of true economic worth. The market price of food is no guide to its real money or food value. When we eat an egg for which we have paid more than 2 cents, we pay for the pleasure it gives us to eat it; for its food-value is in no way commensurate with its cost, when that cost ranges from 4 cents to 6 or more cents an egg.

Then, too,

THE WASTE FROM BAD COOKING AND SERVING

or from bad combinations of foods must be taken into account, for it opens up a huge economic question. Kitchen and table refuse is not total loss in the country, for it goes to pigs and poultry, bringing compensation in the form of pork and eggs. But in cities the material thus wasted has been found to amount to one-ninth of the food bought, and that the most expensive ninth, for analysis has shown that such wastes consist usually of about one-fifth of the protein and fat-containing foods, which, as we have learnt, are the most costly which appear on our tables.

IF THE FOOD WASTED IN AN ORDINARY HOUSEHOLD

were collected over a period of one month and then displayed before the family's eyes, much horrified surprise would be experienced. Careless leavings on plates, unpalatably prepared dishes or unappetizing modes of service, would account for most of this accumulation; but it is also to be wished, though, alas! vainly, that such a convincing method of conviction were also possible with the "overeaten" food swallowed, which is just as much wasted!

A NOTED ENGLISH PHYSICIAN,

who was a profound student of this subject of food and diet, wrote as follows: "I have come to the conclusion that more than half the disease which embitters the middle and latter part of life is due to *avoidable* errors of diet . . . and that more mischief *in the form of actual disease*, of impaired vigour, and of shortened life accrues to civilized man . . . from erroneous habits of eating than from the habitual use of alcoholic drink, considerable as I know that evil to be."

PROXIMATE PRINCIPLES OF FOODS.

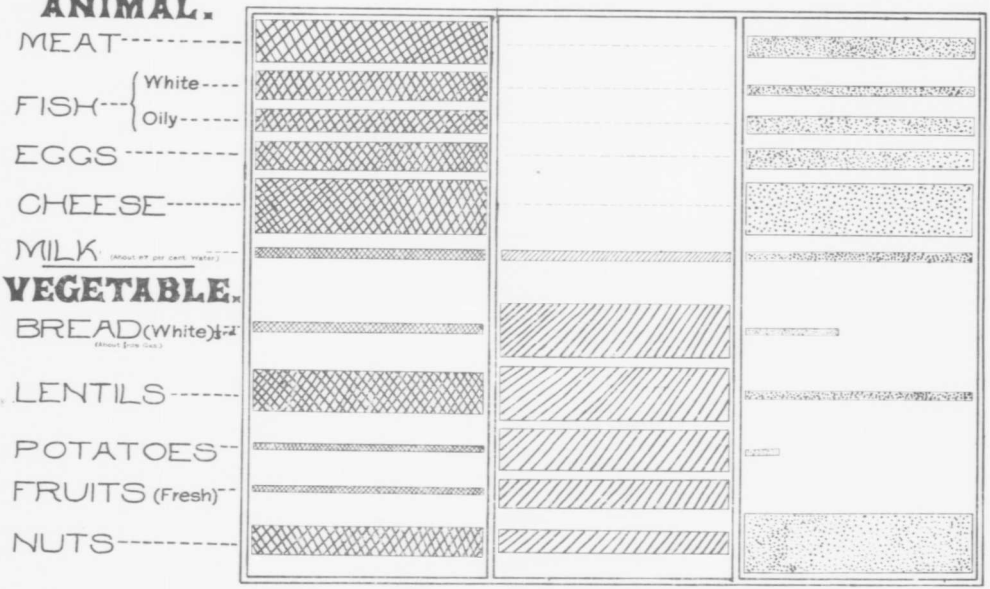

Fig. 2. Reproduced by kind permission of Messrs. E. J. Arnold & Sons, Ltd., Leeds, England.

References to our tendency to

OVER-EAT CARBOHYDRATE FOODS

have been so frequent (bread, cakes, biscuits, farinaceous puddings, cereal preparations, and candies) that the minute quantity of this nutrient stored in the human body—*see* Fig. (1)—will excite some curiosity. What becomes of all the starch and sugar consumed daily in every household?

If only the *correct* amount of these carbohydrates is taken in the course of the day, it is used right away by the muscles to supply the energy they need for their constant activities. Very little of this rapidly consumed form of fuel remains over. Should more fuel be called for unexpectedly, there is a reserve of fat, some of which can be employed for the purpose, until the next stoking with carbohydrates takes place.

AN EXCESS OF STARCHES OR SUGAR

clogs the machinery of the body with half-consumed fuel and loads it with much unwholesome, watery fat, which interferes with the harmonious working of its parts; just as a fire is choked with half-burnt wood and ash cannot burn brightly until the ashes have been raked out. A body overloaded with fuel-food is hampered in its work, even damaged, by a surfeit of candies or an excess of cakes and tarts.

IF AN ENGINE HAS TO PUT ON A SPURT,

fuel is piled on to its furnace; so, if we are taking much exercise, more carbohydrates are allowable, indeed necessary, to supply the extra demand for fuel; and we can indulge, though always with reason, our taste for sweet things; but when confined to the house by the weather or other causes, or when on the shady side of fifty, when we expect a certain amount of waiting upon from our juniors, good sense dictates reduction of carbohydrate food.

HOW ARE WE TO JUDGE WHAT IS THE CORRECT PROPORTION OF THESE DIFFERENT FOODSTUFFS

which should be consumed at different times of life, and by what considerations should our daily diet be guided? These questions are of great importance and call for careful answers. As we have now learnt, much light has been thrown by chemical analysis upon the proportion of each nutrient contained in our common foods. A useful, working knowledge of some of these will be gained from a study of Fig. (2). Observe that the protein present in animal foods is always combined with more or less fat. In some cases the amount is very small, as in white fish, for instance. (Note,

THE GENERAL CUSTOM

of eating melted butter with whiting or halibut to make good this deficiency.) In cheese, however, there is as much fat present as protein. That there is actually a little fat in bread and potatoes will occasion some surprise; and very few people realize how much fat there is in an egg. As a matter of fact, the form of fat found in an egg is peculiarly easy of digestion; hence one of the reasons why eggs are so generally recommended for invalids and young children. The traces of fat in bread and potatoes are too small to be taken into account in our diet.

MORE SURPRISING STILL IS THE FACT

that potatoes and fruit contain protein. Potatoes contain just over 1 per cent. of protein, so much of which is habitually lost owing to careless peeling and cooking that it has been calculated that the loss of this nutriment from a bushel of potatoes, peeled and soaked before cooking, is about the equivalent of a pound of beef-steak. Consequently, the careful housewife and intelligent cook steam or otherwise prepare potatoes "in their jackets," that "nothing be lost."

Apricots, strawberries, grapes, raspberries, and bananas all contain about 1 per cent. of protein; while in dried fruit the amount varies from 5.5 per cent. in figs and 4.4 per cent. in dates to 2.5 per cent. in prunes and raisins. This explains why these dried fruits form so usual and sufficient a substitute for meat in hot climates, such as Arabia, where meat is either difficult to procure or to keep wholesome for even a few hours, owing to the intense heat.

THE LARGE AMOUNT OF FAT IN NUTS

will also excite interest. When thoroughly chewed or ground in a machine, nuts are among our most nutritious foods; for which reason they are a fruitful source of indigestion when eaten at the close of a full meal or at odd moments during the day.

The *average* composition of nuts, such as walnuts, chestnuts, almonds, filberts, etc., is as follows:—

Protein	15 to 20 per cent.
Fat	50 to 60 „
Carbohydrates	9 to 12 „
Salts	1 „
Water	4 to 5 „

What further do nuts contain, you will ask, to complete the hundred parts? The question is most timely, for it enables reference again to be made to the substance—*cellulose*—found in all vegetable foods; a substance which, though wholly indigestible, is nevertheless of great importance and value, for cellulose is the "ballast" mentioned on page 20. It is a fibrous substance, which serves as a framework to support the juices, rich in carbohydrates and salts, of which the bulk of vegetables and fruits are composed.

THE DELICATE, TISSUE-PAPER-LIKE SUBSTANCE

remaining in a "squeezed" lemon is cellulose. It encloses, fragile as it appears, all the nutrients in this class of foods, and locks them most effectively away from the digestive juices, unless the framework be broken down and crushed by the teeth or softened by cooking or by acids, such as vinegar. It is for this reason that old or slowly grown vegetables call for prolonged, slow cooking, as these cellulose envelopes have become toughened and almost woody in consistency. Under any circumstances, this framework is particularly dense in nuts, which is another reason why they are so generally difficult of digestion. A third cause is found in their high proportion of fat, and a fourth in their extreme concentration.

All the same,

THIS FACT MUST NOT BE LOST SIGHT OF:

Indigestible as cellulose is, it constitutes, if well chewed and well cooked, a most important element in our diet. Food, such as eggs or milk, which can be almost entirely absorbed, results in constipation, because there is not enough

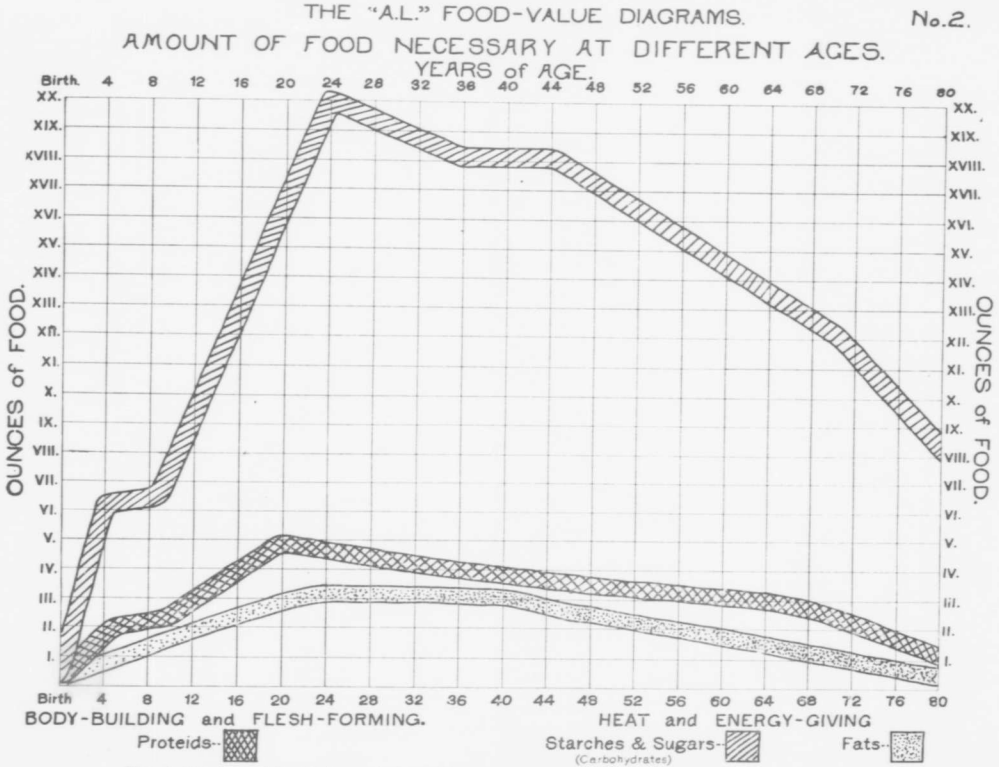

Fig. 3. Reproduced by kind permission of Messrs. E. J. Arnold & Sons, Ltd., Leeds, England.

bulky residue left in the intestines to excite them to expel the undesirable matters, which accumulate after nutrients have been absorbed in the process of digestion. Oatmeal, green vegetables, whole-meal bread, fruits, etc., are prescribed for this trouble, because they leave a relatively large amount of this desirable "ballast," which, as it is pushed along by the worm-like movements of the intestine, carries with it matters, minute perhaps in bulk, but highly injurious to the health, if allowed to remain in the bowels, through the delicate lining of which they are liable to be absorbed into the blood; hence

"BILIOUS ATTACKS," SKIN-ERUPTIONS, LEADEN-HUED SKIN,

and other indications to the trained eye of self-poisoning, technically called "auto-intoxication." But again a caution is necessary. Valuable to health as is this bulkiness of vegetable foods, it becomes a disadvantage if these be taken to excess; for then the nutrient substances, always more difficult of digestion and absorption when eaten in vegetable form, may be so rushed along, owing to the stimulating effect of this class of "ballast" upon the intestine, that there is not time for the process of absorption to be completely performed, and the eater suffers from insufficient nutrition.

MAN IS DESIGNED TO EAT A MIXED DIET,

and in temperate climates he is at his best when he eats about one part of animal food to four or five parts of vegetable.

Attention must now be directed to Fig. (3), for it emphasizes several of the facts which bear most materially upon

THE SUBJECT OF APPROPRIATE FOOD.

The series of figures, from 0 to 80, which run along the top and bottom of this diagram, represent the years of age from birth onwards; while the Roman numerals at each side refer to the amount of food (in ounces) which is required by the healthy human being during these years.

The lowest curve of the three represents the quantity of fat which should be included in the daily diet, the middle curve demonstrates the quantity of protein necessary, and the upper curve indicates the proportion of carbohydrate, shown by experience, to be desirable at the different age periods.

It will be seen that at birth the three classes of foodstuffs are called for in equal amount, hence milk—*see* Milk in Fig. (2)—is the sole and appropriate form of food for the infant. But each year a greater divergence occurs in the three curves. More protein is wanted than fat, and, as muscular activity increases, the demand for carbohydrates increases out of all proportion to the increase of the other two nutrients, which maintain a fairly close relationship throughout life.

NOTICE THE ALMOST ABRUPT UPWARD COURSE

of each curve until the year 24 is reached, the age when growth is practically complete. Then, with one consent, each curve begins to decline; though, be it observed, not in the same proportion, and in a very gradual, long-drawn-out fashion.

What does all this signify? How does it concern the housewife? Is it not rather a matter for the medical man or the scientific worker than for us, every-day sort of folk?

These questions shall receive replies in the same order as that in which they have been put. The lesson taught by this diagram is the significance

throughout life of food suited to the eater. It is a vital matter that our diet be adapted to our age, both in quantity and quality. The appalling annual loss of infant life is an object-lesson of this fact. Feed an infant in accordance with the Law of Nature, and it survives almost any kind of ill which may befall it. Neglect this law, and no human skill, no exquisite climate, no expenditure of money, will rear it to maturity.

The small child and the grown man, the youth and his grandfather, each need varying amounts and proportions of food. To overfeed old age is to shorten and to sadden the declining years; to underfeed youth is to warp and check the normal course of development.

PROVISION FOR GROWTH AND FOR WARMTH

are the urgent requirements of the new-born child. Protein and fat are therefore of primary importance. Not much sugar or starch are needed, as during the first six or nine months of its life the infant leads, or should lead, an almost vegetable existence; sleep, warmth, and food fulfil its demands, which should be met with machine-like regularity. With the development of a more active phase of life a diet of different proportions is required. The addition of crisped bread, of a lightly cooked egg, and other suited foods, such as farinaceous puddings, white-fish, later on poultry and certain kinds of stewed fruit with cream, gradually train the child's digestive organs while meeting his bodily needs, until, by the age of seven or eight years, a healthy child will be eating much the same food as its parents, only with a larger proportion of milk, and generally of a simpler character.

The teachings of this diagram concern the housewife most nearly, because it is she who must provide for these ever-changing requirements. Not, of course, that any one suggests the making of elaborate calculations daily; or that the attention of the family should be concentrated upon the varying proportions of nutrients desirable under varying conditions. But every intelligent woman must familiarize herself with the broad principles which govern healthful feeding at each age period, and apply them to the best of her ability. For this is a question of efficiency, and of the courage, the cheerfulness, and the love of work associated with good nutrition.

NOW THAT THE FACTS ARE KNOWN,

it becomes a duty to make use of them. Otherwise man cannot do his full or best work in the world; he cannot serve his country or his empire to the degree of which he should be capable; he cannot play his part in the progress of civilization; he cannot become the parent of healthy children; he cannot enter fully into his heritage of culture, of experience, of world-wide knowledge.

With the object of equipping the housewives of this Province with that "working knowledge" of intelligent feeding to which repeated reference has been made, Part II. of this bulletin will be devoted to the practical applications of the theoretical information furnished in these pages.

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Late Lecturer on Hygiene, University of London, King's College for Women.

NOTICE.

The Department of Agriculture is issuing the following series of bulletins prepared by Miss Alice Ravenhill, Shawnigan Lake, B.C., to be available for distribution among the members of the Women's Institutes throughout the Province:—

No. 1. The Place and Purpose of Family Life.
" 2. The Preparation of Food.
" 3. The Preservation of Food.
" 4. Labour-saving Devices in the Household.
" 5. Food and Diet—Parts I. and II.
" 6. The Art of Right Living.
" 7. The Care of Children.

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" 20. Varieties of Fruit Recommended. (Revised.)
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" 30. Guide to Bee-keeping in British Columbia.
" 32. Control of Bovine Tuberculosis in British Columbia.
" 33. Fruit-growing Possibilities, Skeena River and Porcher Island Districts.
" 34. Fruit-trees and Black-spot Canker.
" 35. The Place and Purpose of Family Life.
" 36. The Preparation of Food.
" 37. The Preservation of Food.
" 38. The Construction of Silos.
" 39. Natural and Artificial Incubation and Brooding.
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